

(08-2019)
10 CFR 30, 32,
33, 34, 35, 36,
37, 39, and 40



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- A. NEW LICENSE
- B. AMENDMENT TO LICENSE NUMBER 27-05861-02
- C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT (Include zip code)

Julie K Sejour (RSO)
4220 S Maryland Pkwy Bldg C.
Las Vegas, NV 89119

3. ADDRESS WHERE LICENSED MATERIALS WILL BE USED OR POSSESSED

As described on license # 27-05861-02

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Julie K. Sejour

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8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

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CERTIFYING OFFICER - TYPED/PRINTED NAME AND TITLE

Edward A. Wilds Jr, Ph.D

Director, National Center for Radiation-Field Operations

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Edward A. Wilds Jr

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**SUNRISE WAREHOUSE
SUMMARY INVESTIGATION REPORT**

FOR

**U.S. Environmental Protection Agency
University of Nevada, Las Vegas Facilities
Characterization**

**IN SUPPORT OF
U.S. ENVIRONMENTAL PROTECTION AGENCY**

DOCUMENT CONTROL NUMBER
EPA-LV-EDDP-P2-Sup.037
REVISION NO. 1
EFFECTIVE DATE: September 2017

TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	1
3.0	SITE BACKGROUND AND DESCRIPTION	2
4.0	APPROACH	3
4.1	Survey Rationale	4
5.0	SAMPLING AND ANALYSIS ACTIVITIES.....	4
5.1	Survey Areas	4
5.1.1	Instrumentation	5
5.1.2	Calibration.....	5
5.1.3	Minimum Detectable Concentration	6
5.1.4	Background	6
5.2	Removable Wipe Measurements	7
5.2.1	Instrumentation	7
5.2.2	Calibration.....	7
5.2.3	Minimum Detectable Concentration	7
5.2.4	Background	8
5.3	Media Sampling.....	8
6.0	FIELD SURVEY RESULTS.....	8
6.1	Sunrise Warehouse	8
6.1.1	Radiological Scan Results.....	8
6.1.2	Direct Measurement Results	8
6.1.3	Removable Wipe Results	9
6.1.4	Media Sample Results.....	10
7.0	QUALITY CONTROL.....	11
7.1	Quality Control Measurements.....	11
7.2	Field Instrumentation Response Checks	11
7.3	Laboratory Analysis Data.....	11
8.0	SUMMARY AND CONCLUSIONS	12
8.1	Sunrise Warehouse	12
8.2	Conclusion.....	12
9.0	REFERENCES	13

LIST OF TABLES

Table 5-1: Static Surface Contamination Measurement MDC Parameters	6
Table 5-2: Floor Monitor Scanning Measurement MDCscan Parameters and Values.....	6
Table 5-3: Removable Contamination Measurement MDC Parameters	7
Table 6-1: Direct Measurement Results	9
Table 6-2: Removable Wipe Results	9
Table 6-3: Media Sample Results	10
Table 8-1: Sunrise Warehouse Direct Measurement Summary.....	12
Table 8-2: Sunrise Warehouse Removable Wipe Summary.....	12
Table 8-3: Sunrise Warehouse Media Sample Summary	12

LIST OF FIGURES

Figure 1: EPA Sunrise Warehouse Floor Plan.....	2
Figure 2: Survey Unit and Locations	5

APPENDICES

Appendix A – Characterization Surveys

Appendix B – Laboratory reports

Appendix C – Field Instrument Documentation

Appendix D – Field Notes and Documentation

LIST OF ACRONYMS

ALS	ALS Environmental
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
Booz Allen	Booz Allen Hamilton, Inc.
CERFA	Community Environmental Response Facilitation Act
CHL	Chemistry Laboratory
Ci	Curie
cm ²	Square centimeters
cpm	Counts per Minute
Cs	Cesium
DCGL	Derived Concentration Guideline Level
DCGL _w	Derived Concentration Guideline Level – wide area average
dpm	Disintegrations Per Minute
DQO	Data Quality Objectives
EAX	Exposure Assessment Annex
EDDP	Environmental Due Diligence Process
EPA	U.S. Environmental Protection Agency
EXC	Executive Center
FSS	Final Status Survey
HAC	Harmon Avenue Complex
HASP	Health and Safety Plan
ISO	International Organization for Standardization
MARSSIM	Multi-Agency Radiological Survey and Site Investigation Manual
MCL	Maximum Concentration Level
MDC	Minimum Detectable Concentration
MSL	Monitoring Systems Laboratory
NCRFO	National Center for Radiation Field Operations
NELAP	National Environmental Laboratory Accreditation Program
NERL-LV	National Exposure Research Laboratory – Las Vegas
NUREG	Nuclear Regulatory Commission Regulatory Report
NRC	Nuclear Regulatory Commission
OAR	Office of Air and Radiation
ORD	Office of Research and Development
POS	Program Operations Support
ProgM	Program Manager
PTI	Property Transfer-Related Issue
QA	Quality Assurance
QAL	Quality Analysis Laboratory
QAPP	Quality Assurance Project Plan
QC	Quality Control
Ra	Radium
REC	Recognized Environmental Condition
RSO	Radiation Safety Officer

LIST OF ACRONYMS

SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TOPO	Task Order Project Officer
uCi	Microcurie
UNLV	University of Nevada, Las Vegas
VSP	Visual Sampling Plan

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1.0 EXECUTIVE SUMMARY

The purpose of the Sunrise Warehouse Summary Investigation Report is to describe the radiological characterization survey and results for the U.S. Environmental Protection Agency (EPA) Sunrise Warehouse.

Investigative criteria implemented for this characterization were in accordance with the National Center for Radiation Field Operations (NCRFO) Nuclear Regulatory Commission (NRC) radioactive materials license NRC screening values for unrestricted use. Surveys were performed in accordance with methods approved using Derived Concentration Guideline Levels-wide area average (DCGLw) established in U.S. Nuclear Regulatory Commission Regulatory Report (NUREG) 1757, Vol. 2, Rev. 1, NUREG 5512, Vol. 3, the *Multi-Agency Radiation Survey and Site Investigative Manual (MARSSIM)*, August 2000, and the site-specific radiological investigative levels as determined by the Booz Allen Hamilton (Booz Allen) Team and NCRFO Radiation Safety Officer (RSO). The investigation levels were established in Table 1 of the Final Status Survey Plan (September 2016). The investigation levels are Alpha total/removable 27 dpm/100 cm² (Am-241 DCGL), Beta total/removable 550 dpm/100 cm² (Pb-210 DCGL).

Radiological scans (30% coverage), 14 direct measurements, 14 removable wipes, and 14 media samples were collected on the concrete floor surfaces inside the Sunrise Warehouse, approximately 3,300 square feet. Media samples were collected and analyzed for gross alpha and gross beta radioactivity by a National Environmental Laboratory Accreditation Program (NELAP) accredited off-site laboratory in an effort to determine if historical radioactive material storage and transportation activities impacted the warehouse. The results of the Characterization Survey indicated that there is no radioactive contamination exceeding the investigation levels (NRC Screening Values for Unrestricted Release).

2.0 INTRODUCTION

The U.S. EPA Office of Research and Development (ORD) and Office of Air and Radiation (OAR) are executing a consolidation of its facilities in Las Vegas, Nevada. The facilities include buildings located within EPA's Harmon Avenue Complex (HAC) on the campus of the University of Nevada, Las Vegas (UNLV) at 944 East Harmon Avenue, buildings located within EPA's La Plaza Complex at 4220 South Maryland Parkway, and the Sunrise Warehouse located at 3201 Sunrise Avenue. At the HAC, the Exposure Assessment Annex (EAX) building, Quality Analysis Laboratory (QAL) building, and approximately one-third of the Monitoring Systems Laboratory (MSL) building, also known as the Program Operations Support (POS) building, are considered as Part 1 buildings and were vacated, screened for radiological contamination, met NRC partial site release requirements, and turned over to UNLV in November 2016. The Executive Center (EXC) building, the Chemistry Laboratory (CHL) building, and the remainder of the MSL building will be vacated and turned back over to UNLV by September 30, 2020.

Under the auspices of the Community Environmental Response Facilitation Act (CERFA), Section 4, and in accordance with the American Society for Testing and Materials (ASTM) Standard

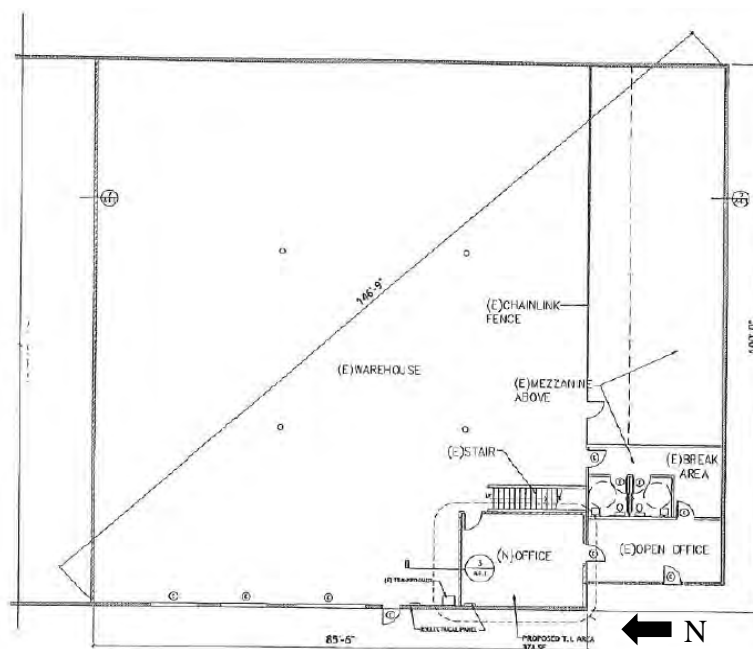
Practice for Environmental Site Assessment Process, E 1527-05, EPA conducted a Phase I Environmental Due Diligence Process (EDDP) project review on the HAC in 2013. The EDDP Phase I Report, dated June 12, 2014, outlines the results of the Phase I EDDP review. The report identifies recognized environmental conditions (REC) and property-transfer related issues (PTI) at the subject property that required further evaluation before lease expiration, per NRC requirements.

Sunrise Warehouse was a historical shipping and receiving area for NRC Material License 27-05861-02 that has not been used for this purpose for more than five years. The decommissioning at HAC provided a unique and cost effective opportunity to remove Sunrise Warehouse from the NRC Material License. Booz Allen has contracted with Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) to assist with Transition Management II services in support of the implementation and execution of the Sunrise Warehouse investigation.

3.0 SITE BACKGROUND AND DESCRIPTION

The subject site is addressed as 3201 Sunrise Avenue, Las Vegas, Nevada, and is located on the south side of Sunrise Avenue at the intersection with Spectrum Boulevard. The warehouse was used for the initial receipt and delivery of specifically-licensed and generally-licensed radioactive materials used by EPA OAR and ORD, such as standards for calibrating instruments, and for the general storage of equipment and records (designated area east of break room).

The 85 ft. 6 in. by 100 ft. facility (Figure 1) is made up of a main warehouse level with concrete floors, as well as an elevated mezzanine level on the south side of the building. There are two (2) offices, a break area, and two (2) bathrooms in the southwest corner of the main warehouse level. The raised mezzanine level is used for storage of records management files.



4.0 APPROACH

The approach taken to accomplish the characterization of the EPA Las Vegas Sunrise Warehouse floor areas followed the approved Sunrise Warehouse Work Plan, Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP) (refer to references cited in Section 9.0). Investigative criteria implemented for this characterization were in accordance with the NCRFO NRC radioactive materials license, NRC screening values for unrestricted use. Surveys were performed in accordance with methods approved using DCGL_w established in NUREG 1757, Vol. 2, Rev. 1, NUREG 5512, Vol. 3, the *Multi-Agency Radiation Survey and Site Investigative Manual (MARSSIM)*, August 2000, and the site-specific radiological investigative levels as determined by the Booz Allen Team and NCRFO RSO. The investigation levels were established in Table 1 of the Final Status Survey Plan (September 2016). The investigation levels are Alpha total/removable 27 dpm/100 cm² (Am-241 DCGL), Beta total/removable 550 dpm/100 cm² (Pb-210 DCGL).

Given the extremely low levels for some alpha emitters as part of the NRC screening level criteria (primarily thorium), alpha scan and total MDCs are not less than the proposed criteria. As the potential radionuclides were not previously determined (objective of this characterization) and the radionuclides with the lowest criteria may not even be present, a 3-minute static count was utilized and the achievable MDCs is the basis for this characterization. It is anticipated that this will provide an alpha total Minimum Detection Concentration (MDC) in the 20 – 40 dpm/100 cm² range. This is in line with Regulatory Guide 8.23 levels.

Alpha and beta surface scans were performed with the floor monitor proportional detector system (Ludlum Model 43-37) by moving it over the surface at a rate of two inches per second in order to provide the appropriate alpha scan sensitivity necessary for this scope. Discernable increases in the count rate within investigation levels were used to determine additional surveying of the location. ISO 7503-1 (International Organization for Standardization [ISO] 1988), NUREG/CR-1507 (NRC 1997a), and *Selection and Use of Portable Radiological Survey Instruments for Performing In Situ Radiological Assessments in Support of Decommissioning* (American Society for Testing and Materials [ASTM] 1998), were used as technical guidance to ensure accuracy in the measurement of surface activity. Scan MDC were 97 dpm/100 cm² alpha and 160 dpm/100 cm² beta.

Direct measurements, smears, and media samples were collected at each specified survey/sample location. Direct measurements were conducted by placing the instrument probe directly on the specified location, measuring the location for a minimum of three minutes, and recording the reading. A minimum three-minute count was chosen in order to achieve the necessary alpha sensitivity MDC for alpha measurements. MDCs were 34 dpm/100 cm² alpha and 304 dpm/100 cm² beta. Locations for direct measurements in each survey area were randomly determined using Visual Sample Plan (VSP) software.

Media samples were obtained by using a demolition drill with a bushing tip at each sampling location. The samples were then sent to ALS Environmental Laboratory (ALS), an off-site, NELAP-accredited laboratory and analyzed for gross alpha and gross beta radioactivity.

Waste materials resulting from the decommissioning activities were managed in accordance with applicable state and federal waste regulations. Job safety briefings were conducted each day prior to work activities.

4.1 Survey Rationale

The design of this characterization survey was based upon the limited usage of radioactive materials within the Sunrise Warehouse. Essentially, the Sunrise Warehouse was only used for receiving and delivering packages in transit or for temporary storage of instruments. The purpose of this survey was to confirm the presence or absence of radiological contamination and to provide sufficient documentation to address Final Status Survey (FSS) for eventual release from the NRC license. Given this approach, the survey design was a combination of the characterization and FSS from Part 1 activities.

The survey conformed to the MARSSIM graded approach by focusing the most rigorous survey effort in high concern areas, reduced effort in medium concern areas, and the least rigorous survey in low concern areas. It follows the Final Status Survey Project Plan (September 2016) with respect to the MARSSIM approach for EPA OAR. Due to the historical use of the Sunrise Warehouse facility and limited handling of radioactive materials in transit or storage, it had been assigned a low level of radiological concern (Class 3 area for FSS).

5.0 SAMPLING AND ANALYSIS ACTIVITIES

This section describes the field sampling and analysis activities as they were performed during the characterization survey of the Sunrise Warehouse, including the instrumentation used, calibration procedures, project-specific MDCs, and background methods and measurements. All activities for this scope were conducted in accordance with the Sunrise Warehouse Work Plan, SAP, QAPP, HASP, laboratory analysis quality assurance (QA) requirements, and federal, state and local regulations, and NRC license requirements (references cited in Section 9.0).

5.1 Survey Areas

The Sunrise Warehouse survey is a single survey unit consisting of the floor in the central portion of the warehouse (shipping/receiving packages area) and connecting to the EPA OAR designated storage cage floor, approximate dimensions (in feet) shown around the perimeter in Figure 2. As the characterization plan only calls for three locations in a low level of radiological concern, but the FSS of a Class 3 area calls for 14 randomly placed locations, 14 locations were selected to ensure sufficient data to meet FSS requirements. The 14 locations for this survey were randomly located using the Visual Sample Plan computer code, and are shown in Figure 2.

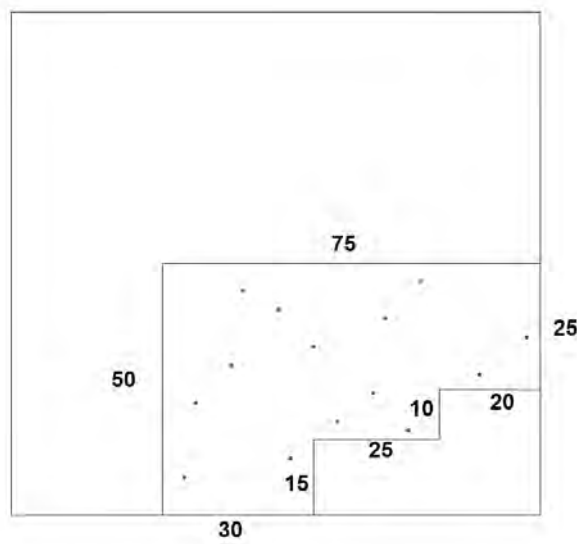


Figure 2: Survey Unit and Locations

5.1.1 Instrumentation

Several different types of instrumentation were used for performing surveys or analyzing samples at the Sunrise Warehouse. This section provides details about the instrumentation that may be used during the characterization surveys.

Scan surveys for alpha/beta contamination were performed using a Ludlum Model 2224-1 scaler/rate meter equipped with the 821 cm² Ludlum Model 43-37 alpha-beta gas proportional probe. It should be noted that the floor monitor proportional detector system (43-37) described above is better known as the Model 239-1F Floor Monitor system. Direct measurements for total alpha/beta contamination were performed using a Ludlum Model 2224-1 scaler/rate meter equipped with a 100 cm² Ludlum Model 43-93 zinc sulfide (ZnS[Ag]) plastic scintillation detector. The Model 43-93 was only used as a direct measurement instrument.

5.1.2 Calibration

Instrument calibrations, response checks, and MDCs for all instrumentation were performed as described in Section 3 of the QAPP (reference cited in Section 9.0).

Field instruments used for scanning and direct measurements were operated, maintained, and calibrated according to the manufacturer's recommendations. Instrument calibration is performed on an annual basis or following repairs or modifications. Each instrument was calibrated in accordance with the manufacturer's recommended method in addition to American National Standards Institute (ANSI) N323AB-2013. An initial pre-use alpha and beta efficiency determination, quality control check and daily instrument functional checks were conducted in accordance with the SAP (reference cited in Section 9.0) and Amec Foster Wheeler's instrumentation operating procedures to verify that the equipment was functioning properly. Field instrument documentation is provided in Appendix C.

5.1.3 Minimum Detectable Concentration

The MDC for the instruments used during characterization is provided in Table 5-1 (static) and Table 5-2 (floor monitor). A three-minute static count was utilized and the achievable MDCs are the basis for this characterization. The alpha total MDC is in line with Regulatory Guide 8.23 levels (Section 4.0).

Table 5-1: Static Surface Contamination Measurement MDC Parameters

Parameter		Ludlum Model 2224-1 with Ludlum AB 43-93 Probe Serial Number-312990	
		Alpha	Beta
C_b	Background Count Rate (counts per minute [cpm])	1.6	126.8
T_s	Sample count time (minutes)	3	3
A_P	Probe Size (cm ²)	100	100
ϵ_T	Counting system efficiency in counts per disintegration	0.116	0.0919
MDC	dpm/100 cm ²	34	304

Table 5-2: Floor Monitor Scanning Measurement MDCscan Parameters and Values

Parameter		Ludlum Model 2224 with Ludlum AB Probe 43-37 Serial Number-183047	
		Alpha	Beta
C_b	Background Count Rate (cpm)	4	770
i	The residence time of the detector probe over a given surface area (the counting interval) in seconds.	3	
d'	Index of sensitivity	1.38	
p	Surveyor efficiency	0.5	
A_P	Probe size (cm ²)	821	
ϵ_T	Counting system efficiency in counts per disintegration	0.022	0.184
MDCR	Minimum count rate above background	12	171
MDC _{scan}	dpm/100 cm ²	97	160

5.1.4 Background

A five-minute (direct measurement instrument) and one-minute (floor monitor) alpha-beta background measurement was taken in the center of the area (air) prior to conducting scan and direct measurement surveys. These measurements provide a comparison for scan survey results and to determine net activity above background for direct measurements.

5.2 Removable Wipe Measurements

In addition to scan and direct measurements, areas were also sampled for removable contamination via wipes that were analyzed onsite using a Ludlum Model 2929 equipped with a Ludlum Model 43-10-1 dual-channel analyzer. All wipe samples were conducted and analyzed in accordance with the SAP, QAPP, HASP, and federal, state and local regulatory requirements (references cited in Section 9.0).

5.2.1 Instrumentation

The Ludlum Model 2929 dual-channel analyzer equipped with a Ludlum Model 43-10-1 zinc sulfide (ZnS[Ag]) plastic scintillation detector was used to quantify gross alpha/beta contamination on wipe samples collected from the floor surfaces to determine the presence or absence of removable radioactive contamination.

5.2.2 Calibration

Field instruments used for wipe counting were operated, maintained, and calibrated according to the manufacturer's recommendations. Instrument calibration is performed on an annual basis and following any repairs or modifications. Each instrument was calibrated in accordance with the manufacturer's recommended method in addition to ANSI N323AB-2013. An initial pre-use efficiency determination, quality control check, and daily instrument functional check was conducted in accordance with the SAP (reference cited in Section 9.0) and Amec Foster Wheeler's instrumentation operating procedures to verify that the equipment was functioning properly. Instrument documentation is provided in Appendix C.

5.2.3 Minimum Detectable Concentration

The instrument MDC parameters for onsite wipe sample analysis for removable contamination during characterization are provided in Table 5-3.

Table 5-3: Removable Contamination Measurement MDC Parameters

Parameter		Ludlum Model 2929 with Ludlum 43-10-1 Serial Number 83085	
		Alpha	Beta
T_B	Background Count Time (min)	20	20
T_{S+B}	Sample Count Time (min)	10	10
R_b	Background Count Rate (cpm)	0.1	55.65
ϵ_T	Instrument system efficiency in counts per disintegration	0.257	0.167
MDC	dpm/100 cm ²	2.62	58.54

5.2.4 Background

Twenty-minute alpha-beta background measurements were taken in POS Room 23 prior to and after the use of each instrument as part of the QA/QC process. These measurements were used to determine net alpha-beta activity above background for removable contamination.

5.3 Media Sampling

A media sample was obtained from the concrete floor at each of the 14 survey/sample points by using a demolition drill with a bushing tip. The samples were sent to ALS, a NELAP-accredited off-site laboratory, and analyzed for gross alpha and gross beta radioactivity.

6.0 FIELD SURVEY RESULTS

This section provides a description of the Sunrise Warehouse radiological survey and sampling results and remedial action.

Radiological surveys were performed in the Sunrise Warehouse to address both total and removable alpha, beta, and gamma residual contamination in support of the release of laboratory components and buildings as part of the overarching lease termination. Survey results were documented on Radiological Survey Forms, as prescribed in the SAP (reference cited in Section 9.0) and Amec Foster Wheeler procedure RPO-301, and are presented in Appendix A.

6.1 Sunrise Warehouse

The characterization of the Sunrise Warehouse concrete floor included a scan survey of at least 30% of the floor surface, direct measurements, wipe sampling, and media sampling.

The number of samples and sample locations were determined using VSP software in order to meet MARSSIM Class 3 Final Status Survey (FSS) requirements established during previous project work.

The sampling techniques used for scans, direct measurements, wipes, and media sampling followed those established in the SAP and QAPP (references cited in Section 9.0).

6.1.1 Radiological Scan Results

Beta and alpha background levels were 770 cpm and 4 cpm, respectively, demonstrating that the scan survey results indicated no activity exceeding background levels. Given these results, no additional investigations were performed. The scan survey reports are provided in Appendix A.

6.1.2 Direct Measurement Results

Three-minute direct measurements were taken at each survey/sample point. The direct measurement results are shown in Table 6-1. No measurement exceeded the beta or alpha investigation levels (DCGLs) of 550 dpm/100 cm² and 27 dpm/100 cm², respectively. The background counts for beta and alpha direct measurements were 126.8 cpm and 1.6 cpm, respectively. No additional investigations were performed. The direct measurement surveys are provided in Appendix A.

Table 6-1: Direct Measurement Results

Sample Location	Net Beta dpm/100 cm ²	Net Alpha dpm/100 cm ²
1	92.5	-2.6
2	23.9	-7.8
3	-41.3	-2.6
4	-12	-7.8
5	-27.2	-2.6
6	67.5	-5.2
7	59.8	-2.6
8	-99	-2.6
9	-146.9	-11.2
10	9.8	-5.2
11	64.2	-5.2
12	-92.5	-5.2
13	-476.6	-7.8
14	38.1	-7.8

6.1.3 Removable Wipe Results

A wipe was taken from each survey/sample point following a direct measurement and counted for ten minutes on the Ludlum 2929 smear counter. The removable wipe measurement results are shown in Table 6-2. No measurement exceeded the beta and alpha investigation levels (DCGLs) of 5500 dpm/100 cm² and 27 dpm/100 cm², respectively. The background counts for beta and alpha wipe measurements are 55.65 cpm and 0.1 cpm, respectively. No additional investigations were performed. The removable wipe surveys are provided in Appendix A.

Table 6-2: Removable Wipe Results

Sample Location	Net Beta dpm/100 cm ²	Net Alpha dpm/100 cm ²
1	-8.7	1.2
2	12.9	2.3
3	11.7	0
4	-24.9	-0.4
5	-19.5	1.6
6	2.1	0.0
7	17.7	0.8
8	3.9	1.9
9	-27.2	0.0
10	-31.4	1.2
11	-4.5	0.4
12	-17.1	2.7
13	23.7	1.6
14	-23.1	2.3

6.1.4 Media Sample Results

A concrete floor sample was collected at each of the sampling points by using a demolition drill with a bushing tip. The samples were sent to ALS, a NELAP-accredited off-site laboratory, and analyzed for gross alpha and gross beta radioactivity. The concrete media sample results are shown in Table 6-3. The background sample for concrete was previously collected from the concrete floor of room 103 (below the east stairwell) in EXC (non-impacted area). The background concrete results were gross beta 1.99 pCi/g and gross alpha 1.74 pCi/g. The concrete floor samples are within the expected range/variation of background concrete. No additional investigations were performed. The laboratory report is provided in Appendix B.

Table 6-3: Media Sample Results

Sample Location	Gross Beta pCi/g	Gross Alpha pCi/g
1	2.9	0.8
2	1.7	1.9
3	2.5	1.3
4	1.5	1.7
5	2.1	2.9
6	3.0	2.3
7	3.7	2.2
8	2.0	2.2
9	2.3	1.2
10	0.5	1.6
11	0.9	0.6
12	0.7	1.9
13	1.6	1.3
14	0.8	2.0

7.0 QUALITY CONTROL

Data quality objectives (DQOs) for each sampling and work assignment were developed during the initial project stages in accordance with EPA's Guidance for the *Data Quality Objectives Process* (EPA QA/G-4). During the planning process the Booz Allen Team, with assistance from the NCRFO RSO, identified constituents and media of concern, number of samples required, and acceptance limits of accuracy and precision. Any additions or deviations from the procedures described in the SAP or QAPP were recorded and approved by the Booz Allen Program Manager (ProgM), EPA Task Order Project Officer (TOPO), and NCRFO RSO.

7.1 Quality Control Measurements

Quality control measurements instituted in this project included up-to-date personnel training, implementation of field standard operating procedures (SOPs), daily field instrumentation response checks, and ALS Quality Assurance Manual procedures.

7.2 Field Instrumentation Response Checks

Field instrumentation response checks were performed by Amec Foster Wheeler personnel twice each day prior to the beginning of work and following completion of work activities. Instrument response checks were performed in accordance with Amec Foster Wheeler Procedure No. RPO-201. Concurrent background checks and source response checks were performed and recorded using the appropriate Portable Instrument Response Check Sheet. Instruments meeting all response check criteria continued in-use service while instruments failing to meet the acceptable response range were designated as "out-of-service" or "out-of-calibration" until repaired. Field instrument response checks were successful and no quality issues were identified. Documentation is provided in Appendix C.

7.3 Laboratory Analysis Data

ALS Environmental in Fort Collins, Colorado was contracted by Amec Foster Wheeler to provide radiological analytical and testing services as prescribed in the SAP and QAPP (referenced in Section 9.0). Samples were processed and analyzed as received by the laboratory and results were delivered to the Amec Foster Wheeler Project Manager as soon as data packages were available. Analysis data packages were prepared with Level 4 criteria. The Fort Collins facility currently holds a State of Colorado issued Radioactive Materials Handling License and holds a NELAP accreditation. ALS laboratory quality controls were successful, with the exception of the matrix spike for Sample 2. The radiometric recovery for this matrix spike was below the lower control limit of 70% at 44% for gross alpha. The results for that sample are considered an estimated value. All other quality control criteria were met. Documentation is provided in Appendix B.

8.0 SUMMARY AND CONCLUSIONS

8.1 Sunrise Warehouse

Characterization survey and sampling results indicate residual radioactivity levels are well below investigation levels (DCGLs) in the Sunrise Warehouse as a result of EPA radioactive material licensed activities. Direct, removable and media sample summaries for average, standard deviation, minimum and maximum measurements are provided in Tables 8-1, 8-2 and 8-3 respectively.

Table 8-1: Sunrise Warehouse Direct Measurement Summary

Net Beta dpm/100 cm ²				Net Alpha dpm/100 cm ²			
Ave	Stdev	Min	Max	Ave	Stdev	Min	Max
-38.6	144.6	-476.6	92.5	-5.4	2.7	-11.2	-2.6

Table 8-2: Sunrise Warehouse Removable Wipe Summary

Net Beta dpm/100 cm ²				Net Alpha dpm/100 cm ²			
Ave	Stdev	Min	Max	Ave	Stdev	Min	Max
-6.0	18.3	-31.4	23.7	1.1	1.0	-0.4	2.7

Table 8-3: Sunrise Warehouse Media Sample Summary

Gross Beta pCi/g				Gross Alpha pCi/g			
Ave	Stdev	Min	Max	Ave	Stdev	Min	Max
1.9	1.0	0.5	3.7	1.7	0.6	0.6	2.9

8.2 Conclusion

The results of the characterization surveys and sampling indicate no radioactive contamination present in the Sunrise Warehouse concrete floor and that all residual radioactivity levels are well below NRC screening levels for unrestricted use. This survey may be used as FSS for release from the NCRFO radioactive materials license.

9.0 REFERENCES

- American National Standards Institute (ANSI), 1997; Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments, N323A.
- Booz Allen Hamilton, 2017; Sunrise Warehouse Work Plan, EPA-LV-EDDP-P2-Sup 035, Revision 0, May 2017.
- Booz Allen Hamilton, 2017; Sampling & Analysis Plan (SAP), EPA-LV-EDDP-P2-Sup. 009 Revision 4, May 2017.
- Booz Allen Hamilton, 2016; Sampling & Analysis Plan Addendum 1, EPA-LV-EDDP-P2-Sup 014, January 2016.
- Booz Allen Hamilton, 2017; Characterization & Decommissioning Quality Assurance Project Plan (QAPP), EPA-LV-EDDP-P2-Sup. 010 Revision 4, May 2017.
- Booz Allen Hamilton, 2016; Characterization & Decommissioning Quality Assurance Project Plan Addendum 1, EPA-LV-EDDP-P2-Sup. 015, January 2016.
- Booz Allen Hamilton, 2016; Characterization & Decommissioning Quality Assurance Project Plan Addendum 2, EPA-LV-EDDP-P2-Sup. 020, February 2016.
- Booz Allen Hamilton, 2017; Characterization & Decommissioning and EDDP Phase II & Phase III Health and Safety Plan (HASP), EPA-LV-EDDP-P2-Sup. 011 Revision 4, May 2017.
- Booz Allen Hamilton, 2016; Characterization & Decommissioning and EDDP Phase II & Phase III Health and Safety Plan Addendum 1, EPA-LV-EDDP-P2-Sup. 016, January 2016.
- Booz Allen Hamilton, 2016; Characterization & Decommissioning and EDDP Phase II & Phase III Health and Safety Plan Addendum 2, EPA-LV-EDDP-P2-Sup. 021, February 2016. Booz Allen Hamilton, 2016; Characterization & Decommissioning and EDDP Phase II & Phase III Health and Safety Plan Addendum 3, EPA-LV-EDDP-P2-Sup. 024, February 2016.
- EPA, 2000; Guidance for the Data Quality Objectives Process, EPA QA/G-4, EPA/600/R-96/055, Washington, D.C.
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- NRC, 2006a; Consolidated NMSS Decommissioning Guidance – Decommissioning Process for Materials Licensees, NUREG-1757, Vol. 1, Rev. 2, Nuclear Regulatory Commission, September 2006.
- NRC, 1999, Residual Radioactive Contamination from Decommissioning – Parameter Analysis, NUREG 5512, Vol. 3, Nuclear Regulatory Commission, October 1999.
- NRC, 2006b. Consolidated NMSS Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria. NUREG-1757 Vol. 2. Rev 1, September 2006.

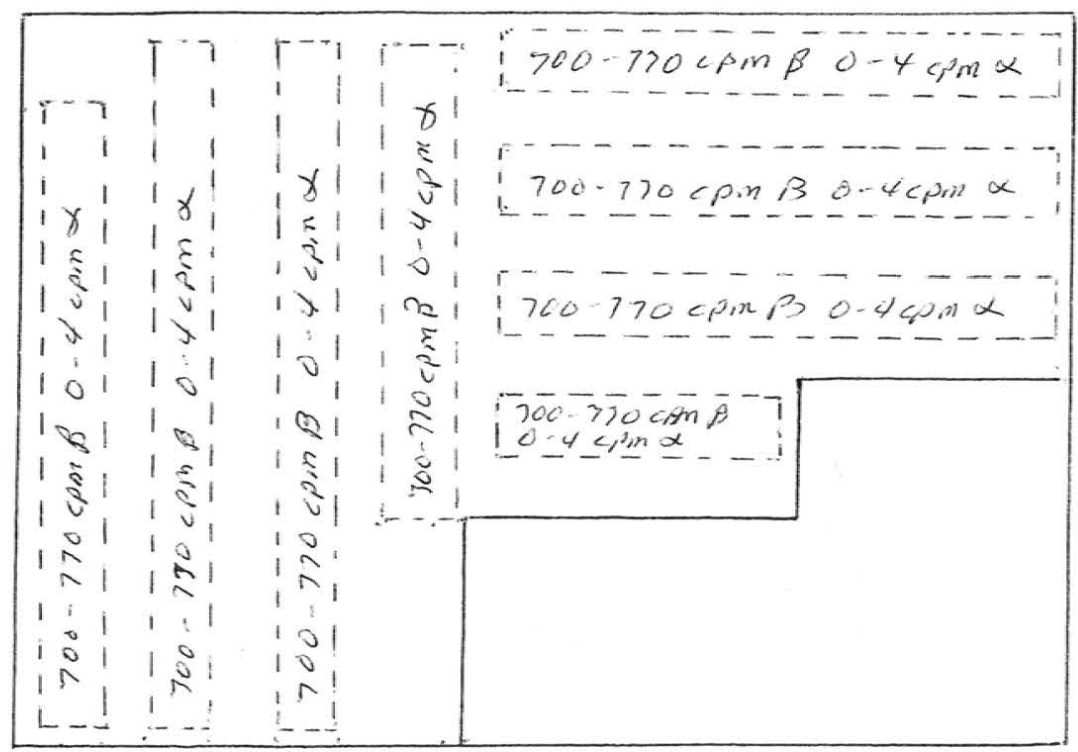
- NRC, 1997a; ISO 7503-1 (International Organization for Standardization) [ISO] 1988) ASTM, 1998; Selection and Use of Portable Radiological Survey Instruments for Performing In Situ Radiological Assessments in Support of Decommissioning. American Society for Testing and Materials, E1893-97, January 1997.
- Pacific Northwest National Laboratory (PNNL), 2017, Visual Sampling Plan (VSP) Version 7.9.

APPENDIX A – CHARACTERIZATION SURVEYS

RADIOLOGICAL SURVEY MAP (complete)

Site Name: EPA LAS VEGAS Location: SUNRISE WAREHOUSE Date: 6-8-17 Time: 1030
 Purpose: Concrete Floor Scan Survey (30%) Survey # N/A RWP #: N/A
 Instrument #1 - Model: 2224 Serial # 183047 Probe Model: 43-37-1 Serial# 177875 Cal Due: 8/30/17 Eff.: $\alpha = 0.022$
 $\beta = 0.184$
 Instrument #1 - Model: N/A Serial # N/A Probe Model: N/A Serial# N/A Cal Due: N/A Eff.: N/A
 Remarks: LOW RAD CONCERN (1 min background count) $\alpha = 4 \text{cpm}$ $\beta = 770 \text{cpm}$ Scan Speed = 10'/min
 Surveyor Name (Print): TOM MAVEAL Surveyor Signature: Tom Maveal Reviewed By (RSO Signature): A. Smith

--- = SCANNED AREA



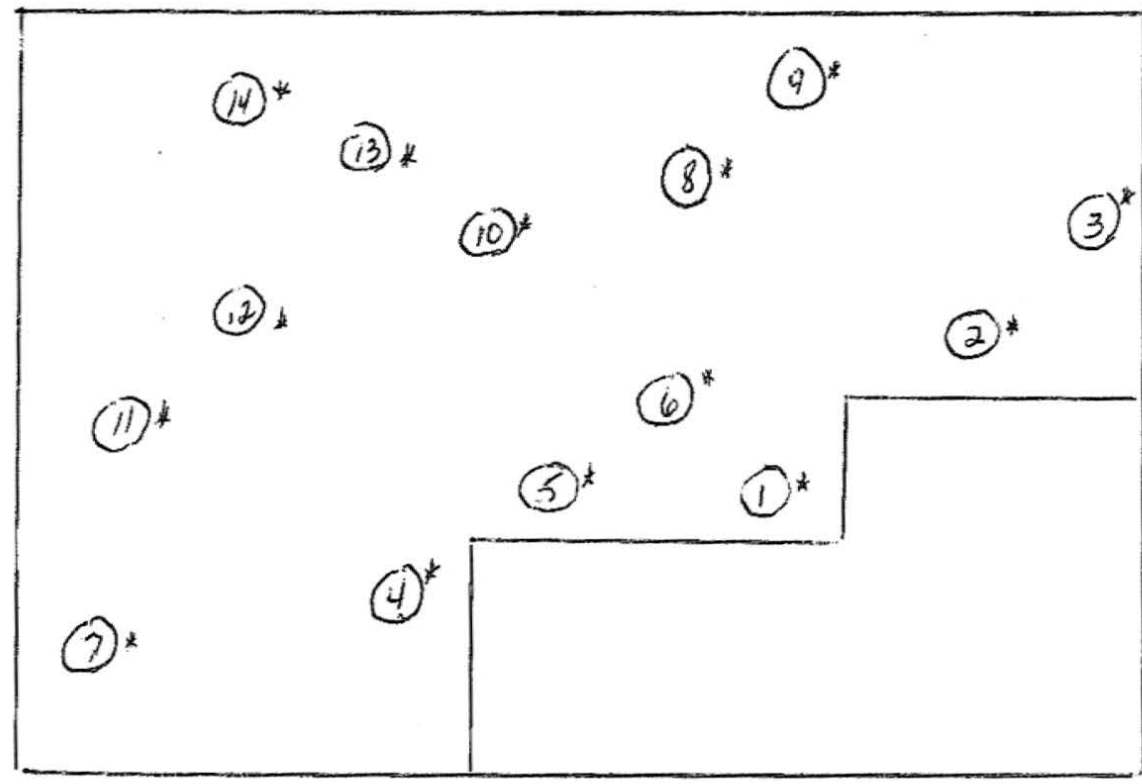
O indicates smear location * indicates contact radiation reading \triangle indicates volumetric sample location LAW indicates large area wipe
 All radiation readings are gamma in mrem/h unless noted.

RADIOLOGICAL SURVEY MAP (complete)

Site Name: EPA Las Vegas Location: Surprise Warehouse Date: 6-8-17 Time: 10:45
 Purpose: Concrete floor static & smear locations Survey # N/A RWP #: N/A
 Instrument #1 - Model: 2224-1 Serial # 312990 Probe Model: 43 93 Serial# 342019 Cal Due: 11/7/17 Eff: $\alpha = 0.115$
 $\beta = 0.0919$
 Instrument #1 - Model: 2929 Serial # 86484 Probe Model: 43-10-1 Serial# 83085 Cal Due: 8/25/17 Eff: $\alpha = 0.257$
 $\beta = 0.167$
 Remarks: 2224-1 Background count time = 5 min, Bkg counts: $\alpha = 8$, $\beta = 634$, Bkg cpm: $\alpha = 1.6$ cpm $\beta = 126.8$ cpm
 Surveyor Name (Print): Tom Maveal Surveyor Signature: Tom Maveal Reviewed By (RSO Signature): [Signature]

16
802
6-28-17

2224-1 = 3 min count time (static counts)



O indicates smear location * indicates contact radiation reading \triangle indicates volumetric sample location LAW indicates large area wipe
 All radiation readings are gamma in mrem/h unless noted.

RADIOLOGICAL DATA COLLECTION FORM

Survey Number: _____

Page 3 of 6

Location EAP Las Vegas Sunrise Warehouse		Requester EPA				Date 6/8/2017		Time 10:45			
Purpose Concrete Floor, Static		Instrument and Probe Type and Serial Number				Surveyor(s) Printed Name		RWP #:			
		Ludlum 2224-1 312990				Tom Maveal		Surveyor(s) Signature <i>Tom Maveal</i>			
		Ludlum 43-93 PR342019									
#	ITEM DESCRIPTION/LOCATION	BETA-GAMMA ACTIVITY				ALPHA ACTIVITY				RADIATION SURVEY	
		Counting Data Attached <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		/Radionuclide Tc-99		Counting Data Attached <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		/Radionuclide Th-230			
		% Eff.	Count	CPM	T/R/F ⁽²⁾	% Eff.	Count	CPM	T/R/F ⁽²⁾	µr/hr	Distance
		Gross counts	Time			Gross Counts	Time				
1	Concrete Floor (See Attached Map)	406	3	135.3	T	4	3	1.3	T		
2	Concrete Floor (See Attached Map)	387	3	129.0	T	2	3	0.7	T		
3	Concrete Floor (See Attached Map)	369	3	123.0	T	4	3	1.3	T		
4	Concrete Floor (See Attached Map)	377	3	125.7	T	2	3	0.7	T		
5	Concrete Floor (See Attached Map)	373	3	124.3	T	4	3	1.3	T		
6	Concrete Floor (See Attached Map)	399	3	133.0	T	3	3	1.0	T		
7	Concrete Floor (See Attached Map)	397	3	132.3	T	4	3	1.3	T		
8	Concrete Floor (See Attached Map)	353	3	117.7	T	4	3	1.3	T		
9	Concrete Floor (See Attached Map)	340	3	113.3	T	1	3	0.3	T		
10	Concrete Floor (See Attached Map)	383	3	127.7	T	3	3	1.0	T		
11	Concrete Floor (See Attached Map)	398	3	132.7	T	3	3	1.0	T		
12	Concrete Floor (See Attached Map)	355	3	118.3	T	3	3	1.0	T		
13	Concrete Floor (See Attached Map)	249	3	83.0	T	2	3	0.7	T		
14	Concrete Floor (See Attached Map)	391	3	130.3	T	2	3	0.7	T		
<small>(1) If area other than 100 cm², record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n or β).</small>											
Remarks:											
Reviewed by: <i>[Signature]</i>										Date: 6-12-17	

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RADIOLOGICAL DATA COLLECTION FORM

Survey Number:

Page 4 of 6

Location EPA Las Vegas Sunrise Warehouse		Requester EPA				Date 6/8/2017		Time 10:45					
Purpose Concrete Floor, Smears		Instrument and Probe Type and Serial Number						Surveyor(s) Printed Name		RWP #:			
Ludlum 2929		86484				Tom Maveal						Surveyor(s) Signature <i>Tom Maveal</i>	
Ludlum 43-10-1		PR083085											
#	ITEM DESCRIPTION/LOCATION	BETA-GAMMA ACTIVITY				ALPHA ACTIVITY				RADIATION SURVEY			
		Counting Data Attached <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		/Radionuclide Tc-99		Counting Data Attached <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		/Radionuclide Th-230					
		% Eff.	0.167			% Eff.	0.257			µr/hr	Distance		
		Gross	Count	CPM	T/R/F ⁽²⁾	Gross	Count	CPM	T/R/F ⁽²⁾				
		counts	Time			Counts	Time						
1	Concrete Floor (See Attached Map)	542	10	54.2	R	4	10	0.4	R				
2	Concrete Floor (See Attached Map)	578	10	57.8	R	7	10	0.7	R				
3	Concrete Floor (See Attached Map)	576	10	57.6	R	1	10	0.1	R				
4	Concrete Floor (See Attached Map)	515	10	51.5	R	0	10	0.0	R				
5	Concrete Floor (See Attached Map)	524	10	52.4	R	5	10	0.5	R				
6	Concrete Floor (See Attached Map)	560	10	56.0	R	1	10	0.1	R				
7	Concrete Floor (See Attached Map)	586	10	58.6	R	3	10	0.3	R				
8	Concrete Floor (See Attached Map)	563	10	56.3	R	6	10	0.6	R				
9	Concrete Floor (See Attached Map)	511	10	51.1	R	1	10	0.1	R				
10	Concrete Floor (See Attached Map)	504	10	50.4	R	4	10	0.4	R				
11	Concrete Floor (See Attached Map)	549	10	54.9	R	2	10	0.2	R				
12	Concrete Floor (See Attached Map)	528	10	52.8	R	8	10	0.8	R				
13	Concrete Floor (See Attached Map)	596	10	59.6	R	5	10	0.5	R				
14	Concrete Floor (See Attached Map)	518	10	51.8	R	7	10	0.7	R				
(1) If area other than 100 cm ² , record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n or β).													
Remarks:													
Reviewed by: <i>A. Smith</i>										Date: 6-12-17			

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RADIOLOGICAL SURVEY FORM

Survey Number: _____

Page 5 of 6

Location	EPA Las Vegas Sunrise Warehouse	Requester	EPA	Date	6/8/2017	Time	10:45
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Purpose	Concrete Floor, Statics	Instrument and Probe Type and Serial Number	Ludlum 2224-1 312990	Ludlum 43-93 342019	Surveyor(s) Printed Name	Tom Maveal	RWP #	Surveyor(s) Signature <i>Tom Maveal</i>
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#	ITEM DESCRIPTION/TIME	BETA-GAMMA ACTIVITY						ALPHA ACTIVITY					RADIATION SURVEY	
		Counting Data Attached <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		/Radionuclide		Tc-99	T/R/F ⁽²⁾	Counting Data Attached <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		/Radionuclide		Th-230	uR/hr ⁽³⁾	Distance
		% Eff.	0.0919	Bkg.	Net			% Eff.	0.116	Bkg.	Net			
cpm	cpm	cpm	dpm	cpm	cpm	cpm	cpm	100 cm ² (1)	T/R/F ⁽²⁾					
1	Concrete Floor (See Attached Map)	135.3	126.8	8.5	92.5	T	1.3	1.6	-0.3	-2.6	T			
2	Concrete Floor (See Attached Map)	129	126.8	2.2	23.9	T	0.7	1.6	-0.9	-7.8	T			
3	Concrete Floor (See Attached Map)	123	126.8	-3.8	-41.3	T	1.3	1.6	-0.3	-2.6	T			
4	Concrete Floor (See Attached Map)	125.7	126.8	-1.1	-12.0	T	0.7	1.6	-0.9	-7.8	T			
5	Concrete Floor (See Attached Map)	124.3	126.8	-2.5	-27.2	T	1.3	1.6	-0.3	-2.6	T			
6	Concrete Floor (See Attached Map)	133	126.8	6.2	67.5	T	1	1.6	-0.6	-5.2	T			
7	Concrete Floor (See Attached Map)	132.3	126.8	5.5	59.8	T	1.3	1.6	-0.3	-2.6	T			
8	Concrete Floor (See Attached Map)	117.7	126.8	-9.1	-99.0	T	1.3	1.6	-0.3	-2.6	T			
9	Concrete Floor (See Attached Map)	113.3	126.8	-13.5	-146.9	T	0.3	1.6	-1.3	-11.2	T			
10	Concrete Floor (See Attached Map)	127.7	126.8	0.9	9.8	T	1	1.6	-0.6	-5.2	T			
11	Concrete Floor (See Attached Map)	132.7	126.8	5.9	64.2	T	1	1.6	-0.6	-5.2	T			
12	Concrete Floor (See Attached Map)	118.3	126.8	-8.5	-92.5	T	1	1.6	-0.6	-5.2	T			
13	Concrete Floor (See Attached Map)	83	126.8	-43.8	-476.6	T	0.7	1.6	-0.9	-7.8	T			
14	Concrete Floor (See Attached Map)	130.3	126.8	3.5	38.1	T	0.7	1.6	-0.9	-7.8	T			

⁽¹⁾ If area other than 100 cm², record as dpm/probe, or dpm/LAW. ⁽²⁾ Total/Removable/Fixed. ⁽³⁾ Indicate type, if other than gamma (i.e., n or β).

Remarks: Background Count Time = 5 minutes (Alpha Background counts = 8)(Beta background counts=634)

Reviewed by: *[Signature]* Date: 6-12-17

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RADIOLOGICAL SURVEY FORM

Survey Number: _____

Page 6 of 6

Location EPA Las Vegas Sunrise Warehouse Requester EPA Date 6/8/2017 Time 10:45

Purpose Concrete Floor Smears RWP # _____

Instrument and Probe Type and Serial Number Surveyor(s) Printed Name Surveyor(s) Signature

Ludlum 2929 86484 Tom Maveal *Tom Maveal*

Ludlum 43-10-1 PR083085

BETA-GAMMA ACTIVITY ALPHA ACTIVITY RADIATION SURVEY

Counting Data Attached Yes No Counting Data Attached Yes No

% Eff. 0.1670 /Radionuclide Tc-99 % Eff. 0.2570 /Radionuclide Th-230

Bkg. Net dpm Bkg. Net dpm

cpm cpm cpm 100 cm² (1) T/R/F(2) cpm cpm cpm 100 cm² (1) T/R/F(2) uR/hr (3) Distance

#	ITEM DESCRIPTION/TIME	% Eff.	Bkg. cpm	Net cpm	dpm 100 cm ² (1)	T/R/F(2)	% Eff.	Bkg. cpm	Net cpm	dpm 100 cm ² (1)	T/R/F(2)	uR/hr (3)	Distance
1	Concrete Floor Smear (See Map)	54.2	55.65	-1.5	-8.7	R	0.4	0.1	0.3	1.2	R		
2	Concrete Floor Smear (See Map)	57.8	55.65	2.2	12.9	R	0.7	0.1	0.6	2.3	R		
3	Concrete Floor Smear (See Map)	57.6	55.65	2.0	11.7	R	0.1	0.1	0.0	0.0	R		
4	Concrete Floor Smear (See Map)	51.5	55.65	-4.2	-24.9	R	0	0.1	-0.1	-0.4	R		
5	Concrete Floor Smear (See Map)	52.4	55.65	-3.3	-19.5	R	0.5	0.1	0.4	1.6	R		
6	Concrete Floor Smear (See Map)	56	55.65	0.4	2.1	R	0.1	0.1	0.0	0.0	R		
7	Concrete Floor Smear (See Map)	58.6	55.65	3.0	17.7	R	0.3	0.1	0.2	0.8	R		
8	Concrete Floor Smear (See Map)	56.3	55.65	0.6	3.9	R	0.6	0.1	0.5	1.9	R		
9	Concrete Floor Smear (See Map)	51.1	55.65	-4.6	-27.2	R	0.1	0.1	0.0	0.0	R		
10	Concrete Floor Smear (See Map)	50.4	55.65	-5.3	-31.4	R	0.4	0.1	0.3	1.2	R		
11	Concrete Floor Smear (See Map)	54.9	55.65	-0.8	-4.5	R	0.2	0.1	0.1	0.4	R		
12	Concrete Floor Smear (See Map)	52.8	55.65	-2.9	-17.1	R	0.8	0.1	0.7	2.7	R		
13	Concrete Floor Smear (See Map)	59.6	55.65	4.0	23.7	R	0.5	0.1	0.4	1.6	R		
14	Concrete Floor Smear (See Map)	51.8	55.65	-3.9	-23.1	R	0.7	0.1	0.6	2.3	R		

(1) If area other than 100 cm², record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n or β).

Remarks: Report reflects instrument background on 6-9-17 when smears were counted.

Reviewed by: *[Signature]* Date: 6-12-17

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APPENDIX B – LABORATORY REPORTS



Gross Alpha/Beta Case Narrative

AMEC

EPA UNLV Characterization -- 6480155089

Work Order Number: 1706257

1. This report consists of the analytical results and supporting documentation for 14 solid samples received by ALS on 06/12/2017.
2. These samples were prepared according to the current revision of SOP 702.
3. The samples were analyzed for gross alpha and beta activity by gas flow proportional counting according to the current revision of SOP 724. The analyses were completed on 07/05/2017. Gross alpha results are referenced to ^{241}Am . Gross beta results are referenced to $^{90}\text{Sr/Y}$.
4. The analysis results for these samples are reported on an 'As Received' basis in units of pCi/gram.
5. The radiometric recovery for the matrix spike of sample 1706257-2 is below the lower control limit of 70% at 44% for gross alpha. ALS does not control on matrix samples. The results for this sample are considered an estimated value. All other quality control criteria have been met.
6. 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.

Jean Anderson

Jean Anderson
Radiochemistry Primary Data Reviewer

7/11/17
Date

[Signature]

Radiochemistry Final Data Reviewer

7/12/17
Date

Section 1

CHAIN OF CUSTODY

ALS -- Fort Collins

Sample Number(s) Cross-Reference Table

OrderNum: 1706257

Client Name: AMEC

Client Project Name: EPA UNLV Characterization

Client Project Number: 6480155089

Client PO Number: F013800268

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
1	1706257-1		SOLID	08-Jun-17	13:20
2	1706257-2		SOLID	08-Jun-17	13:25
3	1706257-3		SOLID	08-Jun-17	13:30
4	1706257-4		SOLID	08-Jun-17	13:35
5	1706257-5		SOLID	08-Jun-17	13:40
6	1706257-6		SOLID	08-Jun-17	13:45
7	1706257-7		SOLID	08-Jun-17	13:50
8	1706257-8		SOLID	08-Jun-17	13:55
9	1706257-9		SOLID	08-Jun-17	14:00
10	1706257-10		SOLID	08-Jun-17	14:05
11	1706257-11		SOLID	08-Jun-17	14:10
12	1706257-12		SOLID	08-Jun-17	14:15
13	1706257-13		SOLID	08-Jun-17	14:20
14	1706257-14		SOLID	08-Jun-17	14:25



ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

Chain-of-Custody

WORKORDER # **1706257**

Form 202r8

PROJECT NAME		SAMPLER	Amec Foster Wheeler	DATE	6/9/2017	PAGE	1 of 2												
PROJECT No.	6480155089	SITE ID	HAC Las Vegas	TURNAROUND	30 days	DISPOSAL	By Lab or Return-to-Client												
COMPANY NAME	Amec Foster Wheeler	EDD FORMAT		Gross Alpha/Beta															
SEND REPORT TO	Heath Downey	PURCHASE ORDER	F013800268																
ADDRESS	511 Congress St.	BILL TO COMPANY	Amec Foster Wheeler																
CITY / STATE / ZIP	Portland, ME 04101	INVOICE ATTN TO	Tammie Rippie																
PHONE	(207) 828-3505	ADDRESS	9210 Sky Park Court																
FAX	(207) 772-4762	CITY / STATE / ZIP	San Diego, CA 92123																
E-MAIL	Heath.Downey@amecfw.com	PHONE	(858) 300-4313																
		FAX	(858) 300-4301																
		E-MAIL	Tammie.Rippie@amecfw.com																
Lab ID	Field ID	Matrix	Sample Date	Sample Time	# Bottles	Pres.	QC												
1	1	NS	6/8/2017	13:20	1		X												
2	2	NS	6/8/2017	13:25	1		X												
3	3	NS	6/8/2017	13:30	1		X												
4	4	NS	6/8/2017	13:35	1		X												
5	5	NS	6/8/2017	13:40	1		X												
6	6	NS	6/8/2017	13:45	1		X												
7	7	NS	6/8/2017	13:50	1		X												
8	8	NS	6/8/2017	13:55	1		X												
9	9	NS	6/8/2017	14:00	1		X												
10	10	NS	6/8/2017	14:05	1		X												

*Time Zone (Circle): EST CST MST PST Matrix: O=oil S=soil NS=non-soil solid W=water L=liquid E=extract F=filter

For metals or anions, please detail analytes below.

Comments: Sunrise Warehouse Concrete Floor Samples 5 of 328	QC PACKAGE (check below)	
	<input type="checkbox"/>	LEVEL II (Standard QC)
	<input type="checkbox"/>	LEVEL III (Std QC + forms)
	<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)

Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Art Samiljan	6/9/2017	11:30
RECEIVED BY	Fed Ex			
RELINQUISHED BY	Fed Ex			
RECEIVED BY	<i>[Signature]</i>	JOSHUA BENNETT	6/12/17	09:55
RELINQUISHED BY				
RECEIVED BY				



ALS Laboratory Group

225 Commerce Drive, Fort Collins, Colorado 80524
 TF: (800) 443-1511 PH: (970) 490-1511 FX: (970) 490-1522

Chain-of-Custody

WORKORDER # **1706257**

Form 202r8

PROJECT NAME		EPA UNLV Characterization		SAMPLER		Amec Foster Wheeler		DATE		6/9/2017		PAGE		2 of 2	
PROJECT No.		6480155089		SITE ID		HAC Las Vegas		TURNAROUND		30 days		DISPOSAL		By Lab or Return-to-Client	
COMPANY NAME		Amec Foster Wheeler		PURCHASE ORDER		F013800268		Gross Alpha/Beta							
SEND REPORT TO		Heath Downey		BILL TO COMPANY		Amec Foster Wheeler									
ADDRESS		511 Congress St.		INVOICE ATTN TO		Tammie Rippie									
CITY / STATE / ZIP		Portland, ME 04101		ADDRESS		9210 Sky Park Court									
PHONE		(207) 828-3505		CITY / STATE / ZIP		San Diego, CA 92123									
FAX		(207) 772-4762		PHONE		(858) 300-4313									
E-MAIL		Heath.Downey@amecfw.com		FAX		(858) 300-4301									
E-MAIL		Heath.Downey@amecfw.com		E-MAIL		Tammie.Rippie@amecfw.com									
Lab ID	Field ID	Matrix	Sample Date	Sample Time	# Bottles	Pres.	QC								
	11	NS	6/8/2017	14:10	1		X								
	12	NS	6/8/2017	14:15	1		X								
	13	NS	6/8/2017	14:20	1		X								
	14	NS	6/8/2017	14:25	1		X								

*Time Zone (Circle): EST CST MST PST Matrix: O=oil S=soil NS=non-soil solid W=water L=liquid E=extract F=filter

For metals or anions, please detail analytes below.

Comments: Sunrise Warehouse Concrete Floor Samples 6 of 328	QC PACKAGE (check below)	
	<input type="checkbox"/>	LEVEL II (Standard QC)
	<input type="checkbox"/>	LEVEL III (Std QC + forms)
	<input checked="" type="checkbox"/>	LEVEL IV (Std QC + forms + raw data)
Preservative Key: 1-HCl 2-HNO3 3-H2SO4 4-NaOH 5-NaHSO4 7-Other 8-4 degrees C 9-5035		

	SIGNATURE	PRINTED NAME	DATE	TIME
RELINQUISHED BY	<i>[Signature]</i>	Art Samiljan	6/9/2017	11:30
RECEIVED BY	Fed Ex			
RELINQUISHED BY	Fed Ex			
RECEIVED BY	<i>[Signature]</i>	JOSUA GARCIA-SUSA	6/12/17	09:15
RELINQUISHED BY				
RECEIVED BY				



ALS Environmental - Fort Collins
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: AMEC
Project Manager: LADCE

Workorder No: 1706257
Initials: JNS Date: 6/12/17

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	NONE	<input checked="" type="radio"/> YES	NO
3. Are Custody seals on sample containers intact?	NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	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?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	N/A	YES	NO
15. Do any water samples contain sediment? Amount Amount of sediment: ___ dusting ___ moderate ___ heavy	N/A	YES	NO
16. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4		<input checked="" type="radio"/> YES	NO
Cooler #: <u>1</u>			
Temperature (°C): <u>amb</u>			
No. of custody seals on cooler: <u>2</u>			
External μR/hr reading: <u>10</u>			
Background μR/hr reading: <u>10</u>			
Were external μR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / NO / NA (If no, see Form 008.)			

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

If applicable, was the client contacted? YES / NO / NA Contact: [Signature] Date/Time: _____
Project Manager Signature / Date: [Signature] 6/13/17

ORIGIN: D-GJTA (970) 243-2861
JEANETTE DEARBORN
AILEE FOSTER WHEELER
2275 LOGOS CT, STE A
GRAND JUNCTION, CO 81505
UNITED STATES

SHIP DATE: 09JUN17
ACT WT: 15.00 LB
ACT DIMS: 21X19X15 IN
BILL SENDER

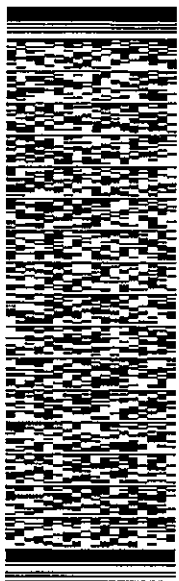
TO LANCE STEERE
ALS
SAMPLE RECEIVING
225 COMMERCE DRIVE
FORT COLLINS CO 80524

(800) 443-1511

REF: 6460155039307.08

NOV

DEPT:



J1711171401w

10-2

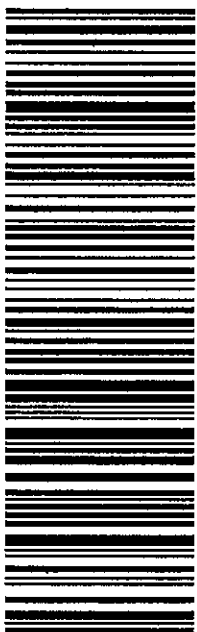
546J 850263C1

TRK# 7793 4259 3097
0201

MON - 12 JUN 3:00P
STANDARD OVERNIGHT

XHFTCA

80524
DEN
CO-US



1766257

After printing this label:

1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
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.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.

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Section 2



SAMPLE RESULTS SUMMARY

Gross Alpha/Beta by GFPC Sample Results Summary

Client Name: AMEC
Client Project Name: EPA UNLV Characterization
Client Project Number: 6480155089
Laboratory Name: ALS -- Fort Collins
PAI Work Order: 1706257

Page: 1 of 4
Reported on: Monday, July 10, 2017
 10:18:18 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	DL	Units	Matrix	Prep Batch	Date Analyzed	Flags
1706257-1	1	Sample	GROSS ALPHA	0.8 +/- 1.1	2.2	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-1	1	Sample	GROSS BETA	2.9 +/- 1.6	2.8	NA	pCi/g	SOLID	AB170626-1	7/3/2017	LT
1706257-2	2	Sample	GROSS ALPHA	1.9 +/- 1.3	2.2	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-2	2	Sample	GROSS BETA	1.7 +/- 1.6	3.0	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-3	3	Sample	GROSS ALPHA	1.3 +/- 1.4	2.6	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-3	3	Sample	GROSS BETA	2.5 +/- 1.8	3.2	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-4	4	Sample	GROSS ALPHA	1.7 +/- 1.2	2.2	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-4	4	Sample	GROSS BETA	1.5 +/- 1.6	3.0	NA	pCi/g	SOLID	AB170626-1	7/3/2017	U
1706257-5	5	Sample	GROSS ALPHA	2.9 +/- 1.5	2.4	NA	pCi/g	SOLID	AB170626-1	7/5/2017	LT

Comments:

Data Package ID: AB1706257-1

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 - Sample specific Minimum Detectable Concentration
 BDL - Below Detection Limit

Gross Alpha/Beta by GFPC Sample Results Summary

Client Name: AMEC
Client Project Name: EPA UNLV Characterization
Client Project Number: 6480155089
Laboratory Name: ALS -- Fort Collins
PAI Work Order: 1706257

Page: 2 of 4
Reported on: Monday, July 10, 2017
 10:18:18 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	DL	Units	Matrix	Prep Batch	Date Analyzed	Flags
1706257-5	5	Sample	GROSS BETA	2.1 +/- 1.9	3.6	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-6	6	Sample	GROSS ALPHA	2.3 +/- 1.3	2.0	NA	pCi/g	SOLID	AB170626-1	7/5/2017	LT
1706257-6	6	Sample	GROSS BETA	3.0 +/- 1.8	3.1	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-7	7	Sample	GROSS ALPHA	2.2 +/- 1.5	2.6	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-7	7	Sample	GROSS BETA	3.7 +/- 1.7	2.9	NA	pCi/g	SOLID	AB170626-1	7/5/2017	LT
1706257-8	8	Sample	GROSS ALPHA	2.2 +/- 1.6	2.7	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-8	8	Sample	GROSS BETA	2.0 +/- 1.7	3.2	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-9	9	Sample	GROSS ALPHA	1.2 +/- 1.4	2.5	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-9	9	Sample	GROSS BETA	2.3 +/- 1.7	3.1	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U

Comments:

Data Package ID: AB1706257-1

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 - Sample specific Minimum Detectable Concentration
 BDL - Below Detection Limit

Gross Alpha/Beta by GFPC Sample Results Summary

Client Name: AMEC
Client Project Name: EPA UNLV Characterization
Client Project Number: 6480155089
Laboratory Name: ALS -- Fort Collins
PAI Work Order: 1706257

Page: 3 of 4
Reported on: Monday, July 10, 2017
 10:18:18 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	DL	Units	Matrix	Prep Batch	Date Analyzed	Flags
1706257-10	10	Sample	GROSS ALPHA	1.6 +/- 1.3	2.4	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-10	10	Sample	GROSS BETA	0.5 +/- 1.6	3.0	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-11	11	Sample	GROSS ALPHA	0.6 +/- 1.2	2.4	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-11	11	Sample	GROSS BETA	0.9 +/- 1.6	3.0	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-12	12	Sample	GROSS ALPHA	1.9 +/- 1.4	2.4	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-12	12	Sample	GROSS BETA	0.7 +/- 1.6	3.2	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-13	13	Sample	GROSS ALPHA	1.3 +/- 1.2	2.2	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-13	13	Sample	GROSS BETA	1.6 +/- 1.7	3.1	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U
1706257-14	14	Sample	GROSS ALPHA	2.0 +/- 1.3	2.1	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U

Comments:

Data Package ID: AB1706257-1

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 - Sample specific Minimum Detectable Concentration
 BDL - Below Detection Limit

Gross Alpha/Beta by GFPC Sample Results Summary

Client Name: AMEC
Client Project Name: EPA UNLV Characterization
Client Project Number: 6480155089
Laboratory Name: ALS -- Fort Collins
PAI Work Order: 1706257

Page: 4 of 4
Reported on: Monday, July 10, 2017
 10:18:18 AM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	DL	Units	Matrix	Prep Batch	Date Analyzed	Flags
1706257-14	14	Sample	GROSS BETA	0.8 +/- 1.6	3.0	NA	pCi/g	SOLID	AB170626-1	7/5/2017	U

Comments:

Data Package ID: AB1706257-1

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 - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit

Section 3

QC RESULTS SUMMARY



Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Lab ID: AB170626-1MB

Sample Matrix: SOLID

Prep Batch: AB170626-1

Final Aliquot: 2.00 g

Prep SOP: PAI 702 Rev 20

QCBatchID: AB170626-1-1

Result Units: pCi/g

Date Collected: 26-Jun-17

Run ID: AB170626-1A

File Name: ABC0705D

Date Prepared: 26-Jun-17

Count Time: 480 minutes

Date Analyzed: 05-Jul-17

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	0.022 +/- 0.056	0.110	3	NA	U
12587-47-2	GROSS BETA	-0.039 +/- 0.093	0.183	4	NA	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 - Sample specific 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.

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins
Work Order Number: 1706257
Client Name: AMEC
ClientProject ID: EPA UNLV Characterization 6480155089

Lab ID: AB170626-1LCS

Sample Matrix: SOLID
Prep SOP: PAI 702 Rev 20
Date Collected: 26-Jun-17
Date Prepared: 26-Jun-17
Date Analyzed: 28-Jun-17

Prep Batch: AB170626-1
QCBatchID: AB170626-1-1
Run ID: AB170626-1A
Count Time: 45 minutes

Final Aliquot: 2.00 g
Result Units: pCi/g
File Name: ABC0628

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
12587-46-1	GROSS ALPHA	17.4 +/- 3.2	0.5	15.08	115	70 - 130	P
12587-47-2	GROSS BETA	12.9 +/- 2.3	0.9	12.92	99.7	70 - 130	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: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Matrix Spike Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	2
Lab ID:	1706257-2MS

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 28-Jun-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 45 minutes

Report Basis: As Received

Final Aliquot: 0.102 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0628

CASNO	Target Nuclide	Matrix Spike	Sample Results	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
12587-46-1	GROSS ALPHA	8.4	1.9	8.3	14.7	44.0	70 - 130	N,M3
12587-47-2	GROSS BETA	14.1	1.7	12.7	12.6	98.3	70 - 130	P,M3

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 in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

N - Matrix Spike Recovery outside control limits

P - Matrix Spike 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:

MDC - Sample specific Minimum Detectable Concentration

Data Package ID: AB1706257-1

Date Printed: Monday, July 10, 2017

ALS -- Fort Collins

LIMS Version: 6.843

Page 1 of 1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID: 4
Lab ID: 1706257-4DUP

Sample Matrix: SOLID
Prep SOP: PAI 702 Rev 20
Date Collected: 08-Jun-17
Date Prepared: 26-Jun-17
Date Analyzed: 03-Jul-17

Prep Batch: AB170626-1
QCBatchID: AB170626-1-1
Run ID: AB170626-1A
Count Time: 480 minutes
Report Basis: As Received

Final Aliquot: 0.101 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: ABC0703H

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
12587-46-1	GROSS ALPHA	1.7 +/-	1.2	2.2	U	1.7 +/-	1.5	2.6	U	0.0364	2.13
12587-47-2	GROSS BETA	1.5 +/-	1.6	3.0	U	1.8 +/-	1.7	3.1	U	0.131	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: AB1706257-1

Section 4

INDIVIDUAL SAMPLE RESULTS

4

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	1
Lab ID:	1706257-1

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 03-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.102 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0703H

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	0.8 +/- 1.1	2.2	3	NA	U
12587-47-2	GROSS BETA	2.9 +/- 1.6	2.8	4	NA	LT

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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	2
Lab ID:	1706257-2

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 03-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.101 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0703H

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.9 +/- 1.3	2.2	3	NA	U
12587-47-2	GROSS BETA	1.7 +/- 1.6	3.0	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706257
Client Name: AMEC
ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	3
Lab ID:	1706257-3

Sample Matrix: SOLID
Prep SOP: PAI 702 Rev 20
Date Collected: 08-Jun-17
Date Prepared: 26-Jun-17
Date Analyzed: 03-Jul-17

Prep Batch: AB170626-1
QCBatchID: AB170626-1-1
Run ID: AB170626-1A
Count Time: 480 minutes
Report Basis: As Received

Final Aliquot: 0.102 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: ABC0703H

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.3 +/- 1.4	2.6	3	NA	U
12587-47-2	GROSS BETA	2.5 +/- 1.8	3.2	4	NA	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 - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	4
Lab ID:	1706257-4

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 03-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.102 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0703H

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.7 +/- 1.2	2.2	3	NA	U
12587-47-2	GROSS BETA	1.5 +/- 1.6	3.0	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Duplicate Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706257
Client Name: AMEC
ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	4
Lab ID:	1706257-4DUP

Sample Matrix: SOLID	Prep Batch: AB170626-1	Final Aliquot: 0.101 g
Prep SOP: PAI 702 Rev 20	QCBatchID: AB170626-1-1	Prep Basis: As Received
Date Collected: 08-Jun-17	Run ID: AB170626-1A	Moisture(%): NA
Date Prepared: 26-Jun-17	Count Time: 480 minutes	Result Units: pCi/g
Date Analyzed: 03-Jul-17	Report Basis: As Received	File Name: ABC0703H

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.7 +/- 1.5	2.6	3	NA	U
12587-47-2	GROSS BETA	1.8 +/- 1.7	3.1	4	NA	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.
M - The requested MDC was not met.
M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
W - DER is greater than Warning Limit of 1.42
D - DER is greater than Control Limit of 2.13

Abbreviations:

TPU - Total Propagated Uncertainty
MDC - Sample specific Minimum Detectable Concentration
BDL - Below Detection Limit
DL - Decision Level

Data Package ID: AB1706257-1

Date Printed:

Monday, July 10, 2017

ALS -- Fort Collins

LIMS Version: 6.843

Page 1 of 1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	5
Lab ID:	1706257-5

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.102 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABA0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.9 +/- 1.5	2.4	3	NA	LT
12587-47-2	GROSS BETA	2.1 +/- 1.9	3.6	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	6
Lab ID:	1706257-6

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.101 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABA0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.3 +/- 1.3	2.0	3	NA	LT
12587-47-2	GROSS BETA	3.0 +/- 1.8	3.1	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1706257
Client Name: AMEC
ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	7
Lab ID:	1706257-7

Sample Matrix: SOLID
Prep SOP: PAI 702 Rev 20
Date Collected: 08-Jun-17
Date Prepared: 26-Jun-17
Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1
QCBatchID: AB170626-1-1
Run ID: AB170626-1A
Count Time: 480 minutes
Report Basis: As Received

Final Aliquot: 0.103 g
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/g
File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.2 +/- 1.5	2.6	3	NA	U
12587-47-2	GROSS BETA	3.7 +/- 1.7	2.9	4	NA	LT

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 - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	8
Lab ID:	1706257-8

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.100 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.2 +/- 1.6	2.7	3	NA	U
12587-47-2	GROSS BETA	2.0 +/- 1.7	3.2	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	9
Lab ID:	1706257-9

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.102 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.2 +/- 1.4	2.5	3	NA	U
12587-47-2	GROSS BETA	2.3 +/- 1.7	3.1	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID: 10

Lab ID: 1706257-10

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.102 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.6 +/- 1.3	2.4	3	NA	U
12587-47-2	GROSS BETA	0.5 +/- 1.6	3.0	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID:	11
Lab ID:	1706257-11

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.101 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	0.6 +/- 1.2	2.4	3	NA	U
12587-47-2	GROSS BETA	0.9 +/- 1.6	3.0	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID: 12

Lab ID: 1706257-12

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.103 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.9 +/- 1.4	2.4	3	NA	U
12587-47-2	GROSS BETA	0.7 +/- 1.6	3.2	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID: 13

Lab ID: 1706257-13

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.103 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	1.3 +/- 1.2	2.2	3	NA	U
12587-47-2	GROSS BETA	1.6 +/- 1.7	3.1	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Gross Alpha/Beta by GFPC

PAI 724 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1706257

Client Name: AMEC

ClientProject ID: EPA UNLV Characterization 6480155089

Field ID: 14

Lab ID: 1706257-14

Sample Matrix: SOLID

Prep SOP: PAI 702 Rev 20

Date Collected: 08-Jun-17

Date Prepared: 26-Jun-17

Date Analyzed: 05-Jul-17

Prep Batch: AB170626-1

QCBatchID: AB170626-1-1

Run ID: AB170626-1A

Count Time: 480 minutes

Report Basis: As Received

Final Aliquot: 0.101 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: ABC0705D

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
12587-46-1	GROSS ALPHA	2.0 +/- 1.3	2.1	3	NA	U
12587-47-2	GROSS BETA	0.8 +/- 1.6	3.0	4	NA	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 - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: AB1706257-1

Section 5

RAW DATA

5

Gross Alpha/Beta by GFPC Raw Data Report

Laboratory Name: ALS -- Fort Collins
 PAI Work Order: 1706257

Prep SOP: PAI 702
 Analytical SOP: PAI 724

Reported on: Thursday, July 06, 2017
 1:22:01 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC/BatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Aliq Analy Aliq	InstID DetID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CndDur(min) Yield	Activity +/- 2 s TPU	MDC DeclEv	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1706257-1	GROSS ALPHA	6/8/2017 1:20:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C A3	AB170626-1A ABC0703H	7/3/2017 3:31 PM	0.129 0.103	21.01% NA	480 NA	0.8 1.1	2.2 2.2	pCi/g As Received	NA NA	U
1706257-1	GROSS BETA	6/8/2017 1:20:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C A3	AB170626-1A ABC0703H	7/3/2017 3:31 PM	1.829 1.548	44.40% NA	480 NA	2.9 1.6	2.8 2.2	pCi/g As Received	NA NA	LT
1706257-2	GROSS ALPHA	6/8/2017 1:25:00 PM	AB170626-1	NA	NA	SOLID	3.04 g 0.101 g	LB4100-C A4	AB170626-1A ABC0703H	7/3/2017 3:31 PM	0.150 0.089	20.68% NA	480 NA	1.9 1.3	2.2 3.0	pCi/g As Received	NA NA	U
1706257-2	GROSS BETA	6/8/2017 1:25:00 PM	AB170626-1	NA	NA	SOLID	3.04 g 0.101 g	LB4100-C A4	AB170626-1A ABC0703H	7/3/2017 3:31 PM	1.723 1.548	42.84% NA	480 NA	1.7 1.6	3.0 8.3	pCi/g As Received	NA NA	U
1706257-2	GROSS ALPHA	6/8/2017 1:25:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C C4	AB170626-1A ABC0628	6/28/2017 9:33 AM	0.444 0.127	20.42% NA	45 NA	8.4 5.5	8.3 12.7	pCi/g As Received	NA NA	44.0 N.M.3
1706257-2	GROSS BETA	6/8/2017 1:25:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C C4	AB170626-1A ABC0628	6/28/2017 9:33 AM	3.993 2.536	42.85% NA	45 NA	14.1 6.9	12.7 2.6	pCi/g As Received	NA NA	98.3 P.M.3
1706257-3	GROSS ALPHA	6/8/2017 1:30:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C D1	AB170626-1A ABC0703H	7/3/2017 3:31 PM	0.142 0.104	19.46% NA	480 NA	1.3 1.4	2.6 3.2	pCi/g As Received	NA NA	U
1706257-3	GROSS BETA	6/8/2017 1:30:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C D1	AB170626-1A ABC0703H	7/3/2017 3:31 PM	1.904 1.670	40.99% NA	480 NA	2.5 1.8	3.2 2.2	pCi/g As Received	NA NA	U
1706257-4	GROSS ALPHA	6/8/2017 1:35:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C D2	AB170626-1A ABC0703H	7/3/2017 3:31 PM	0.179 0.118	21.66% NA	480 NA	1.7 1.2	2.2 3.0	pCi/g As Received	NA NA	U
1706257-4	GROSS BETA	6/8/2017 1:35:00 PM	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C D2	AB170626-1A ABC0703H	7/3/2017 3:31 PM	1.675 1.523	41.07% NA	480 NA	1.5 1.6	3.0 2.6	pCi/g As Received	NA NA	U
1706257-4	GROSS ALPHA	6/8/2017 1:35:00 PM	AB170626-1	NA	NA	SOLID	3.04 g 0.101 g	LB4100-C D3	AB170626-1A ABC0703H	7/3/2017 3:31 PM	0.188 0.132	20.56% NA	480 NA	1.7 1.5	2.6 2.6	pCi/g As Received	0.04 NA	U

Comments:

Data Package ID: AB1706257-1

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- Notes:
 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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 DER - Duplicate Error Ratio
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Gross Alpha/Beta by GFPC Raw Data Report

Laboratory Name: **ALS -- Fort Collins**
PAI Work Order: 1706257

Prep SOP: **PAI 702**
 Analytical SOP: **PAI 724**

Reported on: **Thursday, July 06, 2017**
1:22:01 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC/BatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Aliq Analy Aliq	Inst ID Det ID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CmDur(min) Yield	Activity +/- 2 s TPU	MDC DeclEv	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1706257-4	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.04 g 0.101 g	LB4100-C D3	AB170626-1A ABC0705H	7/3/2017 3:31 PM	1.794 1.615	41.96% NA	480 NA	1.8 1.7	3.1	pCi/g As Received	NA NA	0.13 U
1706257-5	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.05 g 0.102 g	LB4100-A C1	AB170626-1A ABA0705D	7/5/2017 3:31 PM	0.194 0.104	19.82% NA	480 NA	2.9 1.5	2.4	pCi/g As Received	NA NA	NA LT
1706257-5	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.05 g 0.102 g	LB4100-A C1	AB170626-1A ABA0705D	7/5/2017 3:31 PM	2.398 2.183	42.47% NA	480 NA	2.1 1.9	3.6	pCi/g As Received	NA NA	U
1706257-6	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.03 g 0.101 g	LB4100-A C3	AB170626-1A ABA0705D	7/5/2017 3:31 PM	0.188 0.100	23.16% NA	480 NA	2.3 1.3	2.0	pCi/g As Received	NA NA	NA LT
1706257-6	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.03 g 0.101 g	LB4100-A C3	AB170626-1A ABA0705D	7/5/2017 3:31 PM	2.021 1.725	43.39% NA	480 NA	3.0 1.8	3.1	pCi/g As Received	NA NA	NA U
1706257-7	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.08 g 0.103 g	LB4100-C B3	AB170626-1A ABC0705D	7/5/2017 3:31 PM	0.200 0.129	20.40% NA	480 NA	2.2 1.5	2.6	pCi/g As Received	NA NA	NA U
1706257-7	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.08 g 0.103 g	LB4100-C B3	AB170626-1A ABC0705D	7/5/2017 3:31 PM	1.917 1.551	42.89% NA	480 NA	3.7 1.7	2.9	pCi/g As Received	NA NA	NA LT
1706257-8	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.01 g 0.101 g	LB4100-C B4	AB170626-1A ABC0705D	7/5/2017 3:31 PM	0.192 0.125	20.08% NA	480 NA	2.2 1.6	2.7	pCi/g As Received	NA NA	NA U
1706257-8	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.01 g 0.101 g	LB4100-C B4	AB170626-1A ABC0705D	7/5/2017 3:31 PM	1.854 1.658	41.95% NA	480 NA	2.0 1.7	3.2	pCi/g As Received	NA NA	NA U
1706257-9	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C C1	AB170626-1A ABC0705D	7/5/2017 3:31 PM	0.156 0.119	20.54% NA	480 NA	1.2 1.4	2.5	pCi/g As Received	NA NA	NA U
1706257-9	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.07 g 0.102 g	LB4100-C C1	AB170626-1A ABC0705D	7/5/2017 3:31 PM	1.873 1.656	42.14% NA	480 NA	2.3 1.7	3.1	pCi/g As Received	NA NA	NA U

Comments:

Data Package ID: AB1706257-1

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 NC - Not Calculated for duplicate results less than 5 times MDC
 B - Analyte concentration greater than MDC.
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- Notes:**
 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
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- Abbreviations:**
 TR - Tracer TA - Target Analyte
 TPU - Total Propagated Uncertainty
 MDC - Minimum Detectable Concentration
 DER - Duplicate Error Ratio
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Gross Alpha/Beta by GFPC Raw Data Report

Laboratory Name: ALS -- Fort Collins
 PAI Work Order: 1706257

Prep SOP: PAI 702
 Analytical SOP: PAI 724

Reported on: Thursday, July 06, 2017
 1:22:01 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC/BatchID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Aliq Analy Aliq	InstID DetID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CmDur(min) Yield	Activity +/- 2 s TPU	MDC DeclEv	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
1706257-10	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.07 g	LB4100-C	AB170626-1A	7/5/2017	0.190	22.32%	480	1.6	2.4	pC/g	NA	U
	TRG. ANALYTE	2:05:00 PM	AB170626-1-1	NA	NA	NA	0.102 g	C2	ABC0705D	3:31 PM	0.135	NA	NA	1.3	3.0	As Received	NA	U
1706257-10	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.07 g	LB4100-C	AB170626-1A	7/5/2017	1.777	43.39%	480	0.5	3.0	pC/g	NA	U
	TRG. ANALYTE	2:05:00 PM	AB170626-1-1	NA	NA	NA	0.102 g	C2	ABC0705D	3:31 PM	1.715	NA	NA	1.6	2.4	As Received	NA	U
1706257-11	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.04 g	LB4100-C	AB170626-1A	7/5/2017	0.133	21.34%	480	0.6	2.4	pC/g	NA	U
	TRG. ANALYTE	2:10:00 PM	AB170626-1-1	NA	NA	NA	0.101 g	C3	ABC0705D	3:31 PM	0.114	NA	NA	1.2	3.0	As Received	NA	U
1706257-11	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.04 g	LB4100-C	AB170626-1A	7/5/2017	1.725	42.78%	480	0.9	3.0	pC/g	NA	U
	TRG. ANALYTE	2:10:00 PM	AB170626-1-1	NA	NA	NA	0.101 g	C3	ABC0705D	3:31 PM	1.641	NA	NA	1.6	2.4	As Received	NA	U
1706257-12	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.09 g	LB4100-C	AB170626-1A	7/5/2017	0.163	19.46%	480	1.9	2.4	pC/g	NA	U
	TRG. ANALYTE	2:15:00 PM	AB170626-1-1	NA	NA	NA	0.103 g	D1	ABC0705D	3:31 PM	0.105	NA	NA	1.4	3.2	As Received	NA	U
1706257-12	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.09 g	LB4100-C	AB170626-1A	7/5/2017	1.731	40.99%	480	0.7	3.2	pC/g	NA	U
	TRG. ANALYTE	2:15:00 PM	AB170626-1-1	NA	NA	NA	0.103 g	D1	ABC0705D	3:31 PM	1.655	NA	NA	1.6	2.2	As Received	NA	U
1706257-13	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.09 g	LB4100-C	AB170626-1A	7/5/2017	0.156	21.66%	480	1.3	2.2	pC/g	NA	U
	TRG. ANALYTE	2:20:00 PM	AB170626-1-1	NA	NA	NA	0.103 g	D2	ABC0705D	3:31 PM	0.111	NA	NA	1.2	3.1	As Received	NA	U
1706257-13	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.09 g	LB4100-C	AB170626-1A	7/5/2017	1.773	41.07%	480	1.6	3.1	pC/g	NA	U
	TRG. ANALYTE	2:20:00 PM	AB170626-1-1	NA	NA	NA	0.103 g	D2	ABC0705D	3:31 PM	1.619	NA	NA	1.7	2.1	As Received	NA	U
1706257-14	GROSS ALPHA	6/8/2017	AB170626-1	NA	NA	SOLID	3.03 g	LB4100-C	AB170626-1A	7/5/2017	0.183	20.56%	480	2.0	2.1	pC/g	NA	U
	TRG. ANALYTE	2:25:00 PM	AB170626-1-1	NA	NA	NA	0.101 g	D3	ABC0705D	3:31 PM	0.112	NA	NA	1.3	3.0	As Received	NA	U
1706257-14	GROSS BETA	6/8/2017	AB170626-1	NA	NA	SOLID	3.03 g	LB4100-C	AB170626-1A	7/5/2017	1.652	41.96%	480	0.8	3.0	pC/g	NA	U
	TRG. ANALYTE	2:25:00 PM	AB170626-1-1	NA	NA	NA	0.101 g	D3	ABC0705D	3:31 PM	1.563	NA	NA	1.6	0.110	As Received	NA	U
AB170626-1	GROSS ALPHA	6/26/2017	AB170626-1	NA	NA	SOLID	3 g	LB4100-C	AB170626-1A	7/5/2017	0.123	19.96%	480	0.022	0.110	pC/g	NA	U
	TRG. ANALYTE	11:35:26 AM	AB170626-1-1	NA	NA	NA	2 g	D4	ABC0705D	3:31 PM	0.108	NA	NA	0.056	0.056	As Received	NA	U

Comments:

Data Package ID: AB1706257-1

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Gross Alpha/Beta by GFPC Raw Data Report

Laboratory Name: **ALS -- Fort Collins**
 PAI Work Order: **1706257**

Prep SOP: **PAI 702**
 Analytical SOP: **PAI 724**

Reported on: **Thursday, July 06, 2017**
 1:22:01 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date /Time	Decay Date/Time	Matrix %Moist.	Samp Aliq Analy Aliq	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
AB170626-1 MB	GROSS BETA Trg. Analyte	6/26/2017 11:35:26 AM	AB170626-1 AB170626-1-1	NA NA	NA NA	SOLID NA	3 g 2 g	LB4100-C D4	AB170626-1A ABC0705D	7/5/2017 3:31 PM	2.213 2.278	42.14% NA	480 NA	-0.039 0.093	0.183	pCi/g As Received	NA NA	U
AB170626-1 LCS	GROSS ALPHA Trg. Analyte	6/26/2017 11:35:26 AM	AB170626-1 AB170626-1-1	NA NA	NA NA	SOLID NA	3 g 2 g	LB4100-C D1	AB170626-1A ABC0628	6/28/2017 9:33 AM	11.933 0.104	19.46% NA	45 NA	17.4 3.2	0.5	pCi/g As Received	NA NA	115 P
AB170626-1 LCS	GROSS BETA Trg. Analyte	6/26/2017 11:35:26 AM	AB170626-1 AB170626-1-1	NA NA	NA NA	SOLID NA	3 g 2 g	LB4100-C D1	AB170626-1A ABC0628	6/28/2017 9:33 AM	27.022 1.670	40.99% NA	45 NA	12.9 2.3	0.9	pCi/g As Received	NA NA	99.7 P

Comments:

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Abbreviations:

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

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC0628
 Batch ID: AB170626-2, -1
 Count Preset (m): 45
 Batch Ended: 6/28/2017 10:12

Background logfile: BKGABW
 Date of Bkg. Cal: 6/22/2017
 Alpha efficiency logfile: Am241R-06/17
 Alpha attenuation calibration: AAM0610, 061
 Beta efficiency logfile: Sr90R-06/17
 Beta attenuation calibration: ASR0611

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b \cdot m^a \cdot (a \cdot (\text{mass} - x0))$	$y = b \cdot m^a \cdot (a \cdot (\text{mass} - x0))$
Alpha b= 0.89490	Beta b= 0.9681
m= 0.99140	m= 0.9996
a= 0.9119	a= 0.9174
x0= 21.4875	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot \text{mass}$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2414	b -> a xtalk b= 1.12E-05
a -> b xtalk m= 0.8990	b -> a xtalk m= 0.0018

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C1	1706559-1	6/28/2017 10:12	45.00	49.4	19.622	0.114	0.047	0.2054	0.718	n/a	n/a	21.822	1.714	4.9479	0.4214	0.951	n/a	n/a
C2	AB170626-2LCS	6/28/2017 10:12	45.00	39.2	11.444	0.126	0.063	0.2232	0.778	n/a	n/a	29.800	1.717	2.8416	0.4339	0.954	n/a	n/a
C3	1706408-1	6/28/2017 10:12	45.00	100.7	3.200	0.095	0.050	0.2134	0.480	n/a	n/a	18.822	1.700	0.8290	0.4278	0.933	n/a	n/a
C4	1706257-2MS	6/28/2017 10:12	45.00	34.5	0.444	0.127	0.003	0.2042	0.808	n/a	n/a	3.933	2.536	0.0793	0.4285	0.956	n/a	n/a
B1	1706408-7	6/28/2017 10:12	45.00	46.5	0.111	0.091	0.000	0.1965	0.735	n/a	n/a	1.444	1.630	0.0051	0.4252	0.952	n/a	n/a
B2	1706408-10	6/28/2017 10:12	45.00	30.2	0.089	0.120	0.000	0.2192	0.836	n/a	n/a	1.822	1.726	0.0000	0.4122	0.957	n/a	n/a
B3	1706408-18	6/28/2017 10:12	45.00	34.9	0.222	0.096	0.001	0.2040	0.805	n/a	n/a	1.889	1.645	0.0316	0.4289	0.956	n/a	n/a
B4	1706476-1MS	6/28/2017 10:12	45.00	117.1	0.267	0.122	0.003	0.2008	0.421	n/a	n/a	2.622	1.699	0.0393	0.4195	0.927	n/a	n/a
D1	AB170626-1LCS	6/28/2017 10:12	45.00	38.3	11.933	0.104	0.056	0.1946	0.784	n/a	n/a	27.022	1.670	2.9671	0.4099	0.955	n/a	n/a

W 7-9-17

W 7/16/17

Date 6/28/17

SOP 724r-12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4						H α	JP	P	
5						P			
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									OLP

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed JP 6/28/17

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK00621W			
Dr B				
Dr C				
Dr D	BK00622W			

Dr = Drawer

Gas Supply

	P-10 Supply	P-10 Flow	
Tank 1	1150	Dr A	10
		Dr B	
Tank 2	850	Dr C	
		Dr D	

Comments:

Date 6/28/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Dark EFP	—	—	30	7:05	JP	EFC0628	JP
1-16	Dark BKS	—	—	60	7:17	JP	BK0628E	JCB
4	↓	—	—	60	8:30	JCM	BK0628F	JCB
11	1706408-1	AB170626-2	2B	45	9:27		AB0628	
12	1706257-7MS	AB170626-1	↓	↓	↓			
13	AB170626-1LS	↓	↓	↓	↓			
5	1706408-7	AB170626-2	↓	↓	↓			
6	↓ -10	↓	↓	↓	↓			
7	↓ -18	↓	↓	↓	↓			
8	1706476-1MS	↓	↓	↓	↓			
9	1706559-1	↓	↓	↓	↓			
10	AB170626-2LS	↓	↓	↓	↓			
2	AB170627-5LS	AB170627-5	2B	30	10:24	JMS	AB170628A	↓
1	1706587-7	AB170627-1	↓	10:00	12:10		AB170628B	
2	↓ -8	↓	↓	↓	↓			
3	↓ -80	↓	↓	↓	↓			
4	AB170627-1MS	↓	↓	↓	↓			
5	AB 1706587-2	↓	↓	180	12:12		AB170628C	
6	↓ -3	↓	↓	↓	↓			
7	AB170627-1LS	↓	↓	30	12:13		AB170628D	
7	1706587-1	↓	↓	720	14:44		AB170628E	
8	↓ -4	↓	↓	↓	↓			
9	↓ -9	↓	↓	↓	↓			
10	↓ -10	↓	↓	↓	↓			
11	↓ -11	↓	↓	↓	↓			
13	↓ -12	↓	↓	↓	↓			
14	↓ -13	↓	↓	↓	↓			
15	↓ -14	↓	↓	↓	↓			
5	1706497-6	AB170627-3	↓	60	15:14		AB170628F	
6	↓ -60	↓	↓	↓	↓			
12	↓ -4MS	↓	↓	↓	↓			
5	1706383-3	AB170620-4	↓	360	16:19	JM	AB170628G	
6	↓ -30	↓	↓	↓	↓			
12	↓ -5	↓	↓	↓	↓			

JCB
6/29/17

JP 6/29/17

Comments:

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Rev.12/01/08 JCP

Data file name: ABC0703H
 Batch ID: AB170626-1
 Count Preset (m): 480
 Batch Ended: 7/3/2017 23:29

Background logfile: BKGABW
 Date of Bkg. Cal: 6/22/2017
 Alpha efficiency logfile: Am241R-06/17
 Alpha prog. logfile: n/a
 Alpha attenuation calibration: AAM0610, 0617
 Alpha prog. attenuation: n/a
 Beta efficiency logfile: SR90R-06/17
 Beta prog. logfile: n/a
 Beta attenuation calibration: ASR0611
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b \cdot m^a (a^{\text{mass}} - x_0)$	$y = b \cdot m^a (a^{\text{mass}} - x_0)$
Alpha b= 0.89490	Beta b= 0.9681
m= 0.99140	m= 0.9996
a= 0.9119	a= 0.9174
x0= 21.4675	x0= 0.0000
Alpha to Beta X-talk	Beta to Alpha X-talk
$y = b \cdot m^a - \text{mass}$	$y = b \cdot m^a + m$
a -> b xtalk b= 0.2414	b -> a xtalk b= 1.12E-05
a -> b xtalk m= 0.9990	b -> a xtalk m= 0.0018

DeL ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A3	1706257-1	7/3/2017 23:29	480.00	50.7	0.129	0.103	0.001	0.2101	0.711	n/a	n/a	1.829	1.548	0.0066	0.4440	0.950	n/a	n/a
A4	1706257-2	7/3/2017 23:29	480.00	55.8	0.150	0.089	0.000	0.2068	0.683	n/a	n/a	1.723	1.548	0.0156	0.4284	0.948	n/a	n/a
D1	1706257-3	7/3/2017 23:29	480.00	61.3	0.142	0.104	0.001	0.1946	0.654	n/a	n/a	1.904	1.670	0.0097	0.4099	0.947	n/a	n/a
D2	1706257-4	7/3/2017 23:29	480.00	46.0	0.179	0.118	0.000	0.2166	0.738	n/a	n/a	1.675	1.523	0.0155	0.4107	0.952	n/a	n/a
D3	1706257-4D	7/3/2017 23:29	480.00	55.7	0.188	0.132	0.000	0.2056	0.684	n/a	n/a	1.794	1.615	0.0142	0.4196	0.949	n/a	n/a

u2 7-9-17

JCS 7/6/17

Date 7/3/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									OLB

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK00621W			
Dr B				
Dr C				
Dr D	BK00622W			

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow	
Tank 1	1190	Dr A	10	
		Dr B		
Tank 2	850	Dr C		
		Dr D		

Comments:

Date 7/3/17

SOP 724r 12

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
13	1706551-11	MS170628-4	αβ	30	955	JMS	ABC0703D	JP
14	↓ 12	↓	↓	↓	↓	↓	↓	↓
15	↓ 13	↓	↓	↓	↓	↓	↓	↓
5	AB170531-1MB	AB170531-1		1000	1035	JM	ABC0703E	
6	1705625-1	↓	↓	↓	↓	↓	↓	↓
7	↓ -4	↓	↓	↓	↓	↓	↓	↓
8	1706002-2	AB170601-1		↓	↓	↓	↓	↓
9	AB170601-1MB	↓	↓	↓	↓	↓	↓	↓
10	AB170602-1MB	AB170602-1		↓	↓	↓	↓	↓
11	1706047-1	↓	↓	↓	↓	↓	↓	↓
12	↓ -8	↓	↓	↓	↓	↓	↓	↓
1	17064767	MS170626-2		1000	1246	JM	ABC0703F	
2	AB170626-2MB	↓	↓	↓	↓	↓	↓	↓
13	1706626-2	AB1706301	αβ	10	1505	JM	ABC0703G	
3	1706257-1	AB1706261		480	1526		ABC0703H	
4	↓ 2	↓	↓	↓	↓	↓	↓	↓
13	↓ 3	↓	↓	↓	↓	↓	↓	↓
14	↓ 4	↓	↓	↓	↓	↓	↓	↓
15	↓ 40	↓	↓	↓	↓	↓	↓	↓

JP 7/4/17

Comments:

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.05/09/13 JP

Data file name: ABA0705D
 Batch ID: AB470626-1
 Count Preset (m): 480
 Batch Ended: 7/5/17 23:25

Background logfile: BKGABW
 Date of Bkg. Cal: 7/5/17
 Alpha efficiency logfile: Am241R-11/16
 Alpha attenuation calibration: AAM1206
 Beta efficiency logfile: Sr90R-11/16
 Beta attenuation calibration: ASR1205

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b'm^a[a'(mass-x0)]$	Beta Attenuation Calibration $y = b'm^a[a'(mass-x0)]$
Alpha b= 0.97970	Beta b= 0.9775
m= 0.99020	m= 0.9994
a= 0.8336	a= 1.0249
x0= 21.5000	x0= 0.0000
Alpha to Beta X-talk $y = b'm^a*x$	Beta to Alpha X-talk $y = b'm^a*x$
a->b xtalk b= 0.2560	b->a xtalk b= 1.550E-05
a->b xtalk m= 0.9993	b->a xtalk m= 0.0036

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
C1	1706257-5	7/5/17 23:25	480.00	64.4	0.194	0.104	0.001	0.1982	0.689	n/a	n/a	2.398	2.183	0.0240	0.4247	0.940	n/a	n/a		
C3	1706257-6	7/5/17 23:25	480.00	61.3	0.188	0.100	0.001	0.2316	0.707	n/a	n/a	2.021	1.725	0.0234	0.4339	0.941	n/a	n/a		

7/7-9-17

7/5 7/6/17

Date 7/5/17

SOP 724r. 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100/A

JP 7/5/17

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			*				P
2									
3									
4									
5									
6									OL
7									P
8									OL-D
9									P
10									OL
11									P
12	α	(HB)			↓				OL
13					OL				
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BKA0704W			
Dr B		#8 JP	#2 Hα	BKA0705W
Dr C				
Dr D	OL			

Dr = Drawer

Gas Supply

P-10 Supply		P-10 Flow	
Tank 1	2300	Dr A	10
	↓	Dr B	
Tank 2	850	Dr C	
		Dr D	↓

Comments: * It is not necessary to run a daily background check following a long background calibration.
 JP 7/5/17

Date

7/5/17

ALS

SOP 724r 12

Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-12	Daily Eff			30	6:45			
1	1706002-1	RA170624-1	Ra228	90	10:43	JP	EFA0705	JP
2	-2					JP	RAA0705	JKB
3	-3							
4	-4							
5	1706170-1							
7	-4							
9	-5							
11	1706209-1							
1	1706313-1	TR170619-1	Ra228	30	12:21	JP	RDA0705	
2	315-1							
3	370-1							
4	372-1							
5	373-1							
7	TR170619-1MB							
9	LES							
11	LASD							
1	1706098-1	AB170619-3	α1B	45	12:54	JP	ABA0705	
2	-1MS							
3	-2							
4	-2D							
5	-3							
7	-4							
9	-5							
11	-6							
1	-7				13:42	JP	ABA0705A	
2	-8							
3	-9							
4	-10							
5	-11							
7	AB170619-3MB							
9	LES							
11	1706098-12	AB170619-4						
1	-13							
2	-14							
3	-14D							
4	-15							
5	-15MS							
7	-16							
9	-17							
11	-18							
8	Weekly Bkg			1000	14:52	JP	BKA0705W	JKB
1	1706098-19	AB170619-4	α1B	45	15:21	JP	ABA0705C	JKB
2	-20							
3	-21							
4	AB170619-4MB							
5	LES							
9	1706251-5	AB170626-1	α1B	480	15:23	JP	ABA0705D	
11	-6							

JP 7/5/17

JP 7/5/17

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Rev.12/01/08 JCP

Data file name: ABC0705D
 Batch ID: AB170626-1
 Count Preset (m): 480
 Batch Ended: 7/5/2017 23:24

Background logfile: BKGABW
 Date of Bkg. Cal: 7/5/2017
 Alpha efficiency logfile: Am241R-06/17
 Alpha attenuation calibration: AAM0610_061
 Beta attenuation calibration: ASR0611

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b \cdot m^a (a^*(mass-x0))$		$y = b \cdot m^a (a^*(mass-x0))$	
Alpha b=	0.89490	Beta b=	0.9681
m=	0.99140	m=	0.9998
a=	0.9119	a=	0.9174
x0=	21.4875	x0=	0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot mass$		Beta to Alpha X-talk $y = b \cdot m^a \cdot m$	
a -> b xtalk b=	0.2414	b -> a xtalk b=	1.12E-05
a -> b xtalk m=	0.9990	b -> a xtalk m=	0.0018

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C1	1706257-9	7/5/2017 23:24	480.00	58.5	0.156	0.119	0.001	0.2054	0.669	n/a	n/a	1.873	1.656	0.0095	0.4214	0.948	n/a	n/a
C2	1706257-10	7/5/2017 23:24	480.00	54.3	0.190	0.135	0.000	0.2232	0.691	n/a	n/a	1.777	1.715	0.0139	0.4339	0.949	n/a	n/a
C3	1706257-11	7/5/2017 23:24	480.00	55.9	0.133	0.114	0.000	0.2134	0.682	n/a	n/a	1.725	1.641	0.0049	0.4278	0.948	n/a	n/a
B3	1706257-7	7/5/2017 23:24	480.00	55.4	0.200	0.129	0.001	0.2040	0.685	n/a	n/a	1.917	1.551	0.0181	0.4289	0.949	n/a	n/a
B4	1706257-8	7/5/2017 23:24	480.00	60.5	0.192	0.125	0.000	0.2008	0.658	n/a	n/a	1.854	1.658	0.0171	0.4195	0.947	n/a	n/a
D1	1706257-12	7/5/2017 23:24	480.00	55.5	0.163	0.105	0.000	0.1946	0.685	n/a	n/a	1.731	1.655	0.0147	0.4099	0.949	n/a	n/a
D2	1706257-13	7/5/2017 23:24	480.00	53.4	0.156	0.111	0.000	0.2166	0.696	n/a	n/a	1.773	1.619	0.0115	0.4107	0.949	n/a	n/a
D3	1706257-14	7/5/2017 23:24	480.00	37.4	0.183	0.112	0.000	0.2056	0.789	n/a	n/a	1.652	1.563	0.0179	0.4196	0.955	n/a	n/a
D4	AB170626-1MB	7/5/2017 23:24	480.00	40.2	0.123	0.108	0.000	0.1996	0.772	n/a	n/a	2.213	2.278	0.0037	0.4214	0.954	n/a	n/a

See 7-9-17

JWS 7/6/17

Date 7/5/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	UP	P			*				P
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK0704W			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

P-10 Supply		P-10 Flow	
Tank 1	2300	Dr A	10
		Dr B	
Tank 2	800	Dr C	
		Dr D	

Comments: * It's not necessary to run a daily background check following a long background calibration.
 JP 7/5/17

Date 7/5/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
13	1706257-12	AB170676-1	α13	480	15:22	JP	ABC070SD	JCS
14	-13	↓	↓	↓	↓	↓	↓	↓
15	-14	↓	↓	↓	↓	↓	↓	↓
16	AB170676-1MB	↓	↓	↓	↓	↓	↓	↓
JCS 7/6/17								

Comments:

Date 7/5/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Doubt E4			30	6:49	JV	EFC0705	JV
1	1706209-3	RA170624-	Ra228	90	10:41	JV	RAC0705	JV
2	-4							
3	1706278-1							
4	-2							
5	-3							
6	-4							
7	-5							
8	-6							
9	1706374-1							
10	-2							
11	-7							
13	-8							
14	RA170624-1MB							
15	LC5							
16	LC8D							
1	1706637-4	AB170703-1	α 1B	120	12:23	JV	ABC0705	
2	-6							
3	6-6D							
4	1706646-1							
5	647-1							
6	648-1							
7	-2							
8	649-1							
9	1706613-1			75	12:25		ABC0705A	
10	-1D							
12	-1M							
11	-2							
13	-3							
14	1706637-4MB							
15	1706656-1							
16	-4							
13	-4D				13:42	JV	ABC0705B	JV
14	-12							
15	-14							
16	AB170703-1MB							
1	1706653-1	AB170703-1	α 1B	1000	14:30	JV	ABC0705C	JV
2	-2							
3	1706669-1							
4	670-1							
5	671-1							
6	AB170703-1MB							
7	1706257-7	AB170624-1	α 1B	480	15:22	JV	ABC0705D	
8	-8							
9	-9							
10	-10							
11	-11							

JV
7/5/17

Comments:

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 -- Fort Collins

Prep Batch: AB170626-1

Prep Procedure: GAB (3)(4) 480

Analytical QASS / NCR? Y / N M

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Ins/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Ins/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Ins/Det	Cnt 3 Pos Chk By	Notes	
1	1706257-1	SMP	3.0685	0.1023	g	PCUG	50.7	ABC0703H	3	JP								
1	1706257-2	SMP	3.0403	0.1013	g	PCUG	55.8		4									
1	1706257-2	MS	3.0734	0.1024	g	PCUG	34.5	ABC0628	12	JCS								
1	1706257-3	SMP	3.0702	0.1023	g	PCUG	61.3	ABC0703H	13	JP								
1	1706257-4	SMP	3.0749	0.1025	g	PCUG	46		14									
1	1706257-4	DUP	3.0373	0.1012	g	PCUG	55.7		15									
1	1706257-5	SMP	3.0466	0.1016	g	PCUG	64.4	ABA0705D	9	JCS								
1	1706257-6	SMP	3.0348	0.1012	g	PCUG	61.3		11									
1	1706257-7	SMP	3.0818	0.1027	g	PCUG	55.4	ABC0705D	7	JCS								
1	1706257-8	SMP	3.0144	0.1005	g	PCUG	60.5		8									
1	1706257-9	SMP	3.0747	0.1025	g	PCUG	58.5		9									
1	1706257-10	SMP	3.0693	0.1023	g	PCUG	54.3		10									
1	1706257-11	SMP	3.0391	0.1013	g	PCUG	55.9		11									
1	1706257-12	SMP	3.0879	0.1029	g	PCUG	55.5		13									
1	1706257-13	SMP	3.0865	0.1029	g	PCUG	53.4		14									
1	1706257-14	SMP	3.0326	0.1011	g	PCUG	37.4		15									
1	AB170626-1	MB	3	2	g	PCUG	40.2		16									
1	AB170626-1	LCS	3	2	g	PCUG	38.3	ABC0628	13	JCS								

7/12

DICS 7/6/17

18

Spike Solution Information									
Soln #	Nuclide	SolnID	Exp Date	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	931.4243.12	2-1-18	43.033	DPM/ml	06/26/17	1	ml	RS-033
S2	Am-241	956.4243.10	1-28-18	100.427	DPM/ml	06/26/17	1	ml	RS-033

Sample Barcodes

1706257-1 AB170626-1PS1	1706257-2 AB170626-1PS2	1706257-2MS AB170626-1PS3
1706257-3 AB170626-1PS4	1706257-4 AB170626-1PS5	1706257-4DUP AB170626-1PS6
1706257-5 AB170626-1PS7	1706257-6 AB170626-1PS8	1706257-7 AB170626-1PS9

56 01 328

Radiochemistry Instrument Worksheet

ALS -- Fort Collins

Prep Batch: AB170626-1

Prep Procedure: **GAB**

Analytical QASS / NCR? Y / N _____

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Ins/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Ins/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Ins/Det	Cnt 3 Pos Chk By	Notes	
1706257-8 AB170626-1PS10								1706257-9 AB170626-1PS11						1706257-10 AB170626-1PS12				
1706257-11 AB170626-1PS13								1706257-12 AB170626-1PS14						1706257-13 AB170626-1PS15				
1706257-14 AB170626-1PS16								AB170626-1MB AB170626-1PS17						AB170626-1LCS AB170626-1PS18				

Reporting Units

LabID	TstGrpName	RptUnits
1706257-1	GrossAlpha/Beta	PCI/G
1706257-2	GrossAlpha/Beta	PCI/G
1706257-3	GrossAlpha/Beta	PCI/G
1706257-4	GrossAlpha/Beta	PCI/G
1706257-5	GrossAlpha/Beta	PCI/G
1706257-6	GrossAlpha/Beta	PCI/G
1706257-7	GrossAlpha/Beta	PCI/G
1706257-8	GrossAlpha/Beta	PCI/G
1706257-9	GrossAlpha/Beta	PCI/G
1706257-10	GrossAlpha/Beta	PCI/G
1706257-11	GrossAlpha/Beta	PCI/G
1706257-12	GrossAlpha/Beta	PCI/G
1706257-13	GrossAlpha/Beta	PCI/G
1706257-14	GrossAlpha/Beta	PCI/G

57 of 328

Radiochemistry Gravimetric Worksheet

ALS -- Fort Collins

Prep Batch: **AB170626-1**

Prep Procedure: **GAB**

Reviewed By: hcj *HCS*

Review Date: 6/27/2017

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1706257-1	SMP	5	9.2639	0.0000	0	30	30	1	9.3146	50.7	0	
1	2	1706257-2	SMP	5	9.3596	0.0000	0	30	30	1	9.4154	55.8	0	
1	3	1706257-2	MS	5	9.3153	0.0000	0	30	30	1	9.3498	34.5	0	
1	4	1706257-3	SMP	5	9.3740	0.0000	0	30	30	1	9.4353	61.3	0	
1	5	1706257-4	SMP	5	9.3421	0.0000	0	30	30	1	9.3881	46	0	
1	6	1706257-4	DUP	5	9.3814	0.0000	0	30	30	1	9.4371	55.7	0	
1	7	1706257-5	SMP	5	9.3042	0.0000	0	30	30	1	9.3686	64.4	0	
1	8	1706257-6	SMP	5	9.2972	0.0000	0	30	30	1	9.3585	61.3	0	
1	9	1706257-7	SMP	5	9.3254	0.0000	0	30	30	1	9.3808	55.4	0	
1	10	1706257-8	SMP	5	9.3150	0.0000	0	30	30	1	9.3755	60.5	0	
1	11	1706257-9	SMP	5	9.3707	0.0000	0	30	30	1	9.4292	58.5	0	
1	12	1706257-10	SMP	5	9.3334	0.0000	0	30	30	1	9.3877	54.3	0	
1	13	1706257-11	SMP	5	9.3041	0.0000	0	30	30	1	9.3600	55.9	0	
1	14	1706257-12	SMP	5	9.2778	0.0000	0	30	30	1	9.3333	55.5	0	
1	15	1706257-13	SMP	5	9.3183	0.0000	0	30	30	1	9.3717	53.4	0	
1	16	1706257-14	SMP	5	9.3145	0.0000	0	30	30	1	9.3519	37.4	0	
1	17	AB170626-1	MB	5	9.1831	9.1937	10.6	30	30	20	9.2233	40.2	2	
1	18	AB170626-1	LCS	5	9.3975	9.4073	9.8	30	30	20	9.4358	38.3	2	

58 of 328

Radiochemistry Gravimetric Worksheet

ALS -- Fort Collins

Prep Batch: **AB170626-1**

Prep Procedure: **GAB**

Prep Batch Not Validated!!!

Reviewed By:

Review Date:

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1706257-1	SMP	5	9.4019	10.1901	788.2	0	30	0	0.0000	-9401.9	0	
1	2	1706257-2	SMP	5	9.2773	10.0483	771	0	30	0	0.0000	-9277.3	0	
1	3	1706257-2	MS	5	9.2861	10.0659	779.8	0	30	0	0.0000	-9286.1	0	
1	4	1706257-3	SMP	5	9.4225	10.2486	826.1	0	30	0	0.0000	-9422.5	0	
1	5	1706257-4	SMP	5	9.3471	10.1624	815.3	0	30	0	0.0000	-9347.1	0	
1	6	1706257-4	DUP	5	9.3608	9.9123	551.5	1	30	0	0.0000	-9360.8	0	
1	7	1706257-5	SMP	5	9.3266	9.8876	561	1	30	0	0.0000	-9326.6	0	
1	8	1706257-6	SMP	5	9.3173	9.8780	560.7	1	30	0	0.0000	-9317.3	0	
1	9	1706257-7	SMP	5	9.2660	9.8527	586.7	1	30	0	0.0000	-9266	0	
1	10	1706257-8	SMP	5	9.3263	9.9037	577.4	1	30	0	0.0000	-9326.3	0	
1	11	1706257-9	SMP	5	9.2330	9.8292	596.2	1	30	0	0.0000	-9233	0	
1	12	1706257-10	SMP	5	9.2816	9.8643	582.7	1	30	0	0.0000	-9281.6	0	
1	13	1706257-11	SMP	5	9.3004	9.8402	539.8	1	30	0	0.0000	-9300.4	0	
1	14	1706257-12	SMP	5	9.2901	9.8872	597.1	1	30	0	0.0000	-9290.1	0	
1	15	1706257-13	SMP	5	9.3791	9.9737	594.6	1	30	0	0.0000	-9379.1	0	
1	16	1706257-14	SMP	5	9.3262	9.8662	540	1	30	0	0.0000	-9326.2	0	
1	17	AB170626-1	MB	5	9.1831	9.1937	10.6	30	30	20	0.0000	-9183.1	2	
1	18	AB170626-1	LCS	5	9.3975	9.4073	9.8	30	30	0	0.0000	-9397.5	2	

59 of 328

Radiochemistry Prep Worksheet

ALS -- Fort Collins

Prep Batch: AB170626-1

Prep Procedure: **GAB**

Reviewed By: hcj **Hcj**

Review Date: 6/27/2017

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Hunter C. Jordan **Hcj** Balance: 13
 Prep SOP: NONE Prep Date: 6/26/2017 Balance:
 Matrix Class: solid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq g	Fin Alq g	Prep Basis	Standards	Prep Notes
1	1	1706257-1	SMP	<u>N/A</u>	3.0685	0.102283	As Received	<u>N/A</u>	<div style="position: absolute; top: 40%; left: 40%; font-size: 2em;"> Hcj 6-27-17 </div>
2	1	1706257-2	SMP		3.0403	0.101343	As Received	<u>N/A</u>	
3	1	1706257-2	MS		3.0734	0.102447	As Received	S1,S2	
4	1	1706257-3	SMP		3.0702	0.10234	As Received	<u>N/A</u>	
5	1	1706257-4	SMP		3.0749	0.102497	As Received		
6	1	1706257-4	DUP		3.0373	0.101243	As Received		
7	1	1706257-5	SMP		3.0466	0.101553	As Received		
8	1	1706257-6	SMP		3.0348	0.10116	As Received		
9	1	1706257-7	SMP		3.0818	0.102727	As Received		
10	1	1706257-8	SMP		3.0144	0.10048	As Received		
11	1	1706257-9	SMP		3.0747	0.10249	As Received		
12	1	1706257-10	SMP		3.0693	0.10231	As Received		
13	1	1706257-11	SMP		3.0391	0.101303	As Received		
14	1	1706257-12	SMP		3.0879	0.10293	As Received		
15	1	1706257-13	SMP		3.0865	0.102883	As Received		
16	1	1706257-14	SMP		3.0326	0.101087	As Received		
17	1	AB170626-1	MB		3	2	As Received		
18	1	AB170626-1	LCS		3	2	As Received	S1,S2	

Comments

Samples were flamed and desiccated on 6/26/2017.

Spiked By: Hunter C. Jordan Date: 6/26/2017

Witnessed By: Rebecka M. Olivares Date: 6/26/2017

Spike Solution Information									
Soln #	Nuclide	SolnID	Exp Date	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	931.4243.12	<u>2-1-18</u>	43.033	DPM/ml	06/26/17	1	ml	RS-033
S2	Am-241	956.4243.10	<u>1-28-18</u>	100.427	DPM/ml	06/26/17	1	ml	RS-033

60 of 326

Radiochemistry Prep Worksheet

ALS -- Fort Collins

Prep Batch: AB170626-1

Prep Procedure: GAB

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 702 Rev: 20 Prep Analyst: Hunter C. Jordan *HCS* Balance: 13

Prep SOP: NONE Prep Date: 6/26/2017 Balance:

Matrix Class: solid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq g	Fin Aliq g	Prep Basis	Standards	Prep Notes
1	1	1706257-1	SMP		3	0			
2	1	1706257-2	SMP		3	0			
3	1	1706257-2	MS		3	0	As Received	S1,S2	
4	1	1706257-3	SMP		3	0			
5	1	1706257-4	SMP		3	0			
6	1	1706257-4	DUP		3	0	As Received		
7	1	1706257-5	SMP		3	0			
8	1	1706257-6	SMP		3	0			
9	1	1706257-7	SMP		3	0			
10	1	1706257-8	SMP		3	0			
11	1	1706257-9	SMP		3	0			
12	1	1706257-10	SMP		3	0			
13	1	1706257-11	SMP		3	0			
14	1	1706257-12	SMP		3	0			
15	1	1706257-13	SMP		3	0			
16	1	1706257-14	SMP		3	0			
17	1	AB170626-1	MB		3	0			
18	1	AB170626-1	LCS		3	0		S1,S2	

Comments _____

Spiked By: Hunter C. Jordan Date: 6/26/2017

Witnessed By: Rebecka M. Olivares *emo* Date: 6/26/2017

Spike Solution Information										
Soln #	Nuclide	SolnID	Exp Date	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
S1	Sr-90	931.4243.12	<i>2/1/18</i>	43.033	DPM/ml	06/26/17	1	ml	RS-033	
S2	Am-241	956.4243.10	<i>1/26/18</i>	100.427	DPM/ml	06/26/17	1	ml	RS-033	

61 of 329

Sample Condition Form (Solids)

Analyst: Hunter Jordan

Analysis Date: 6-26-17

Method: GAS prep

AB170626-1

Sample Condition (Visual Appearance of Analysis Aliquot at Time of Prep)

Work Order	Sample ID	Dry/Wet/Moist	Texture	Remarks
<u>1706257</u>	<u>1</u>	<u>DRY</u>	<u>FINE powder with rocks & clumps</u>	<u>GREY GRAINY powder, sand, rock mixture</u>
	<u>2</u>			
	<u>3</u>			
	<u>4</u>			
	<u>5</u>			
	<u>6</u>			
	<u>7</u>			
	<u>8</u>			
	<u>9</u>			
	<u>10</u>			
	<u>11</u>			
	<u>12</u>			
	<u>13</u>			
	<u>14</u>			
<u>HLS 6-26-17</u>				

Section 8

STANDARDS TRACEABILITY DOCUMENTS



Prepare a working dilution of

931.4095.11 1g 1/17/17

1. Density of 0.1M HCl, lot # 0000132881

Mass of 100mL vol. flask: 68.5633g Balance # 12
 Mass of flask & 100mL acid: 168.3994g Balance # 12
 Net Mass: 99.8361g
 Density: 0.9984 g/mL

2. Mass of 931.4095.1 transferred:

Mass of open empty nalgene: 75.1466g Balance # 12
 Mass of nalgene & standard: 76.3800g Balance # 12
 Net mass of standard transferred: 1.2334g

3. Dilute to final volume:

Mass of nalgene, standard, & diluent: 912.1g Balance # 26
 Mass of empty nalgene (from above): 75.1466g Balance # 12
 Net mass of new dilution: 836.9534g

4. Final activity calculation:

$$33966.93 \text{ dpm/g} (0.9984 \text{ g/mL}) \left(\frac{1.2334 \text{ g}}{836.9534 \text{ g}} \right) = 49.98 \text{ dpm/mL}$$

1g 1/17/17

JP 2/9/17

Std ID: 931.4243.12

Description: Sr-90
 Expiration: 2/1/2018
 Activity: 49.98 dpm/ml

2s Uncertainty: 0.90 dpm/ml

Ref. Date: 4/11/2011

Ref Time: N/A

Prep Date: 1/17/2017 Prep by: TE

Matrix/Comp. 0.1 M HCl

Half Life (y): 2.88E+01

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 2/9/17

Continued on Page

1 Elmt

Signed

1/17/17

Date

Read and Understood By [Signature]

Signed

2/09/17

Date

MEL 12/14/11

Prepare an intermediate dilution of 931 Sr-90

1. Density of 0.1 M HCl, lot # K30039
 Mass of 100mL vol. flask: 66.4305g Balance # 12
 Mass of flask & 100mL acid: 166.278g Balance# 12
 Net Mass: 99.8475g
 Density: 0.9984g/mL
2. Mass of 931 transferred:
 Mass of open empty 40mL. Voa vial: 21.7293g Balance# 12
 Mass of Voa vial and standard: 27.0645g Balance# 12
 Net mass of standard transferred: 5.3352g
3. Dilute to final volume:
 Mass of open empty 40mL. Voa vial: 21.7293g Balance# 12
 Mass of vial, standard, & diluent: 56.1105g Balance# 12
 Net mass of new dilution: 34.3812g

4. Final activity calculation:

$$1.967 \times 10^4 \text{ Bq} \left(\frac{5.3352 \text{ g}}{5.37174 \text{ g}} \right) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{0.9984 \text{ g/mL}}{34.3812 \text{ g}} \right) = 33,966.93 \text{ dpm/g}$$

33,966.93 dpm/g
JP 6/12/12

MEL
12/14/11

MEL
12/14/11

MEL 12/14/11

JP 6/12/12

Std ID: 931.4095.11

Description: Sr-90
 Expiration: 1/19/2013
 Activity: 33812.59 dpm/mL
 2s Uncertainty: 610.43 dpm/mL
 Ref. Date: 4/11/2011
 Ref Time: N/A
 Prep Date: 12/14/2011 Prep by: NL
 Matrix/Comp. 0.1 M HCl JP 6/12/12
 Half Life (y): 2.88E+01

Verification Log		
Analysis Date	Initials	Expiration Date

JP 6/12/12

Continued on Page _____

Meym L... 12/14/11
 Sign: _____ Date: _____

Read and Understand By T Elst 12/14/11
 Sign: _____ Date: _____

rec 4-5-11 RSO# 931

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

84379-307

5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group/Fort Collins, CO
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u_A	u_B	U	
Sr-90	1.052E+04	1.967E+04	0.1	0.9	1.8	04/11/2011

*Uncertainty: U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %. 5.39174 grams 0.1M HCl solution with approximately 30 $\mu\text{g/g}$ each of Sr and Y carriers.

NOTE: This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

Source Prepared by: *W. Mao*
W. Mao, Radiochemist

QA Approved: *J. D. McCorvey*
J. D. McCorvey, QA Manager Alternate

Date: 3/31/11



Single Isotope Certificate, Rev 1 9/28/2009

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Prepare a working dilution of

956.4095.60 ^{1E} 1/17/17

1. Density of 1M HCl, lot # 0000132881

Mass of 100mL vol. flask:

68.5633g

Balance # 12

Mass of flask & 100mL acid:

170.0263g

Balance# 12

Net Mass:

101.4630g

Density:

1.0146g/mL

2. Mass of 956.4095.60 transferred:

Mass of open empty nalgene:

75.2563g

Balance# 12

Mass of nalgene & standard:

78.4123g

Balance# 12

Net mass of standard transferred:

3.1560g

3. Dilute to final volume:

Mass of nalgene, standard, & diluent:

1100.3g

Balance# 26

Mass of empty nalgene (from above):

75.2563g

Balance# 12

Net mass of new dilution:

1025.0437g

4. Final activity calculation:

32,428.06 dpm/g $\left(\frac{3.1560g}{1025.0437g}\right) (1.0146g/mL) = 101.30 dpm/mL$

Std ID: 956.4243.10

Description: Am-241

Expiration: 1/28/2018

Activity: 101.30 - dpm/ml

2s Uncertainty: 1.82 dpm/ml

Ref. Date: 1/30/2012

Ref Time: N/A

Prep Date: 1/17/2017 Prep by: TE

Matrix/Comp. 1 M HCl

Half Life (y): 4.32E+02

Reverification Log		
Analysis Date	Initials	Expiration Date

Continued on Page

A Elmt

Signed

1/17/17

Date

Read and Understood By

[Signature]

Signed

2/2/17

Date

Prepare an intermediate dilution of RSO # 956 ^{11/15/14}

1. Density of 1M HCl, lot # 0000079759
 Mass of 100mL vol. flask: 68.5657g Balance # 12
 Mass of flask & 100mL acid: 169.9213g Balance # 12
 Net Mass: 101.3556g
 Density: 1.0136g/mL

2. Mass of RSO #956 transferred:
 Mass of open empty 40mL Voa vial: 26.7205g Balance # 12
 Mass of Voa vial and standard: 31.8113g Balance # 12
 Net mass of standard transferred: 5.1108g ^{11/15/14}

3. Dilute to final volume:
 Mass of open empty 40mL Voa vial: 26.7205g Balance # 12
 Mass of vial, standard, & diluent: 62.8691g Balance # 12
 Net mass of new dilution: 36.1686g

4. Final activity calculation:

$$19630 Bq \left(\frac{60 dpm}{1 Bq} \right) \left(\frac{5.1108g}{5.13225g} \right) \left(\frac{1}{36.1686g} \right) = 32,428.06 dpm/g$$

^{11/15/14}

^{11/15/14}

^{11/15/14}

^{11/15/14}

Continued on Page _____

T Edut
Signed

11/15/14
Date

Read and Understood By [Signature]
Signed

11-5-14
Date



Eckert & Ziegler
Analytics

*REC
2-2-2012
RSD
956*

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

90187

Am-241 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins, CO
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide calibration and purity were checked by germanium gamma-ray spectrometry, liquid scintillation counting, and/or alpha spectrometry, as applicable. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 2, July 2007, and compliance with ANSI N42.22-1998, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u _A	u _B	U	
Am-241	1.580E+05	1.963E+04	0.1	0.9	1.8	01/30/2012

*Uncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1%, α -impurities < 0.1%. 5.13225 g 1M HCl solution, carrier free.

Source Prepared by: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: J.D. McCorvey
J.D. McCorvey, Counting Room Manager

Date: 26 Jan 12

6554 Form 01/08 Rev. 01/08

Single Isotope Certificate, Rev 2 04-08-2010



Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Section 9

ADDITIONAL SUPPORTING DOCUMENTATION

Gas Proportional Counter

Instrument Calibration

Background Calibration

**LB4100-A Long Background Instrument Calibration
Background Determinations**

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.138	0.0808	0.1920	PASS	2.071	1.833	2.488	PASS	A1 (01)
A2 (02)	0.096	0.0778	0.2056	PASS	2.026	1.814	2.358	PASS	A2 (02)
A3 (03)	0.092	0.0423	0.1841	PASS	2.114	1.882	2.627	PASS	A3 (03)
A4 (04)	0.094	0.0660	0.1534	PASS	2.020	1.910	2.350	PASS	A4 (04)
B1 (05)	0.134	0.0565	0.1769	PASS	2.094	1.625	2.614	PASS	B1 (05)
B2 (06)	0.127	0.0530	0.1824	PASS	1.920	1.673	2.157	PASS	B2 (06)
B3 (07)	0.133	0.0777	0.2003	PASS	2.112	1.540	2.483	PASS	B3 (07)
B4 (08)	0.198	0.1055	0.2263	PASS	1.779	1.613	2.011	PASS	B4 (08)
C1 (09)	0.147	0.0158	0.2074	PASS	2.348	1.267	2.743	PASS	C1 (09)
C2 (10)	0.156	0.1259	0.2317	PASS	1.732	1.612	1.987	PASS	C2 (10)
C3 (11)	0.107	0.0310	0.1808	PASS	1.829	1.289	2.177	PASS	C3 (11)
C4 (12)	0.146	0.1023	0.2329	PASS	2.057	1.719	2.289	PASS	C4 (12)
D1 (13)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D1 (13)
D2 (14)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D2 (14)
D3 (15)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D3 (15)
D4 (16)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D4 (16)

Reviewed by: _____



Date: _____

6/21/17

Historical Control Limits set to AVE 10 POINTS +/- 3 Std Dev JP 04/10/2017

LB4100-A Long Background Instrument Calibration
Background Determinations

△

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.124	0.0808	0.1920	PASS	1.976	1.833	2.488	PASS	A1 (01)
A2 (02)	0.158	0.0778	0.2056	PASS	2.192	1.814	2.358	PASS	A2 (02)
A3 (03)	0.077	0.0423	0.1841	PASS	2.106	1.882	2.627	PASS	A3 (03)
A4 (04)	0.090	0.0660	0.1534	PASS	2.000	1.910	2.350	PASS	A4 (04)
B1 (05)	0.084	0.0565	0.1769	PASS	1.878	1.625	2.614	PASS	B1 (05)
B2 (06)	0.096	0.0530	0.1824	PASS	1.902	1.673	2.157	PASS	B2 (06)
B3 (07)	0.164	0.0777	0.2003	PASS	1.893	1.540	2.483	PASS	B3 (07)
B4 (08)	0.247	0.1055	0.2263	FLAG-HIGH	1.731	1.613	2.011	PASS	B4 (08)
C1 (09)	0.104	0.0158	0.2074	PASS	2.183	1.267	2.743	PASS	C1 (09)
C2 (10)	0.151	0.1259	0.2317	PASS	1.736	1.612	1.987	PASS	C2 (10)
C3 (11)	0.100	0.0310	0.1808	PASS	1.725	1.289	2.177	PASS	C3 (11)
C4 (12)	0.152	0.1023	0.2329	PASS	2.022	1.719	2.289	PASS	C4 (12)
D1 (13)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D1 (13)
D2 (14)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D2 (14)
D3 (15)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D3 (15)
D4 (16)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D4 (16)

A Record in file * BKA0704W
JP 7/5/17

Reviewed by: JP

Date: 7/5/17

Historical Control Limits set to AVE 10 POINTS +- 3 Std Dev JP 04/10/2017

**LB4100-A Long Background Instrument Calibration
Background Determinations**

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	#REF!	0.0808	0.1920	#REF!	#REF!	1.833	2.488	#REF!	A1 (01)
A2 (02)	#REF!	0.0778	0.2056	#REF!	#REF!	1.814	2.358	#REF!	A2 (02)
A3 (03)	#REF!	0.0423	0.1841	#REF!	#REF!	1.882	2.627	#REF!	A3 (03)
A4 (04)	#REF!	0.0660	0.1534	#REF!	#REF!	1.910	2.350	#REF!	A4 (04)
B1 (05)	#REF!	0.0565	0.1769	#REF!	#REF!	1.625	2.614	#REF!	B1 (05)
B2 (06)	#REF!	0.0530	0.1824	#REF!	#REF!	1.673	2.157	#REF!	B2 (06)
B3 (07)	#REF!	0.0777	0.2003	#REF!	#REF!	1.540	2.483	#REF!	B3 (07)
B4 (08)	0.231	0.1055	0.2263	FLAG-HIGH	1.820	1.613	2.011	PASS	B4 (08)
C1 (09)	#REF!	0.0158	0.2074	#REF!	#REF!	1.267	2.743	#REF!	C1 (09)
C2 (10)	#REF!	0.1259	0.2317	#REF!	#REF!	1.612	1.987	#REF!	C2 (10)
C3 (11)	#REF!	0.0310	0.1808	#REF!	#REF!	1.289	2.177	#REF!	C3 (11)
C4 (12)	#REF!	0.1023	0.2329	#REF!	#REF!	1.719	2.289	#REF!	C4 (12)
D1 (13)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D1 (13)
D2 (14)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D2 (14)
D3 (15)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D3 (15)
D4 (16)	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	D4 (16)

** det. of blue*

Reviewed by: _____

JMS

Date: _____

7/6/17

Historical Control Limits set to AVE 10 POINTS +- 3 Std Dev JP 04/10/2017

LB4100-C
Long Instrument Background Calibration
Background Determination

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.090	0.0008	0.1552	PASS	1.595	1.077	2.154	PASS	A1 (01)
A2 (02)	0.090	0.0009	0.1871	PASS	1.490	1.002	2.004	PASS	A2 (02)
A3 (03)	0.103	0.0010	0.1910	PASS	1.548	1.133	2.265	PASS	A3 (03)
A4 (04)	0.089	0.0008	0.1652	PASS	1.548	1.149	2.298	PASS	A4 (04)
B1 (05)	0.091	0.0009	0.1811	PASS	1.630	1.210	2.420	PASS	B1 (05)
B2 (06)	0.120	0.0012	0.2328	PASS	1.726	1.238	2.475	PASS	B2 (06)
B3 (07)	0.096	0.0008	0.1672	PASS	1.645	1.159	2.318	PASS	B3 (07)
B4 (08)	0.122	0.0010	0.1990	PASS	1.699	1.193	2.387	PASS	B4 (08)
C1 (09)	0.114	0.0011	0.2189	PASS	1.714	1.155	2.310	PASS	C1 (09)
C2 (10)	0.126	0.0011	0.2229	PASS	1.717	1.244	2.489	PASS	C2 (10)
C3 (11)	0.095	0.0010	0.1910	PASS	1.700	1.230	2.460	PASS	C3 (11)
C4 (12)	0.127	0.0014	0.2806	PASS	2.536	1.449	4.346	PASS	C4 (12)
D1 (13)	0.000	0.0010	0.1891	FLAG-LOW	0.000	1.211	2.421	FLAG-LOW	D1 (13)
D2 (14)	0.000	0.0009	0.1731	FLAG-LOW	0.000	1.205	2.411	FLAG-LOW	D2 (14)
D3 (15)	0.000	0.0017	0.3403	FLAG-LOW	0.000	1.249	2.498	FLAG-LOW	D3 (15)
D4 (16)	0.000	0.0010	0.2010	FLAG-LOW	0.000	1.205	2.411	FLAG-LOW	D4 (16)

Δ Drawer Error. Voltage Error. Recount in Fil
JP Date: *6/22/17* *BKC0622W*

Reviewed by: _____

Interim limits for alpha set to be +/- 99%, beta +/-25%
 mh 06/07/2017

LB4100-C
Long Instrument Background Calibration
Background Determination

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	#REF!	0.0008	0.1552	#REF!	#REF!	1.077	2.154	#REF!	A1 (01)
A2 (02)	#REF!	0.0009	0.1871	#REF!	#REF!	1.002	2.004	#REF!	A2 (02)
A3 (03)	#REF!	0.0010	0.1910	#REF!	#REF!	1.133	2.265	#REF!	A3 (03)
A4 (04)	#REF!	0.0008	0.1652	#REF!	#REF!	1.149	2.298	#REF!	A4 (04)
B1 (05)	#REF!	0.0009	0.1811	#REF!	#REF!	1.210	2.420	#REF!	B1 (05)
B2 (06)	#REF!	0.0012	0.2328	#REF!	#REF!	1.238	2.475	#REF!	B2 (06)
B3 (07)	#REF!	0.0008	0.1672	#REF!	#REF!	1.159	2.318	#REF!	B3 (07)
B4 (08)	#REF!	0.0010	0.1990	#REF!	#REF!	1.193	2.387	#REF!	B4 (08)
C1 (09)	#REF!	0.0011	0.2189	#REF!	#REF!	1.155	2.310	#REF!	C1 (09)
C2 (10)	#REF!	0.0011	0.2229	#REF!	#REF!	1.244	2.489	#REF!	C2 (10)
C3 (11)	#REF!	0.0010	0.1910	#REF!	#REF!	1.230	2.460	#REF!	C3 (11)
C4 (12)	#REF!	0.0014	0.2806	#REF!	#REF!	1.449	4.346	#REF!	C4 (12)
D1 (13)	0.104	0.0010	0.1891	PASS	1.670	1.211	2.421	PASS	D1 (13)
D2 (14)	0.118	0.0009	0.1731	PASS	1.523	1.205	2.411	PASS	D2 (14)
D3 (15)	0.132	0.0017	0.3403	PASS	1.615	1.249	2.498	PASS	D3 (15)
D4 (16)	0.127	0.0010	0.2010	PASS	2.551	1.205	2.411	FLAG-HIGH	D4 (16)

D Detector Offline

Reviewed by: _____

JR

Date: 6/23/17

Interim limits for alpha set to be +/- 99%, beta +/-25%
 mh 06/07/2017

LB4100-C
Long Instrument Background Calibration
Background Determination

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.094	0.0008	0.1552	PASS	1.621	1.077	2.154	PASS	A1 (01)
A2 (02)	0.118	0.0009	0.1871	PASS	1.573	1.002	2.004	PASS	A2 (02)
A3 (03)	0.111	0.0010	0.1910	PASS	1.538	1.133	2.265	PASS	A3 (03)
A4 (04)	0.117	0.0008	0.1652	PASS	1.532	1.149	2.298	PASS	A4 (04)
B1 (05)	0.110	0.0009	0.1811	PASS	1.501	1.210	2.420	PASS	B1 (05)
B2 (06)	0.131	0.0012	0.2328	PASS	1.677	1.238	2.475	PASS	B2 (06)
B3 (07)	0.129	0.0008	0.1672	PASS	1.551	1.159	2.318	PASS	B3 (07)
B4 (08)	0.125	0.0010	0.1990	PASS	1.658	1.193	2.387	PASS	B4 (08)
C1 (09)	0.119	0.0011	0.2189	PASS	1.656	1.155	2.310	PASS	C1 (09)
C2 (10)	0.135	0.0011	0.2229	PASS	1.715	1.244	2.489	PASS	C2 (10)
C3 (11)	0.114	0.0010	0.1910	PASS	1.641	1.230	2.460	PASS	C3 (11)
C4 (12)	0.172	0.0014	0.2806	PASS	2.429	1.449	4.346	PASS	C4 (12)
D1 (13)	0.105	0.0010	0.1891	PASS	1.655	1.211	2.421	PASS	D1 (13)
D2 (14)	0.111	0.0009	0.1731	PASS	1.619	1.205	2.411	PASS	D2 (14)
D3 (15)	0.112	0.0017	0.3403	PASS	1.563	1.249	2.498	PASS	D3 (15)
D4 (16)	0.108	0.0010	0.2010	PASS	2.278	1.205	2.411	PASS	D4 (16)

Reviewed by: 

Date: 7/5/17

Interim limits for alpha set to be +/- 99%, beta +/-25%
 mh 06/07/2017

Gas Proportional Counter

Quality Control Data

Daily Instrument Performance Checks

**LB4100-A Daily Instrument Performance Check
Efficiency Determinations**

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.2147	0.1979	0.2300	PASS	0.2256	0.2088	0.2426	PASS	A1 (01)
A2 (02)	0.2033	0.1918	0.2229	PASS	0.2230	0.2077	0.2414	PASS	A2 (02)
A3 (03)	0.2198	0.2064	0.2399	PASS	0.2317	0.2145	0.2492	PASS	A3 (03)
A4 (04)	0.2281	0.2084	0.2421	PASS	0.2409	0.2166	0.2518	PASS	A4 (04)
B1 (05)	0.2215	0.2064	0.2399	PASS	0.2388	0.2220	0.2580	PASS	B1 (05)
B2 (06)	0.2307	0.2124	0.2468	PASS	0.2541	0.2291	0.2663	PASS	B2 (06)
B3 (07)	0.2288	0.1937	0.2352	PASS	0.2274	0.2051	0.2387	PASS	B3 (07)
B4 (08)	0.2223	0.2003	0.2328	PASS	0.2091	0.1998	0.2322	PASS	B4 (08)
C1 (09)	0.2109	0.1911	0.2221	PASS	0.2304	0.2198	0.2554	PASS	C1 (09)
C2 (10)	0.2146	0.1997	0.2320	PASS	0.2402	0.2225	0.2586	PASS	C2 (10)
C3 (11)	0.2243	0.2004	0.2329	PASS	0.2383	0.2144	0.2492	PASS	C3 (11)
C4 (12)	0.2122	0.1908	0.2217	PASS	0.2756	0.2325	0.2702	FLAG-HIGH	C4 (12)
D1 (13)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D1 (13)
D2 (14)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D2 (14)
D3 (15)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D3 (15)
D4 (16)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D4 (16)

Δ Detector Offline

Reviewed by: JP Date: 7/5/17

Historical Control Limits -- +/-7.5% of Average of 30 Data Points. JP 02/10/17

ALS Laboratory Group - Fort Collins

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH GAS FLOW PROPORTIONAL
TEST GFPC / ALL COUNTER
METHOD GFPC
SOP/REV (PREP) -
SOP/REV (ANAL) 724

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

Daily Background Checks are not necessary, and therefore not performed, the day following the Weekly Background Calibration. The results of the Weekly Background Calibration will be used as that day's Daily Background Check. If the Weekly Background Calibration is outside the established control limits for a detector, the Weekly Background Calibration will be performed a second time and will be considered as the second Daily Background Check for that day.

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TECHNICIAN/ANALYST

(Handwritten signature)

DATE 08-05-09

DEPARTMENT MANAGER

(Handwritten signature)

DATE 08/05/09

376920

FORM 302r6.doc (4/22/04)

LB4100-A Daily Instrument Performance Check
Efficiency Determinations

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.2187	0.1979	0.2300	PASS	0.2268	0.2088	0.2426	PASS	A1 (01)
A2 (02)	0.2068	0.1918	0.2229	PASS	0.2296	0.2077	0.2414	PASS	A2 (02)
A3 (03)	0.2251	0.2064	0.2399	PASS	0.2303	0.2145	0.2492	PASS	A3 (03)
A4 (04)	0.2235	0.2084	0.2421	PASS	0.2346	0.2166	0.2518	PASS	A4 (04)
B1 (05)	0.2250	0.2064	0.2399	PASS	0.2423	0.2220	0.2580	PASS	B1 (05)
B2 (06)	0.2343	0.2124	0.2468	PASS	0.2491	0.2291	0.2663	PASS	B2 (06)
B3 (07)	0.2309	0.1937	0.2352	PASS	0.2287	0.2051	0.2387	PASS	B3 (07)
B4 (08)	0.2200	0.2003	0.2328	PASS	0.2127	0.1998	0.2322	PASS	B4 (08)
C1 (09)	0.2066	0.1911	0.2221	PASS	0.2434	0.2198	0.2554	PASS	C1 (09)
C2 (10)	0.2162	0.1997	0.2320	PASS	0.2399	0.2225	0.2586	PASS	C2 (10)
C3 (11)	0.2261	0.2004	0.2329	PASS	0.2327	0.2144	0.2492	PASS	C3 (11)
C4 (12)	0.2070	0.1908	0.2217	PASS	0.2728	0.2325	0.2702	FLAG-HIGH	C4 (12)
D1 (13)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D1 (13)
D2 (14)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D2 (14)
D3 (15)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D3 (15)
D4 (16)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	D4 (16)

det. of time

Reviewed by: *JDS*

Date: *7/6/17*

Historical Control Limits -- +/-7.5% of Average of 30Data Points. JP 02/10/17

LB4100-C
Daily Instrument Performance Check-Efficiency Determination

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.1989	0.1783	0.2179	PASS	0.3832	0.3497	0.4274	PASS	A1 (01)
A2 (02)	0.2086	0.1854	0.2266	PASS	0.3882	0.3493	0.4270	PASS	A2 (02)
A3 (03)	0.2109	0.1917	0.2343	PASS	0.3969	0.3545	0.4333	PASS	A3 (03)
A4 (04)	0.2096	0.1856	0.2269	PASS	0.3872	0.3481	0.4254	PASS	A4 (04)
B1 (05)	0.2335	0.2075	0.2536	PASS	0.4044	0.3709	0.4533	PASS	B1 (05)
B2 (06)	0.1984	0.1734	0.2120	PASS	0.3781	0.3321	0.4060	PASS	B2 (06)
B3 (07)	0.2190	0.1961	0.2396	PASS	0.3944	0.3616	0.4419	PASS	B3 (07)
B4 (08)	0.2135	0.1928	0.2357	PASS	0.3938	0.3566	0.4359	PASS	B4 (08)
C1 (09)	0.2107	0.1913	0.2338	PASS	0.4040	0.3617	0.4421	PASS	C1 (09)
C2 (10)	0.2192	0.1966	0.2403	PASS	0.3992	0.3688	0.4507	PASS	C2 (10)
C3 (11)	0.2124	0.1886	0.2305	PASS	0.3957	0.3594	0.4392	PASS	C3 (11)
C4 (12)	0.2225	0.1972	0.2410	PASS	0.4080	0.3660	0.4473	PASS	C4 (12)
D1 (13)	0.2205	0.1909	0.2333	PASS	0.3980	0.3517	0.4298	PASS	D1 (13)
D2 (14)	0.2231	0.1914	0.2340	PASS	0.3942	0.3534	0.4319	PASS	D2 (14)
D3 (15)	0.2249	0.1933	0.2362	PASS	0.3744	0.3543	0.4330	PASS	D3 (15)
D4 (16)	0.2236	0.1980	0.2420	PASS	0.3911	0.3581	0.4377	PASS	D4 (16)

Reviewed by: _____ *JP*

Date: 6/28/17

Interim Control Limits -- +/-10% of average from last 5 data points
Established: 06/08/17 mh

LB4100-C
Daily Instrument Performance Checks
Background Checks

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.183	-0.026	0.206	PASS	1.517	1.106	2.084	PASS	A1 (01)
A2 (02)	0.133	-0.026	0.206	PASS	1.733	1.017	1.963	PASS	A2 (02)
A3 (03)	0.183	-0.021	0.227	PASS	1.517	1.066	2.030	PASS	A3 (03)
A4 (04)	0.233	-0.027	0.205	FLAG-HIGH	1.650	1.066	2.030	PASS	A4 (04)
B1 (05)	0.200	-0.026	0.208	PASS	1.617	1.136	2.124	PASS	B1 (05)
B2 (06)	0.150	-0.014	0.254	PASS	1.917	1.217	2.235	PASS	B2 (06)
B3 (07)	0.067	-0.024	0.216	PASS	1.933	1.148	2.142	PASS	B3 (07)
B4 (08)	0.133	-0.013	0.257	PASS	2.033	1.194	2.204	PASS	B4 (08)
C1 (09)	0.150	-0.017	0.245	PASS	1.833	1.207	2.221	PASS	C1 (09)
C2 (10)	0.100	-0.011	0.263	PASS	1.717	1.210	2.224	PASS	C2 (10)
C3 (11)	0.117	-0.024	0.214	PASS	1.550	1.195	2.205	PASS	C3 (11)
C4 (12)	0.100	-0.011	0.265	PASS	2.750	1.919	3.153	PASS	C4 (12)
D1 (13)	0.100	-0.021	0.229	PASS	1.917	1.170	2.170	PASS	D1 (13)
D2 (14)	0.117	-0.015	0.251	PASS	1.550	1.045	2.001	PASS	D2 (14)
D3 (15)	0.100	-0.009	0.273	PASS	1.600	1.123	2.107	PASS	D3 (15)
D4 (16)	0.150	-0.011	0.265	PASS	2.350	1.932	3.170	PASS	D4 (16)

→ Recounted in
BKC0628(A)

Reviewed by: JKB Date: 6/28/17

Control Limits established from previous weekly background determinations.
 Weekly Background File: BKC0621W Date: 6/21/2017 Analyst: JP
 BKC0622W 6/22/2017 JP
 0 1/0/1900 0

LB4100-C
Daily Instrument Performance Check-Efficiency Determination

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.1996	0.1783	0.2179	PASS	0.3878	0.3497	0.4274	PASS	A1 (01)
A2 (02)	0.2073	0.1854	0.2266	PASS	0.3858	0.3493	0.4270	PASS	A2 (02)
A3 (03)	0.2180	0.1917	0.2343	PASS	0.3957	0.3545	0.4333	PASS	A3 (03)
A4 (04)	0.2078	0.1856	0.2269	PASS	0.3872	0.3481	0.4254	PASS	A4 (04)
B1 (05)	0.2278	0.2075	0.2536	PASS	0.4140	0.3709	0.4533	PASS	B1 (05)
B2 (06)	0.1986	0.1734	0.2120	PASS	0.3702	0.3321	0.4060	PASS	B2 (06)
B3 (07)	0.2159	0.1961	0.2396	PASS	0.4028	0.3616	0.4419	PASS	B3 (07)
B4 (08)	0.2122	0.1928	0.2357	PASS	0.3993	0.3566	0.4359	PASS	B4 (08)
C1 (09)	0.2129	0.1913	0.2338	PASS	0.3937	0.3617	0.4421	PASS	C1 (09)
C2 (10)	0.2200	0.1966	0.2403	PASS	0.4059	0.3688	0.4507	PASS	C2 (10)
C3 (11)	0.2123	0.1886	0.2305	PASS	0.3926	0.3594	0.4392	PASS	C3 (11)
C4 (12)	0.2285	0.1972	0.2410	PASS	0.4017	0.3660	0.4473	PASS	C4 (12)
D1 (13)	0.2232	0.1909	0.2333	PASS	0.3957	0.3517	0.4298	PASS	D1 (13)
D2 (14)	0.2173	0.1914	0.2340	PASS	0.3921	0.3534	0.4319	PASS	D2 (14)
D3 (15)	0.2277	0.1933	0.2362	PASS	0.3783	0.3543	0.4330	PASS	D3 (15)
D4 (16)	0.2274	0.1980	0.2420	PASS	0.3877	0.3581	0.4377	PASS	D4 (16)

Reviewed by: JP

Date: 6/29/17

Interim Control Limits -- +/-10% of average from last 5 data points
 Established: 06/08/17 mh

LB4100-C
Daily Instrument Performance Checks
Background Checks

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.067	-0.026	0.206	PASS	1.667	1.106	2.084	PASS	A1 (01)
A2 (02)	0.167	-0.026	0.206	PASS	1.683	1.017	1.963	PASS	A2 (02)
A3 (03)	0.167	-0.021	0.227	PASS	1.717	1.066	2.030	PASS	A3 (03)
A4 (04)	0.100	-0.027	0.205	PASS	1.517	1.066	2.030	PASS	A4 (04)
B1 (05)	0.167	-0.026	0.208	PASS	1.517	1.136	2.124	PASS	B1 (05)
B2 (06)	0.200	-0.014	0.254	PASS	1.650	1.217	2.235	PASS	B2 (06)
B3 (07)	0.117	-0.024	0.216	PASS	1.683	1.148	2.142	PASS	B3 (07)
B4 (08)	0.067	-0.013	0.257	PASS	1.867	1.194	2.204	PASS	B4 (08)
C1 (09)	0.100	-0.017	0.245	PASS	1.967	1.207	2.221	PASS	C1 (09)
C2 (10)	0.183	-0.011	0.263	PASS	1.633	1.210	2.224	PASS	C2 (10)
C3 (11)	0.033	-0.024	0.214	PASS	1.767	1.195	2.205	PASS	C3 (11)
C4 (12)	0.233	-0.011	0.265	PASS	2.650	1.919	3.153	PASS	C4 (12)
D1 (13)	0.150	-0.021	0.229	PASS	1.800	1.170	2.170	PASS	D1 (13)
D2 (14)	0.133	-0.015	0.251	PASS	1.683	1.045	2.001	PASS	D2 (14)
D3 (15)	0.217	-0.009	0.273	PASS	1.883	1.123	2.107	PASS	D3 (15)
D4 (16)	0.083	-0.011	0.265	PASS	3.033	1.932	3.170	PASS	D4 (16)

Reviewed by: _____

JP

Date: _____

6/29/17

Control Limits established from previous weekly background determinations.

Weekly Background File: BKC0621W	Date: 6/21/2017	Analyst: JP
BKC0622W	6/22/2017	JP
0	1/0/1900	0

LB4100-C

Daily Instrument Performance Check-Efficiency Determination

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.1977	0.1783	0.2179	PASS	0.3883	0.3497	0.4274	PASS	A1 (01)
A2 (02)	0.2043	0.1854	0.2266	PASS	0.3830	0.3493	0.4270	PASS	A2 (02)
A3 (03)	0.2148	0.1917	0.2343	PASS	0.3931	0.3545	0.4333	PASS	A3 (03)
A4 (04)	0.2075	0.1856	0.2269	PASS	0.3897	0.3481	0.4254	PASS	A4 (04)
B1 (05)	0.2285	0.2075	0.2536	PASS	0.4167	0.3709	0.4533	PASS	B1 (05)
B2 (06)	0.1974	0.1734	0.2120	PASS	0.3753	0.3321	0.4060	PASS	B2 (06)
B3 (07)	0.2212	0.1961	0.2396	PASS	0.3984	0.3616	0.4419	PASS	B3 (07)
B4 (08)	0.2116	0.1928	0.2357	PASS	0.3986	0.3566	0.4359	PASS	B4 (08)
C1 (09)	0.2100	0.1913	0.2338	PASS	0.3934	0.3617	0.4421	PASS	C1 (09)
C2 (10)	0.2187	0.1966	0.2403	PASS	0.4063	0.3688	0.4507	PASS	C2 (10)
C3 (11)	0.2180	0.1886	0.2305	PASS	0.3925	0.3594	0.4392	PASS	C3 (11)
C4 (12)	0.2166	0.1972	0.2410	PASS	0.4070	0.3660	0.4473	PASS	C4 (12)
D1 (13)	0.2184	0.1909	0.2333	PASS	0.3988	0.3517	0.4298	PASS	D1 (13)
D2 (14)	0.2171	0.1914	0.2340	PASS	0.3874	0.3534	0.4319	PASS	D2 (14)
D3 (15)	0.2267	0.1933	0.2362	PASS	0.3809	0.3543	0.4330	PASS	D3 (15)
D4 (16)	0.2263	0.1980	0.2420	PASS	0.3936	0.3581	0.4377	PASS	D4 (16)

Reviewed by: JP

Date: 7/3/17

Interim Control Limits -- +/-10% of average from last 5 data points
Established: 06/08/17 mh

LB4100-C
Daily Instrument Performance Checks
Background Checks

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.167	-0.026	0.206	PASS	1.600	1.106	2.084	PASS	A1 (01)
A2 (02)	0.100	-0.026	0.206	PASS	1.467	1.017	1.963	PASS	A2 (02)
A3 (03)	0.083	-0.021	0.227	PASS	1.700	1.066	2.030	PASS	A3 (03)
A4 (04)	0.133	-0.027	0.205	PASS	1.733	1.066	2.030	PASS	A4 (04)
B1 (05)	0.117	-0.026	0.208	PASS	1.950	1.136	2.124	PASS	B1 (05)
B2 (06)	0.150	-0.014	0.254	PASS	1.733	1.217	2.235	PASS	B2 (06)
B3 (07)	0.167	-0.024	0.216	PASS	1.383	1.148	2.142	PASS	B3 (07)
B4 (08)	0.133	-0.013	0.257	PASS	2.000	1.194	2.204	PASS	B4 (08)
C1 (09)	0.083	-0.017	0.245	PASS	1.733	1.207	2.221	PASS	C1 (09)
C2 (10)	0.100	-0.011	0.263	PASS	2.050	1.210	2.224	PASS	C2 (10)
C3 (11)	0.133	-0.024	0.214	PASS	1.633	1.195	2.205	PASS	C3 (11)
C4 (12)	0.133	-0.011	0.265	PASS	2.833	1.919	3.153	PASS	C4 (12)
D1 (13)	0.150	-0.021	0.229	PASS	1.567	1.170	2.170	PASS	D1 (13)
D2 (14)	0.117	-0.015	0.251	PASS	1.650	1.045	2.001	PASS	D2 (14)
D3 (15)	0.117	-0.009	0.273	PASS	1.800	1.123	2.107	PASS	D3 (15)
D4 (16)	0.117	-0.011	0.265	PASS	2.133	1.932	3.170	PASS	D4 (16)

Reviewed by: _____

JP

Date: _____

7/3/17

Control Limits established from previous weekly background determinations.

Weekly Background File: BKC0621W

Date: 6/21/2017

Analyst: JP

BKC0622W

6/22/2017

JP

0

1/0/1900

0

LB4100-C
Daily Instrument Performance Check-Efficiency Determination

Detector ID	Alpha				Beta				Detector ID
	Eff.	LCL	UCL	Flag	Eff.	LCL	UCL	Flag	
A1 (01)	0.2065	0.1783	0.2179	PASS	0.3801	0.3497	0.4274	PASS	A1 (01)
A2 (02)	0.2052	0.1854	0.2266	PASS	0.3822	0.3493	0.4270	PASS	A2 (02)
A3 (03)	0.2124	0.1917	0.2343	PASS	0.4024	0.3545	0.4333	PASS	A3 (03)
A4 (04)	0.2026	0.1856	0.2269	PASS	0.3842	0.3481	0.4254	PASS	A4 (04)
B1 (05)	0.2302	0.2075	0.2536	PASS	0.4065	0.3709	0.4533	PASS	B1 (05)
B2 (06)	0.1940	0.1734	0.2120	PASS	0.3690	0.3321	0.4060	PASS	B2 (06)
B3 (07)	0.2172	0.1961	0.2396	PASS	0.4091	0.3616	0.4419	PASS	B3 (07)
B4 (08)	0.2160	0.1928	0.2357	PASS	0.3938	0.3566	0.4359	PASS	B4 (08)
C1 (09)	0.2090	0.1913	0.2338	PASS	0.3973	0.3617	0.4421	PASS	C1 (09)
C2 (10)	0.2189	0.1966	0.2403	PASS	0.4050	0.3688	0.4507	PASS	C2 (10)
C3 (11)	0.2075	0.1886	0.2305	PASS	0.3918	0.3594	0.4392	PASS	C3 (11)
C4 (12)	0.2233	0.1972	0.2410	PASS	0.4079	0.3660	0.4473	PASS	C4 (12)
D1 (13)	0.2206	0.1909	0.2333	PASS	0.4015	0.3517	0.4298	PASS	D1 (13)
D2 (14)	0.2175	0.1914	0.2340	PASS	0.4005	0.3534	0.4319	PASS	D2 (14)
D3 (15)	0.2216	0.1933	0.2362	PASS	0.3804	0.3543	0.4330	PASS	D3 (15)
D4 (16)	0.2248	0.1980	0.2420	PASS	0.3873	0.3581	0.4377	PASS	D4 (16)

Reviewed by: _____ JP _____

Date: 7/4/17

Interim Control Limits -- +/-10% of average from last 5 data points
 Established: 06/08/17 mh

LB4100-C
Daily Instrument Performance Checks
Background Checks

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.050	-0.026	0.206	PASS	1.867	1.106	2.084	PASS	A1 (01)
A2 (02)	0.133	-0.026	0.206	PASS	1.283	1.017	1.963	PASS	A2 (02)
A3 (03)	0.117	-0.021	0.227	PASS	1.350	1.066	2.030	PASS	A3 (03)
A4 (04)	0.117	-0.027	0.205	PASS	1.733	1.066	2.030	PASS	A4 (04)
B1 (05)	0.117	-0.026	0.208	PASS	1.450	1.136	2.124	PASS	B1 (05)
B2 (06)	0.200	-0.014	0.254	PASS	1.867	1.217	2.235	PASS	B2 (06)
B3 (07)	0.133	-0.024	0.216	PASS	2.000	1.148	2.142	PASS	B3 (07)
B4 (08)	0.100	-0.013	0.257	PASS	1.683	1.194	2.204	PASS	B4 (08)
C1 (09)	0.217	-0.017	0.245	PASS	1.400	1.207	2.221	PASS	C1 (09)
C2 (10)	0.183	-0.011	0.263	PASS	1.833	1.210	2.224	PASS	C2 (10)
C3 (11)	0.083	-0.024	0.214	PASS	1.567	1.195	2.205	PASS	C3 (11)
C4 (12)	0.150	-0.011	0.265	PASS	2.933	1.919	3.153	PASS	C4 (12)
D1 (13)	0.133	-0.021	0.229	PASS	1.667	1.170	2.170	PASS	D1 (13)
D2 (14)	0.083	-0.015	0.251	PASS	1.650	1.045	2.001	PASS	D2 (14)
D3 (15)	0.200	-0.009	0.273	PASS	1.533	1.123	2.107	PASS	D3 (15)
D4 (16)	0.200	-0.011	0.265	PASS	2.433	1.932	3.170	PASS	D4 (16)

Reviewed by: _____

JP

Date: 7/4/17

Control Limits established from previous weekly background determinations.

Weekly Background File: BKC0621W

Date: 6/21/2017

Analyst: JP

BKC0622W

6/22/2017

JP

0

1/0/1900

0

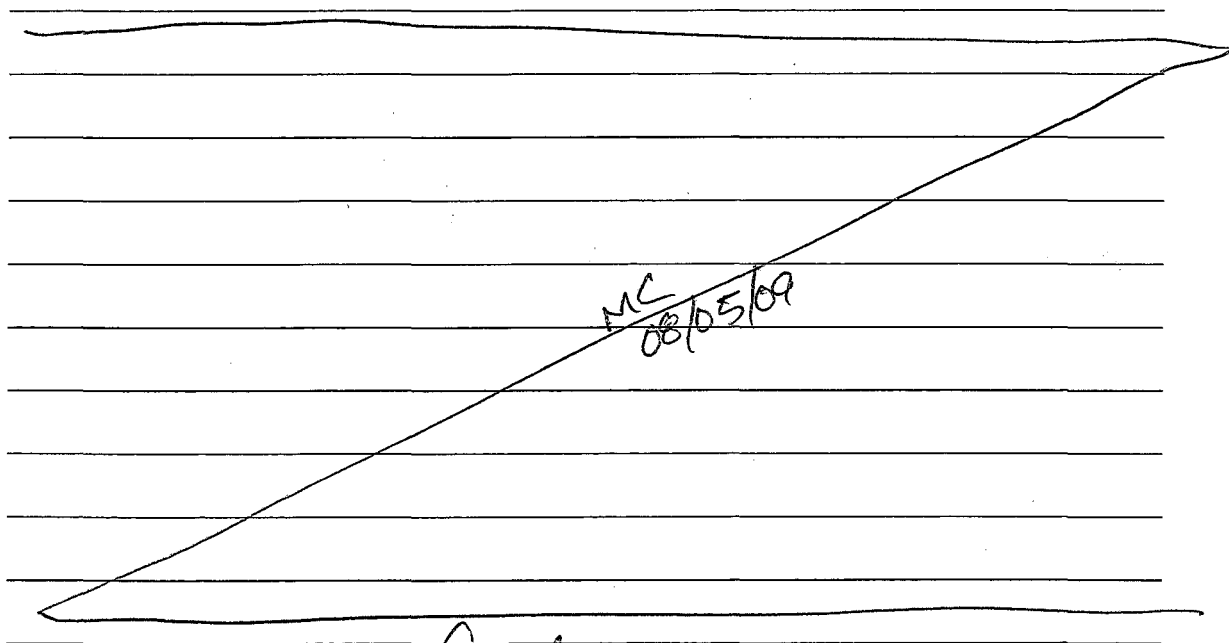
ALS Laboratory Group - Fort Collins

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH GAS FLOW PROPORTIONAL
TEST GFPC / ALL COUNTER
METHOD GFPC
SOP/REV (PREP) -
SOP/REV (ANAL) 724

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

Daily Background Checks are not necessary, and therefore not performed, the day following the Weekly Background Calibration. The results of the Weekly Background Calibration will be used as that day's Daily Background Check. If the Weekly Background Calibration is outside the established control limits for a detector, the Weekly Background Calibration will be performed a second time and will be considered as the second Daily Background Check for that day.



TECHNICIAN/ANALYST

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DATE 08-05-09

DEPARTMENT MANAGER

[Handwritten signature]

DATE 08/05/09

376920

FORM 302r6.doc (4/22/04)

LB4100-C
Daily Instrument Performance Checks
Background Checks

Detector ID	Alpha				Beta				Detector ID
	CPM	LCL	UCL	Flag	CPM	LCL	UCL	Flag	
A1 (01)	0.167	-0.025	0.213	PASS	1.200	1.128	2.114	PASS	A1 (01)
A2 (02)	0.100	-0.015	0.251	PASS	1.750	1.087	2.059	PASS	A2 (02)
A3 (03)	0.200	-0.018	0.240	PASS	1.400	1.058	2.018	PASS	A3 (03)
A4 (04)	0.150	-0.015	0.249	PASS	1.817	1.053	2.011	PASS	A4 (04)
B1 (05)	0.133	-0.018	0.238	PASS	1.717	1.027	1.975	PASS	B1 (05)
B2 (06)	0.267	-0.009	0.271	PASS	1.967	1.175	2.179	PASS	B2 (06)
B3 (07)	0.183	-0.010	0.268	PASS	1.717	1.069	2.033	PASS	B3 (07)
B4 (08)	0.133	-0.012	0.262	PASS	1.433	1.159	2.157	PASS	B4 (08)
C1 (09)	0.200	-0.015	0.253	PASS	1.783	1.158	2.154	PASS	C1 (09)
C2 (10)	0.150	-0.007	0.277	PASS	1.933	1.208	2.222	PASS	C2 (10)
C3 (11)	0.133	-0.017	0.245	PASS	1.500	1.145	2.137	PASS	C3 (11)
C4 (12)	0.100	0.011	0.333	PASS	2.883	1.825	3.033	PASS	C4 (12)
D1 (13)	0.100	-0.020	0.230	PASS	1.750	1.157	2.153	PASS	D1 (13)
D2 (14)	0.083	-0.018	0.240	PASS	1.350	1.126	2.112	PASS	D2 (14)
D3 (15)	0.133	-0.018	0.242	PASS	1.667	1.079	2.047	PASS	D3 (15)
D4 (16)	0.150	-0.019	0.235	PASS	2.433	1.693	2.863	PASS	D4 (16)

Reviewed by: JICB Date: 7/6/17

Control Limits established from previous weekly background determinations.
 Weekly Background File: BKC0704W Date: 7/4/2017 Analyst: JP
 0 1/0/1900 0
 0 1/0/1900 0

Gas Proportional Counter

Instrument Calibration

**Initial Efficiency Calibration
Standards Traceability**

Instrument: LB4100-A

Calibration: Gross Alpha (Am-241)- ringed planchet
Gross Beta (Sr-90/Y-90)- ringed planchet

Date of Calibration: Gross Alpha 12/05/2016
Gross Beta 12/05/2016

Efficiency Log Files: Am-241R-11/16
Sr90R-11/16

Efficiency Instrument Files: EAM1205A, B and C
ESR1205A, B and C

Source ID's: (Am-241 995.4095.10)
(Sr-90/Y-90 777.3020.11)

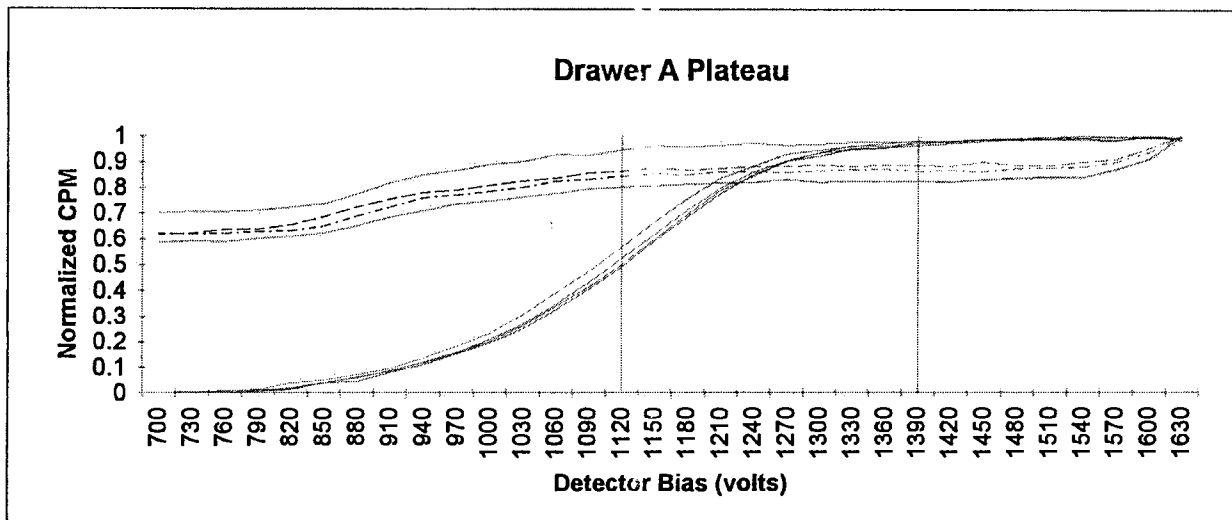
Detectors B2(6), C1(9), C3(11) and Drawer D Off-Line

OK JP 12/12/16
Expires 11/03/2017

Instrument Plateaus

Unit Type: LB4100/W
 Date Performed: 11/3/16 13:18
 FileName: PTA1103
 Batch ID: PLATEAU CHECK

Unit Id: Orange
 Application Revision: B
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage: **1402.5**

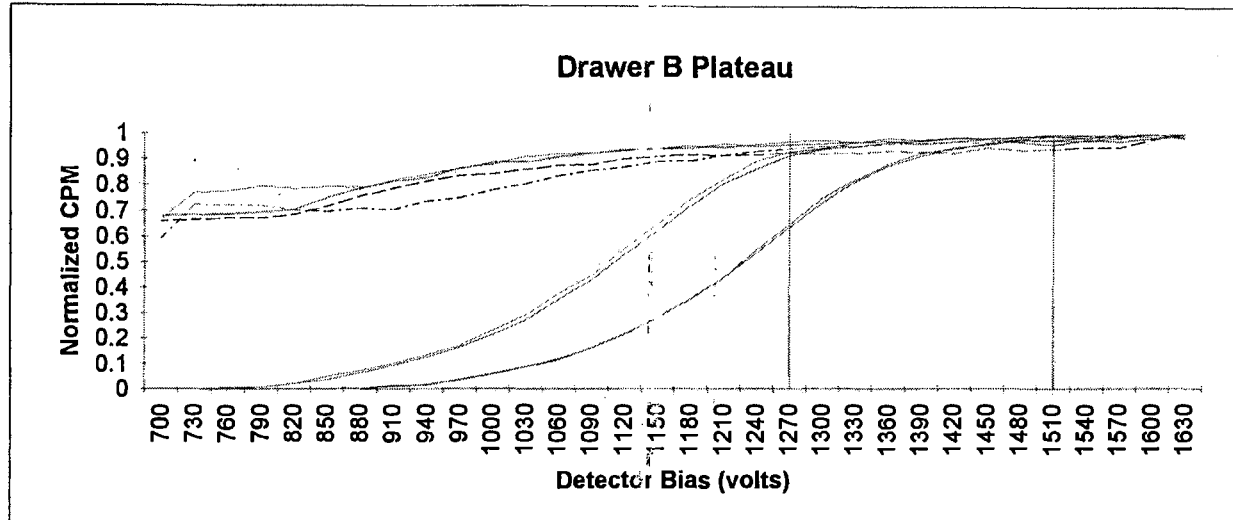
Optimum alpha only operating voltage: **1120**

	A1	A2	A3	A4
Beta slope at beta voltage	2.48%	2.17%	3.46%	2.60%
Alpha slope at beta voltage	0.69%	1.09%	0.53%	-0.62%
Alpha slope at alpha voltage	3.21%	3.26%	3.49%	2.70%

OK JP 11/7/16

Unit Type: LB4100/W
 Date Performed: 11/3/16 13:18
 FileName: PTA1103
 Batch ID: PLATEAU CHECK

Unit Id: Orange
 Application Revision: B
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

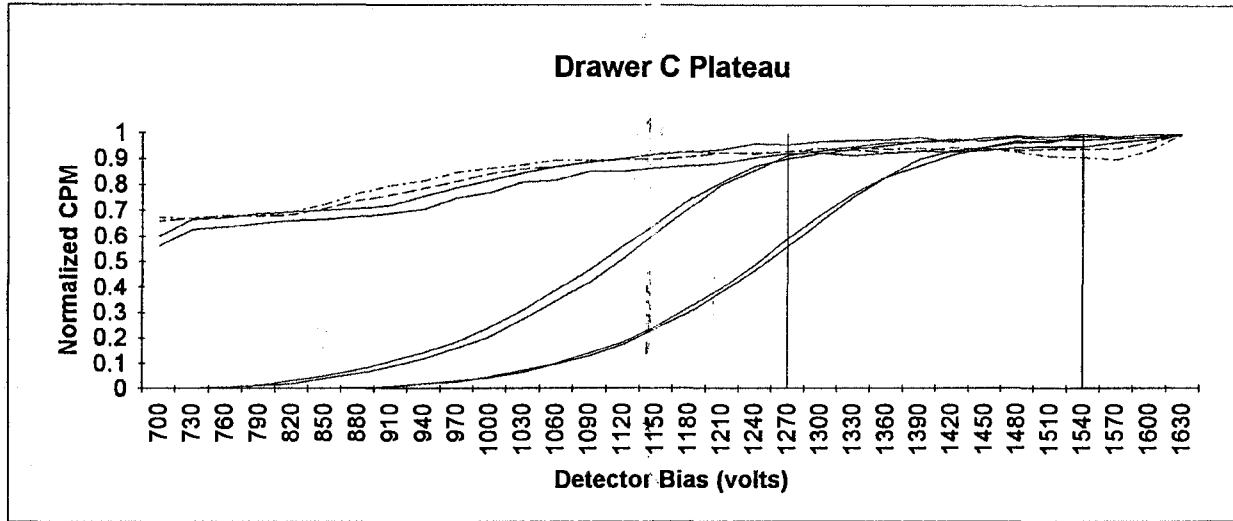
Optimum alpha only operating voltage:

	B1	B2	B3	B4
Beta slope at beta voltage	1.06%	0.81%	1.70%	2.57%
Alpha slope at beta voltage	0.00%	0.72%	1.22%	1.58%
Alpha slope at alpha voltage	0.84%	0.83%	1.99%	3.07%

OK JP 11/7/16

Unit Type: LB4100/W
 Date Performed: 11/4/16 07:00
 FileName: PTA1104C
 Batch ID: DRAWER C PLATEAU

Unit Id: Orange
 Application Revision: B
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	C1	C2	C3	C4
Beta slope at beta voltage	2.80%	0.60%	1.61%	0.38%
Alpha slope at beta voltage	2.88%	2.32%	-0.15%	-0.03%
Alpha slope at alpha voltage	2.92%	1.27%	2.92%	1.94%

OK JP
11/2/16

Continued from Page

11-4-15

Plateau checks performed for Drawers A-C

X sources		Detectors		P sources	
410	Am-241	A1	B1	C1	406 Sr-90/4-90
411	17800dpm	A2	B2	C2	407 29600dpm
412	2-16-95	A3	B3	C3	408 9-15-92
413		A4	B4	C4	409

Parameters

Starting voltage 700	Ct. preset 40,000
Ending voltage 1650	weak check time 0.1
Volts/step 30	weak ct. limit 35
Ct. time/step 5	
time between steps 0.1	

3-24-16

Power outage. Instrument was turned off. ^{Turned} back on when power was restored. _{4/5-16} Daily checks were performed.

All in control. Instrument on-line.

3-30-16

Memory loss caused computer to crash and files to be lost.

All instrument calibration files were restored from last back-up.

As of 4-1-16 instrument was on-line and resumed as normal.

11-3-16 & 11-4-16

Plateau checks performed for Drawers A-C

X sources		Detectors		P sources	
410	Am-241	A1	B1	C1	406 Sr-90/4-90
411	17600dpm	A2	B2	C2	407 29600dpm
412	2-16-95	A3	B3	C3	408 9-15-92
413		A4	B4	C4	409

Parameters

Starting voltage 700	time between steps 0.1
Ending voltage 1650	Ct. preset 40,000
Volts/step 30	weak check time 0.1
Ct. time/step 5	weak ct. limit 35

Continued on Page

Mark J...

Signed

11-7-16

Date

Read and Understood By *[Signature]*

Signed

11/7/16

Date

Date 11/3/16 / 11/4/16

SOP 724r II

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100A

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-4	Alpha/Beta	Dryme / Plat	Plat	5 / Min / Step	13:10	MH	PTA1103	JP
5-6	Beta/Alpha	B						
9-12	Alpha/Beta	C			10:55	JP	PTA11034C	
1-12	Daily Eff.			30	14:08	WJ	EFA1104	WJ
					14:20		A	
					14:31		B	
					14:44		C	
1-12	Weekly bkgd			1000	15:17	WJ	BKA1104W	JP
							JP 11/5/16	

WJ 11-7-16

Comments:

Page No.: 468536 B
 (cont. from page WJ B)

Form 780r8.doc (6/23/06)

Reviewed By / Date JP 11/5/16

Instrument ROIs

LB4100-AW Sample Counting Parameters for LIMS

Certainty requirement for MDA and flags	95%
Maximum count time (min)	120.00
Typical Residual Mass (mg)	80.00
Typical Sample Volume (l)	1.00

	α	β
Action level for flags (pCi/l)	1.000E+00	8.000E+00
Activity Multiplier	1.000E+00	1.000E+00
Mass Error (%)	1.00%	
Volume Error (%)	1.00%	

	Alpha			Beta		
	eff.	bkg.	MDA (pCi/l)	eff.	bkg.	MDA (pCi/l)
A1	16.35%	0.142	3.958E-01	34.64%	2.098	6.404E-01
A2	21.07%	0.125	3.055E-01	37.63%	2.008	5.775E-01
A3	22.60%	0.1	2.635E-01	36.33%	2.117	6.140E-01
A4	19.36%	0.141	3.464E-01	35.10%	2.019	6.206E-01

Batch Specific:

	Event	Recycle
Orange	1	0

Drawer Specific:

	Date/Time	Official	Bias	Step
A	11/3/16 13:18	TRUE	1402.5	0
B	11/3/16 13:18	TRUE	1500	0
C	11/4/16 7:00	TRUE	1530	0
D	8/5/08 11:19	TRUE	1500	0

Detector Specific:

	Date/Time	Official	Threshold	bLL	bUL	aLL	aUL	Time
A1	11/4/16 0:00	TRUE	0.1	0	21.51	41.83	100	120
A2	11/4/16 0:00	TRUE	0.1	0	24.68	47.05	100	120
A3	11/4/16 0:00	TRUE	0.1	0	20.53	39.21	100	120
A4	11/4/16 0:00	TRUE	0.1	0	21.8	40.51	100	120
B1	11/4/16 0:00	TRUE	0.1	0	47.74	94.77	100	120
B2	11/4/16 0:00	TRUE	0.1	0	53.65	100	100	120
B3	11/4/16 0:00	TRUE	0.1	0	13.94	32.01	100	120
B4	11/4/16 0:00	TRUE	0.1	0	11.52	27.44	100	120
C1	11/4/16 0:00	TRUE	0.1	0	21.44	47.05	100	120
C2	11/4/16 0:00	TRUE	0.1	0	67.57	100	100	120
C3	11/4/16 0:00	TRUE	0.1	0	23.27	50.98	100	120
C4	11/4/16 0:00	TRUE	0.1	0	88.44	100	100	120
D1	5/2/13 0:00	TRUE	0.1	0	60.52	100	100	120
D2	5/2/13 0:00	TRUE	0.1	0	60.52	100	100	120
D3	5/2/13 0:00	TRUE	0.1	0	60.52	100	100	120
D4	5/2/13 0:00	TRUE	0.1	0	60.52	100	100	120

Calibration Efficiencies

SOURCES.XLS

626	Am-241	Alpha	158153.25	5516.133	99.29	25-Oct-11	ALS	Am241R-11/16
627	Sr-90	Beta	10519.2	9993.46	199.86	2-Dec-04	ALS	Sr90R-11/16

Am-241 Ringed Planchet Efficiency Calibration

LB4100-A

Date: 12/5/2016

Source ID: 626

Det ID	A1	A2	A3	A4	B1	B2	B3	B4
File Name	EAM1205A	EAM1205A	EAM1205A	EAM1205A	EAM1205B	NA	EAM1205B	EAM1205B
Cnt Time	9.37	8.18	8.54	9.09	8.41	NA	8.13	9.02
Tot Cnts	10007	10005	10008	10021	10013	NA	10002	10011
Bkg CPM	0.122	0.156	0.124	0.095	0.105	NA	0.134	0.158
CPM	1067.8609	1222.9491	1171.773	1102.32524	1190.5014	NA	1230.1243	1109.709
Alpha EFF	0.1951804	0.2235269	0.2141731	0.20147968	0.2175963	NA	0.2248384	0.2028293
Beta EFF	0.0542093	0.0602494	0.0560625	0.05567783	0.0595029	NA	0.0649517	0.0524124
Efficiency	0.1952	0.2235	0.2142	0.2015	0.2176	NA	0.2248	0.2028

Det ID	C1	C3	C2	C4	D1	D2	D3	D4
File Name	EAM1205B	EAM1205B	NA	NA	N.A.	N.A.	N.A.	N.A.
Cnt Time	9.23	7.9	NA	NA	N.A.	N.A.	N.A.	N.A.
Tot Cnts	10011	10012	NA	NA	N.A.	N.A.	N.A.	N.A.
Bkg CPM	0.124	0.115	NA	NA	N.A.	N.A.	N.A.	N.A.
CPM	1084.4914	1267.2268	NA	NA	N.A.	N.A.	N.A.	N.A.
Alpha EFF	0.1982201	0.2316199	NA	NA	N.A.	N.A.	N.A.	N.A.
Beta EFF	0.0604279	0.0655311	NA	NA	N.A.	N.A.	N.A.	N.A.
Efficiency	0.1982	0.2316	NA	NA	N.A.	N.A.	N.A.	N.A.

AM241EFF.XLS

		A1	A2	A3	A4	B1	B3	B4	C1	C3
		0	1	2	3	4	6	7	8	10
	offset	0	1	2	3	0	1	2	0	1
	NumRecs	1	1	1	1	1	1	1	1	1
	total time	9.37	8.18	8.54	9.09	8.41	8.13	9.02	9.23	7.9
Alpha	total counts	10007	10005	10008	10021	10013	10002	10011	10011	10012
	reduced chi	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	CPM	1067.861	1222.949	1171.773	1102.325	1190.501	1230.124	1109.709	1084.491	1267.227
	CPM var	228.0378	299.1226	274.5588	242.8115	283.3248	302.677	246.2257	235.149	321.0386
	Efficiency	0.19518	0.223527	0.214173	0.20148	0.217596	0.224838	0.202829	0.19822	0.23162
	archived ST	0.004468	0.005117	0.004902	0.004611	0.004981	0.005147	0.004643	0.004537	0.005302
	predicted S	0.001951	0.002235	0.002141	0.002013	0.002175	0.002248	0.002027	0.001981	0.002315
	actual STD	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Beta	total counts	2799	2713	2639	2788	2754	2907	2603	3070	2846
	reduced chi	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	CPM	296.5873	329.6336	306.7264	304.6217	325.5493	355.3606	286.7559	330.6101	358.5302
	CPM var	40.80585	51.54759	45.73599	43.15078	49.66325	56.76833	40.32317	47.10088	58.58162
	Efficiency	0.054209	0.060249	0.056063	0.055678	0.059503	0.064952	0.052412	0.060428	0.065531
	archived ST	0.001522	0.001702	0.001596	0.001564	0.001675	0.001806	0.001496	0.00166	0.00183
	predicted S	0.001028	0.00116	0.001095	0.001058	0.001137	0.001208	0.001031	0.001094	0.001231
	actual STD	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Sr-90 Ringed Planchet Efficiency Calibration

LB4100-A

Date: 12/5/2016

Source ID: 627

Det ID	A1	A2	A3	A4	B1	B2	B3	B4
File Name	ESR1205A	ESR1205A	ESR1205A	ESR1205A	ESR1205B	NA	ESR1205B	ESR1205B
Cnt Time	3.21	3.16	3.07	3.04	3.02	NA	3.14	3.21
Tot Cnts	10018	10044	10018	10010	10022	NA	10025	10018
Bkg CPM	2.132	2.029	2.290	2.089	1.918	NA	2.204	1.825
CPM	3118.740274	3176.452013	3260.9022	3290.67416	3316.62505	NA	3190.47116	3119.0473
Alpha EFF	0.000982585	0.001416636	0.0016371	0.00112995	0.00215367	NA	0.0020244	0.0028923
Beta EFF	0.416666305	0.424376642	0.4356593	0.43963682	0.44310411	NA	0.42624984	0.4167075
Efficiency	0.4167	0.4244	0.4357	0.4396	0.4431	NA	0.4262	0.4167

Det ID	C1	C3	C2	C4	D1	D2	D3	D4
File Name	ESR1205C	ESR1205C	NA	NA	N.A.	N.A.	N.A.	N.A.
Cnt Time	3.15	3.08	NA	NA	N.A.	N.A.	N.A.	N.A.
Tot Cnts	10020	10009	NA	NA	N.A.	N.A.	N.A.	N.A.
Bkg CPM	2.001	1.723	NA	NA	N.A.	N.A.	N.A.	N.A.
CPM	3178.951381	3247.952325	NA	NA	N.A.	N.A.	N.A.	N.A.
Alpha EFF	0.001510299	0.001112434	NA	NA	N.A.	N.A.	N.A.	N.A.
Beta EFF	0.424710281	0.433928859	NA	NA	N.A.	N.A.	N.A.	N.A.
Efficiency	0.4247	0.4339	NA	NA	N.A.	N.A.	N.A.	N.A.

SR90EFF.XLS

		A1	A2	A3	A4	B1	B3	B4	C1	C3
		0	1	2	3	4	6	7	8	10
	offset	0	1	2	3	0	1	2	0	1
	NumRecs	1	1	1	1	1	1	1	1	1
	total time	3.21	3.16	3.07	3.04	3.02	3.14	3.21	3.15	3.08
Alpha	total counts	24	34	38	26	49	48	70	36	26
	reduced chi	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	CPM	7.354636	10.60349	12.25385	8.457632	16.12017	15.15262	21.64885	11.30457	8.326558
	CPM var	2.334882	3.416636	4.047318	2.820775	5.399002	4.891854	6.841124	3.641303	2.748007
	Efficiency	0.000983	0.001417	0.001637	0.00113	0.002154	0.002024	0.002892	0.00151	0.001112
	archived ST	0.000205	0.000249	0.000271	0.000226	0.000313	0.000298	0.000354	0.000257	0.000223
	predicted S	0.000202	0.000245	0.000267	0.000223	0.000309	0.000293	0.000347	0.000253	0.00022
	actual STD	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Beta	total counts	10018	10044	10018	10010	10022	10025	10018	10020	10009
	reduced chi	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	CPM	3118.74	3176.452	3260.902	3290.674	3316.625	3190.471	3119.047	3178.951	3247.952
	CPM var	1946.221	2016.125	2127.774	2167.377	2200.13	2036.095	1946.221	2021.674	2111.13
	Efficiency	0.416666	0.424377	0.435659	0.439637	0.443104	0.42625	0.416708	0.42471	0.433929
	archived ST	0.010207	0.010393	0.010672	0.01077	0.010854	0.010441	0.010207	0.010403	0.01063
	predicted S	0.004164	0.004236	0.004354	0.004396	0.004427	0.004259	0.004165	0.004244	0.004338
	actual STD	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

~~11/22/16~~ 12/5/16 JP 12/5/16
 Am-241 Eff. Calibration (gross 2)
 Benchsheet: AB121109-1 Source ID 626
 Logfile Am241R-11/16
 Sources Detectors Filenames
 1223001-20 A1 B1 C1 EAM ¹²⁰⁵ ~~1205~~ JP 12/5/16
 ↓ -22 A2 B3 C3 ↓ b
 ↓ -23 A3 B4 ↓ c
 ↓ -24 A4

Sr-90 Eff. Calibration (gross F)
 Benchsheet: AB160616-3 Source ID 627
 MA 11-22-16

Logfile Sr90R-11/16
 Sources Detectors Filenames
 1118005-2 A1 B1 C1 ESR ¹²⁰⁵ ~~1205~~ JP 12/5/16
 ↓ -3 A2 B3 C3 ↓ b
 ↓ -4 A3 B4 ↓ c
 ↓ -5 A4

Sr90 Mass Attenuation Curve 12/5/16
 Benchsheet: AB110619-4 Sources: 1180071-16
 Filename: ASR1205

Det	10:17	10:58	11:14	11:30	11:38	11:54	12:10	12:23	12:33	12:39	12:47	12:56	13:07	13:16	13:24	13:34
A1	1	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
A2	2	1	16	15	14	13	12	11	10	9	8	7	6	5	4	3
A3	3	2	1	16	15	14	13	12	11	10	9	8	7	6	5	4
A4	4	3	2	1	16	15	14	13	12	11	10	9	8	7	6	5
B1	5	4	3	2	1	16	15	14	13	12	11	10	9	8	7	6
B3	6	5	4	3	2	1	16	15	14	13	12	11	10	9	8	7
B4	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9	8
C1	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
C3	9	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10

[Signature]

12/5/16

Read and Understood By

[Signature]

12/28/16

Signed

Date

Date 12/5/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									α
7									P
8									
9									
10									α
11									P
12									α
13	OL				α				
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK1206W			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow
Tank 1	1000	Dr A	10
		Dr B	
Tank 2	2056	Dr C	
		Dr D	

Comments:

Date 12/5/16

SOP 724r 1.1

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100A

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-12	Dash EF	—	—	30	6:38	JP	EFA1205	JP
1-12	Dash Bkg	—	—	60	6:52	JP	BKA1205	JP
1-4	626	AB121109-1	α EF	30	8:44	JP	EAM1205A	JP
5,7,8					8:19	JP		B
9,11					8:31	JP		C
9,11	627	AB110616-3	B-EF	30	8:05	JP	ESR1205C	
1-4					8:20	JP		A
5,7,8					8:32	JP		B
1	1610549-1	RA161201-1	R226	90	9:02	JP	RAA1205	JP
2	552-1							
3	554-1							
4	556-1							
5	557-1							
7	584-1							
9	-2							
11	-3							
14,5,7,8,9,11	1118007-1-76	AB110619-4	BATTN	30	10:47	JP	ASR1205	

Comments:

Date 12/6/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13			OL						
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BKA1201W			
Dr B				
Dr C				
Dr D		OL		

Dr = Drawer

Gas Supply

P-10 Supply		P-10 Flow	
Tank 1	660	Dr A	10
		Dr B	
Tank 2	2050	Dr C	
		Dr D	

Comments:

Gross Alpha!!

Prep Procedure: GAB

Eff. & ATTN calibration.

Analytical QASS / NCR? Y (N) ML

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	1223001-1	SMP	200	200	ml	PCI/L	23.3										
1	1223001-2	SMP	200	200	ml	PCI/L	22.1										
1	1223001-3	SMP	200	200	ml	PCI/L	21										
1	1223001-4	SMP	200	200	ml	PCI/L	22.8										
1	1223001-5	SMP	200	200	ml	PCI/L	22.7										outlier - don't use
1	1223001-6	SMP	200	200	ml	PCI/L	48.5										
1	1223001-7	SMP	200	200	ml	PCI/L	47.5										
1	1223001-8	SMP	200	200	ml	PCI/L	43.7										
1	1223001-9	SMP	200	200	ml	PCI/L	46.1										
1	1223001-10	SMP	200	200	ml	PCI/L	63.5										
1	1223001-11	SMP	200	200	ml	PCI/L	81.1										
1	1223001-12	SMP	200	200	ml	PCI/L	93.6										
1	1223001-13	SMP	200	200	ml	PCI/L	95.2										
1	1223001-14	SMP	200	200	ml	PCI/L	116.1										
1	1223001-15	SMP	200	200	ml	PCI/L	90.7										
1	1223001-16	SMP	200	200	ml	PCI/L	134.4										
1	1223001-17	SMP	200	200	ml	PCI/L	134.2										
1	1223001-18	SMP	200	200	ml	PCI/L	151.6										
1	1223001-19	SMP	200	200	ml	PCI/L	156										
1	1223001-20	SMP	200	200	ml	PCI/L	21.3										
1	1223001-21	SMP	200	200	ml	PCI/L	21.8										
1	1223001-22	SMP	200	200	ml	PCI/L	19.7										
1	1223001-23	SMP	200	200	ml	PCI/L	20.5										
1	1223001-24	SMP	200	200	ml	PCI/L	21.2										
1	1223001-25	SMP	200	200	ml	PCI/L	21.1										
1	1223001-26	SMP	200	200	ml	PCI/L	21.5										
1	1223001-27	SMP	200	200	ml	PCI/L	20.7										

outlier - don't use

See Run Log 3974 ps 37

OUTLIER don't use

AB1110 1 OK

AB1119 1 OK

A |
B |
C |

A |
B |
C |

M12/12/14

M12/12/14

Use for Eff. Calibration

116 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1




























Prep Procedure: GAB

Analytical QASS / NCR? / *BN*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Ins/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Ins/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Ins/Det	Cnt 3 Pos Chk By	Notes
----------	-------	---------	----------	---------	-------	--------------	--------------------	------------	---------------	------------------	------------	---------------	------------------	------------	---------------	------------------	-------

Spike Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1 ml	RS-008

Sample Barcodes

1223001-1 AB121109-1PS1		1223001-2 AB121109-1PS2		1223001-3 AB121109-1PS3	
1223001-4 AB121109-1PS4		1223001-5 AB121109-1PS5		1223001-6 AB121109-1PS6	
1223001-7 AB121109-1PS7		1223001-8 AB121109-1PS8		1223001-9 AB121109-1PS9	
1223001-10 AB121109-1PS10		1223001-11 AB121109-1PS11		1223001-12 AB121109-1PS12	
1223001-13 AB121109-1PS13		1223001-14 AB121109-1PS14		1223001-15 AB121109-1PS15	
1223001-16 AB121109-1PS16		1223001-17 AB121109-1PS17		1223001-18 AB121109-1PS18	
1223001-19 AB121109-1PS19		1223001-20 AB121109-1PS20		1223001-21 AB121109-1PS21	
1223001-22 AB121109-1PS22		1223001-23 AB121109-1PS23		1223001-24 AB121109-1PS24	
1223001-25 AB121109-1PS25		1223001-26 AB121109-1PS26		1223001-27 AB121109-1PS27	

117 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Reporting Units

LabID:	TstGrpName:	RptUnits:
1223001-1	GrossAlpha/Beta	PCI/L
1223001-2	GrossAlpha/Beta	PCI/L
1223001-3	GrossAlpha/Beta	PCI/L
1223001-4	GrossAlpha/Beta	PCI/L
1223001-5	GrossAlpha/Beta	PCI/L
1223001-6	GrossAlpha/Beta	PCI/L
1223001-7	GrossAlpha/Beta	PCI/L
1223001-8	GrossAlpha/Beta	PCI/L
1223001-9	GrossAlpha/Beta	PCI/L
1223001-10	GrossAlpha/Beta	PCI/L
1223001-11	GrossAlpha/Beta	PCI/L
1223001-12	GrossAlpha/Beta	PCI/L
1223001-13	GrossAlpha/Beta	PCI/L
1223001-14	GrossAlpha/Beta	PCI/L
1223001-15	GrossAlpha/Beta	PCI/L
1223001-16	GrossAlpha/Beta	PCI/L
1223001-17	GrossAlpha/Beta	PCI/L
1223001-18	GrossAlpha/Beta	PCI/L
1223001-19	GrossAlpha/Beta	PCI/L
1223001-20	GrossAlpha/Beta	PCI/L
1223001-21	GrossAlpha/Beta	PCI/L
1223001-22	GrossAlpha/Beta	PCI/L
1223001-23	GrossAlpha/Beta	PCI/L
1223001-24	GrossAlpha/Beta	PCI/L
1223001-25	GrossAlpha/Beta	PCI/L
1223001-26	GrossAlpha/Beta	PCI/L
1223001-27	GrossAlpha/Beta	PCI/L

118 of 328

Radiochemistry Prep Worksheet

Prep Batch: AB121109-1

ALS Environmental -- FC

Prep Procedure: **GAB**

Reviewed By: *jll*

Review Date: 11/15/2012

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 702 Rev: 20
 Prep SOP: NONE
 Matrix Class: liquid

Prep Analyst: Steve Workman
 Prep Date: 11/8/2012
 Prep Dept: RS

Balance: 10
 Balance: 13

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1223001-1	SMP		200	200	Unfiltered	S1	
2	1	1223001-2	SMP		200	200	Unfiltered	S1	
3	1	1223001-3	SMP		200	200	Unfiltered	S1	
4	1	1223001-4	SMP		200	200	Unfiltered	S1	
5	1	1223001-5	SMP		200	200	Unfiltered	S1	
6	1	1223001-6	SMP		200	200	Unfiltered	S1	
7	1	1223001-7	SMP		200	200	Unfiltered	S1	
8	1	1223001-8	SMP		200	200	Unfiltered	S1	
9	1	1223001-9	SMP		200	200	Unfiltered	S1	
10	1	1223001-10	SMP		200	200	Unfiltered	S1	
11	1	1223001-11	SMP		200	200	Unfiltered	S1	
12	1	1223001-12	SMP		200	200	Unfiltered	S1	
13	1	1223001-13	SMP		200	200	Unfiltered	S1	
14	1	1223001-14	SMP		200	200	Unfiltered	S1	
15	1	1223001-15	SMP		200	200	Unfiltered	S1	
16	1	1223001-16	SMP		200	200	Unfiltered	S1	
17	1	1223001-17	SMP		200	200	Unfiltered	S1	
18	1	1223001-18	SMP		200	200	Unfiltered	S1	
19	1	1223001-19	SMP		200	200	Unfiltered	S1	
20	1	1223001-20	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
21	1	1223001-21	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
22	1	1223001-22	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
23	1	1223001-23	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
24	1	1223001-24	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
25	1	1223001-25	SMP		200	200	Unfiltered		0.05 mL of 10 mg/mL natural Uranium
26	1	1223001-26	SMP		200	200	Unfiltered		0.05 mL of 10 mg/mL natural Uranium
27	1	1223001-27	SMP		200	200	Unfiltered		0.05 mL of 10 mg/mL natural Uranium

jll/sh

jll/sh

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: GAB

Reviewed By: jll

Review Date: 11/15/2012

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10

Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes

Comments

Calibration planchets and mass attenuation curve.

Spiked By: Steve Workman Date: 11/8/2012

Witnessed By: N/A Date: N/A

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1	ml	RS-008

Reagent Solution IDs*

J12036

Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

Radiochemistry Gravimetric Worksheet

ALS Environmental -- FC

Prep Batch: **AB121109-1**

Prep Procedure: **GAB**

Reviewed By: *jtl* *SN*

Review Date: 11/15/2012

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1223001-1	SMP	10	9.1050	0.0000	0	200	200	200	9.1283	23.3	0.5	
1	2	1223001-2	SMP	10	9.0995	0.0000	0	200	200	200	9.1216	22.1	0.5	
1	3	1223001-3	SMP	10	9.0872	0.0000	0	200	200	200	9.1082	21	0.5	
1	4	1223001-4	SMP	10	9.1198	0.0000	0	200	200	200	9.1426	22.8	0.5	
1	5	1223001-5	SMP	10	9.1442	0.0000	0	200	200	200	9.1669	22.7	0.5	
1	6	1223001-6	SMP	10	9.1142	0.0000	0	200	200	200	9.1627	48.5	1	
1	7	1223001-7	SMP	10	9.1346	0.0000	0	200	200	200	9.1821	47.5	1	
1	8	1223001-8	SMP	10	9.0877	0.0000	0	200	200	200	9.1314	43.7	1.5	
1	9	1223001-9	SMP	10	9.0922	0.0000	0	200	200	200	9.1383	46.1	1.5	
1	10	1223001-10	SMP	10	9.0712	0.0000	0	200	200	200	9.1347	63.5	2	
1	11	1223001-11	SMP	10	9.1302	0.0000	0	200	200	200	9.2113	81.1	2	
1	12	1223001-12	SMP	10	9.1044	0.0000	0	200	200	200	9.1980	93.6	2.5	
1	13	1223001-13	SMP	10	9.1418	0.0000	0	200	200	200	9.2370	95.2	2.5	
1	14	1223001-14	SMP	10	9.1031	0.0000	0	200	200	200	9.2192	116.1	3	
1	15	1223001-15	SMP	10	9.1182	0.0000	0	200	200	200	9.2089	90.7	3	
1	16	1223001-16	SMP	10	9.1173	0.0000	0	200	200	200	9.2515	134.2	3.5	
1	17	1223001-17	SMP	10	9.0956	0.0000	0	200	200	200	9.2298	134.2	3.5	
1	18	1223001-18	SMP	10	9.1276	0.0000	0	200	200	200	9.2792	151.6	4	
1	19	1223001-19	SMP	10	9.1131	0.0000	0	200	200	200	9.2691	156	4	
1	20	1223001-20	SMP	10	9.0751	0.0000	0	200	200	200	9.0964	21.3	0.5	
1	21	1223001-21	SMP	10	9.1113	0.0000	0	200	200	200	9.1331	21.8	0.5	
1	22	1223001-22	SMP	10	9.0713	0.0000	0	200	200	200	9.0910	19.7	0.5	
1	23	1223001-23	SMP	10	9.1326	0.0000	0	200	200	200	9.1531	20.5	0.5	
1	24	1223001-24	SMP	10	9.1320	0.0000	0	200	200	200	9.1532	21.2	0.5	
1	25	1223001-25	SMP	10	9.1188	0.0000	0	200	200	200	9.1399	21.1	0.5	
1	26	1223001-26	SMP	10	9.0872	0.0000	0	200	200	200	9.1087	21.5	0.5	
1	27	1223001-27	SMP	10	9.1133	0.0000	0	200	200	200	9.1340	20.7	0.5	

121 of 328

Gross α standards

<u>no</u>	<u>mass</u>	<u>Std</u>					
21.3	1	20mg R1	0.5ml salt, 0.1ml 955,4095.10			.0751	.0964
1.8	2	R2				.1113	.1331
9.7	3	R3				.0713	.0910
20.5	4	R4				.1326	.1531
21.2	5	R5				.1320	.1532
21.1	6	20mg + U	0.05ml of 10mg/ml nat. U			.1188	.1399
21.5	7					.0872	.1087
20.7	8					.1133	.134

OUTLIER TEST

FILE	DET	SAMPLE ID	Alpha CPM	Relative % diff. from mean	Within acceptability range	Outlier?
ABA1118	A1(1)	1223001-20	1163.818	0.71%	YES	NO
ABA1118A	A1(1)	1223001-21	1074.100	8.36%	YES	OUTLIER!
ABA1118B	A1(1)	1223001-22	1248.300	6.50%	YES	NO
ABA1118C	A1(1)	1223001-23	1203.900	2.71%	YES	NO
ABA1119	A1(1)	1223001-24	1170.500	0.14%	YES	NO

Mean of all five plachets:

Average= 1172.12

Std dev= 64.21220433

2 Std Dev= 128.42

Upper

Lower

Acceptability range

1300.55

1043.70

relative range

+/- 10.96%

10.96%

Sample 1223001-21 rejected as outlier.

Criteria: Potential outliers fall outside acceptability range; which is the mean of all five measurements +/- 2 std dev per the Grubbs statistical test.

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Rev.12/29/03 JE

Data file name: ABA1118
 Batch ID: OUTLIER TEST
 Count Preset (m): 11
 Batch Ended: 11/18/12 16:44

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM010S
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a \cdot (a' / [\text{mass} \cdot x^0])$	Beta Attenuation Calibration $y = b' \cdot m^{a'} \cdot (a' / [\text{mass} \cdot x^0])$
Alpha b = 1.02810	Beta b = 1.0002
m = 0.99320	m = 0.9995
a = 0.9951	a = 0.7695
x0 = 0.0000	x0 = 0.0000
Alpha to Beta X-talk $y = b' \cdot m^{a' \cdot x}$	Beta to Alpha X-talk $y = b' \cdot \text{mass} \cdot m$
a -> b xtalk b = 0.2560	b -> a xtalk b = -5.900E-09
a -> b xtalk m = 1.0002	b -> a xtalk m = 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
A1	1223001-20	11/18/12 16:44	11.00	21.3	1163.818	0.114	0.060	0.2633	0.890	n/a	n/a	300.818	1.998	296.6420	0.3879	0.992	n/a	n/a		

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-AW
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Rev.12/29/03 JE

Data file name: ABA1118A
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:02

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a \cdot [a \cdot (\text{mass} - x_0)]$	Beta Attenuation Calibration $y = b \cdot m^a \cdot [a \cdot (\text{mass} - x_0)]$
Alpha b = 1.02810	Beta b = 1.0002
m = 0.99320	m = 0.9995
a = 0.9951	a = 0.7695
x0 = 0.0000	x0 = 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b = 0.2560	b -> a xtalk b = -5.800E-09
a -> b xtalk m = 1.0002	b -> a xtalk m = 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity						Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-21	11/18/12 17:02	10.00	21.8	1074.100	0.114	0.056	0.2833	0.887	n/a	n/a	280.100	1.988	273.7444	0.3879	0.992	n/a	n/a

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-AAW
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev. 12/29/03 JE

Data file name: ABA1118B
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:13

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a [a \cdot (\text{mass} - x_0)]$	Beta Attenuation Calibration $y = b \cdot m^a [a \cdot (\text{mass} - x_0)]$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass}^a \cdot m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.900E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
					A1	1223001-22	11/18/12 17:13	10.00	19.7	1248.300	0.114	0.070	0.2833	0.899	n/a	n/a	350.400	1.998	318.2792	0.3879

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1118C
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:37

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a \cdot [a \cdot (\text{mass} - x_0)]$	Beta Attenuation Calibration $y = b \cdot m^a \cdot [a \cdot (\text{mass} - x_0)]$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.900E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity						Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
					A1	1223001-23	11/18/12 17:37	10.00	20.5	1203.900	0.114	0.066	0.2633	0.895	n/a	n/a	332.000	1.998

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1119
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/19/12 9:42

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration y = b*m^a*[mass-x0]	Beta Attenuation Calibration y = b*m^a*[mass-x0]
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk y = b*m^a-x	Beta to Alpha X-talk y = b*mass + m
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.000E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-24	11/19/12 9:42	10.00	21.2	1170.500	0.114	0.066	0.2633	0.890	n/a	n/a	331.600	1.998	298.3512	0.3879	0.992	n/a	n/a

Project 955.4095.10 Am-241
Continued from Page _____

Working Intermediate Standard
MEL 11/8/11

MEL 11/8/11

Prepare a working dilution of 955, Am-241

1. Density of 1M HCl, lot # K22032

Mass of 100mL vol. flask:	<u>66.4295g</u>	Balance #	<u>12</u>
Mass of flask & 100mL acid:	<u>167.9701g</u>	Balance#	<u>12</u>
Net Mass:	<u>101.5406g</u>		
Density:	<u>1.0154g/mL</u>		

2. Mass of 955 transferred:

Mass of empty voa vial:	<u>21.3568g</u>	Balance#	<u>12</u>
Mass of voa vial & standard:	<u>26.4318g</u>	Balance#	<u>12</u>
Net mass of standard transferred:	<u>5.0750g</u>		

MEL 11/8/11

MEL 11/8/11

3. Dilute to final volume:

Mass of vial, standard, & diluent:	<u>42.8085g</u>	Balance#	<u>12</u>
Mass of empty voa vial:	<u>21.3568g</u>	Balance#	<u>12</u>
Net mass of new dilution:	<u>21.4517g</u>		

4. Final activity calculation:

$$(1.965 \times 10^4 \text{ Bq}) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{5.0750 \text{ g}}{5.1341 \text{ g}} \right) \left(\frac{1.0154 \text{ g/mL}}{21.4517 \text{ g}} \right) = 55,161.32 \text{ dpm/mL}$$

MEL 11/8/11
55,161.33 dpm/mL

MEL 11/8/11

Std ID: 955.4095.10

RG 11/29/11

RG 11/29/11

Description: Am-241

Expiration: 11/11/2012

Activity: 55161.33 dpm/mL

2s Uncertainty: 992.90 dpm/mL

Ref. Date: 10/25/2011

Ref Time: N/A

Prep Date: 11/8/2011 Prep by: MEL

Matrix/Comp. 3M HCl

Half Life (y): 4.33E+02

RG 11/29/11

RG 11/29/11

Reverification Log		
Analysis Date	Initials	Expiration Date

Continued on Page

Megan Jones
Signed

11/8/11
Date

Read and Understood By
Renee Kelley
Signed

11/29/11



Eckert & Ziegler
Analytics

RS# 955
Rec 10-31-11

1380 Seaboard Industrial Blvd.
 Atlanta, Georgia 30318
 Tel 404-352-8677
 Fax 404-352-2837
 www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

85983-307

Am-241 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u_A	u_B	U	
Am-241	1.580E+05	1.965E+04	0.1	0.9	1.8	10/25/2011

***Uncertainty:** U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %, α -impurities < 0.1 %. 5.13441 g 1M HCl solution, carrier free.

Source Prepared by: *M. I. Taskaeva*
 M. I. Taskaeva, Radiochemist

QA Approved: *J. D. McCorvey*
 J. D. McCorvey, QA Manager Alternate

Date: 26 Oct 11

ANA Form005 Rev. ---

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Prep Procedure: GAB *EFF CAL SET Drinking H₂O / Sr-90* Analytical QASS / NCR? *YIN*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1118005-1	SMP	200	200	ml	PC/L												
1	1118005-2	SMP	200	200	ml	PC/L												OUTLIER
1	1118005-3	SMP	200	200	ml	PC/L												
1	1118005-4	SMP	200	200	ml	PC/L												
1	1118005-5	SMP	200	200	ml	PC/L												
1	1118005-6	SMP	200	200	ml	PC/L												
1	1118005-7	SMP	200	200	ml	PC/L												OUTLIER
1	1118005-8	SMP	200	200	ml	PC/L												OP 12/12/14
1	1118005-9	SMP	200	200	ml	PC/L												
1	1118005-10	SMP	200	200	ml	PC/L												

SF90

See Runlog 3974 pg. 37

Spike Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005	
S2	T 230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009	

Sample Barcodes

1118005-1 AB110616-3PS1		1118005-2 AB110616-3PS2		1118005-3 AB110616-3PS3	
1118005-4 AB110616-3PS4		1118005-5 AB110616-3PS5		1118005-6 AB110616-3PS6	
1118005-7 AB110616-3PS7		1118005-8 AB110616-3PS8		1118005-9 AB110616-3PS9	
1118005-10 AB110616-3PS10					

131 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Reporting Units

LabID:	TstGrpName:	RptUnits:
1118005-1	GrossAlpha/Beta	PCI/L
1118005-2	GrossAlpha/Beta	PCI/L
1118005-3	GrossAlpha/Beta	PCI/L
1118005-4	GrossAlpha/Beta	PCI/L
1118005-5	GrossAlpha/Beta	PCI/L
1118005-6	GrossAlpha/Beta	PCI/L
1118005-7	GrossAlpha/Beta	PCI/L
1118005-8	GrossAlpha/Beta	PCI/L
1118005-9	GrossAlpha/Beta	PCI/L
1118005-10	GrossAlpha/Beta	PCI/L

132 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3











Prep Procedure: GAB *Calib. SET (GROSS) (GROSS) (DEK 1120)* **OUTLIER TEST** Analytical GASS / NCR? Y / N

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1118005-1	SMP	200	200	ml	PC/L	X	ABC0621	F	11	5	X						OUTLIER
1	1118005-2	SMP	200	200	ml	PC/L			G	11	5							
1	1118005-3	SMP	200	200	ml	PC/L			H	11	5							
1	1118005-4	SMP	200	200	ml	PC/L			I	11	5							
1	1118005-5	SMP	200	200	ml	PC/L			J	11	5							
1	1118005-6	SMP	200	200	ml	PC/L		ABC0621A	70	5								
1	1118005-7	SMP	200	200	ml	PC/L	X		B	6	5	X						OUTLIER
1	1118005-8	SMP	200	200	ml	PC/L			C	6	5							
1	1118005-9	SMP	200	200	ml	PC/L			D	6	5							
1	1118005-10	SMP	200	200	ml	PC/L			E	6	5							

*X Rejected as OUTLIER
8/6/21/11*

Spike Solution Information									
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID	
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005	
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009	

Sample Barcodes

1118005-1 AB110616-3PS1		1118005-2 AB110616-3PS2		1118005-3 AB110616-3PS3	
1118005-4 AB110616-3PS4		1118005-5 AB110616-3PS5		1118005-6 AB110616-3PS6	
1118005-7 AB110616-3PS7		1118005-8 AB110616-3PS8		1118005-9 AB110616-3PS9	
1118005-10 AB110616-3PS10					

133 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Reporting Units

LabID:	TstGrpName:	RptUnits:
1118005-1	GrossAlpha/Beta	PCI/L
1118005-2	GrossAlpha/Beta	PCI/L
1118005-3	GrossAlpha/Beta	PCI/L
1118005-4	GrossAlpha/Beta	PCI/L
1118005-5	GrossAlpha/Beta	PCI/L
1118005-6	GrossAlpha/Beta	PCI/L
1118005-7	GrossAlpha/Beta	PCI/L
1118005-8	GrossAlpha/Beta	PCI/L
1118005-9	GrossAlpha/Beta	PCI/L
1118005-10	GrossAlpha/Beta	PCI/L

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Prep Procedure: GAB

Reviewed By: gdw *GDW* Review Date: 6/20/2011

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 702 Rev: 20 Prep Analyst: Gabriel D. Wagner *GDW* Balance: _____
 Prep SOP: NONE Prep Date: 6/16/2011 Balance: _____
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118005-1	SMP		200	200	Unfiltered	S1	<i>GDW</i> <i>6/20/11</i>
2	1	1118005-2	SMP		200	200	Unfiltered	S1	
3	1	1118005-3	SMP		200	200	Unfiltered	S1	
4	1	1118005-4	SMP		200	200	Unfiltered	S1	
5	1	1118005-5	SMP		200	200	Unfiltered	S1	
6	1	1118005-6	SMP		200	200	Unfiltered	S2	
7	1	1118005-7	SMP		200	200	Unfiltered	S2	
8	1	1118005-8	SMP		200	200	Unfiltered	S2	
9	1	1118005-9	SMP		200	200	Unfiltered	S2	
10	1	1118005-10	SMP		200	200	Unfiltered	S2	

Comments
 Gross alpha and beta zero mass efficiency. Direct spike onto planchet along with concentrated HNO3. *(Into desiccator on 6/20/11 @ 13:00 gdw 6/20/11)*

Spiked By: Gabriel D. Wagner *GDW* Date: 6/20/2011
 Witnessed By: Justin D. Anderson Date: 6/20/2011

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009

Reagent Solution IDs:

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

135 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Prep Procedure: GAB **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 702 Rev: 20 Prep Analyst: Gabriel D. Wagner *GDW* Balance: _____

Prep SOP: NONE Prep Date: 6/16/2011 Balance: _____

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118005-1	SMP		200	200	Unfiltered	S1	
2	1	1118005-2	SMP		200	200	Unfiltered	S1	
3	1	1118005-3	SMP		200	200	Unfiltered	S1	
4	1	1118005-4	SMP		200	200	Unfiltered	S1	
5	1	1118005-5	SMP		200	200	Unfiltered	S1	
6	1	1118005-6	SMP		200	200	Unfiltered	S2	
7	1	1118005-7	SMP		200	200	Unfiltered	S2	
8	1	1118005-8	SMP		200	200	Unfiltered	S2	
9	1	1118005-9	SMP		200	200	Unfiltered	S2	
10	1	1118005-10	SMP		200	200	Unfiltered	S2	

Comments *TRAYS* *desigated on 06/20/11 @ 13:00*

Gross alpha and beta zero mass efficiency. Direct spike onto planchet along with concentrated HNO3.

Spiked By: *GDW* Date: *06/20/11*

Witnessed By: *JPA* Date: *6/20/11*

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009

EXP. 4/1/12
ETP-11/19/11

Reagent Solution IDs:

J12036

Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

136 of 328

OUTLIER TEST

FILE	DET	SAMPLE ID	Beta CPM	Relative % diff. from mean	Within acceptability range	Outlier?
ABC0621F	C3(11)	1118005-1	3650.0	1.94%	YES	OUTLIER!
ABC0621G	C3(11)	1118005-2	3736	0.37%	YES	NO
ABC0621H	C3(11)	1118005-3	3676.67	1.22%	YES	NO
ABC0621I	C3(11)	1118005-4	3757.67	0.95%	YES	NO
ABC0621J	C3(11)	1118005-5	3790.67	1.84%	YES	NO

Mean of all five plachets:

Average= 3722.20

Std dev= 57.927

2 Std Dev= 115.85

Upper

Lower

Acceptability range

3838.05

3606.35

Relative range

+/- 3.11%

3.11%**Sample 1118005-1 rejected as outlier.**

Criteria: Potential outliers fall outside acceptability range; which is the mean of all five measurements +/- 2 std dev per the Grubbs statistical test.

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC0621F
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 9:59

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha prog. logfile: n/a
 Alpha attenuation calibration: AAM0611/12/14
 Alpha prog. attenuation: n/a
 Beta efficiency logfile: Sr-89-06/11
 Beta prog. logfile: n/a
 Beta attenuation calibration: ASR0610/0611
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b * m * (a * (mass - x0))$	$y = b * m * (a * (mass - x0))$
Alpha b = 1.14100	Beta b = 1.0680
m = 0.99380	m = 0.9990
a = 0.9950	a = 0.9920
x0 = 0.0000	x0 = 0.0000
Alpha to Beta X-talk	Beta to Alpha X-talk
$y = b * m * mass$	$y = b * mass + m$
a -> b xtalk b = 0.2779	b -> a xtalk b = -1.05E-05
a -> b xtalk m = 1.0004	b -> a xtalk m = 0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-1	6/21/2011 9:59	3.00	0.0	2.667	0.064	8.391	0.2180	1.141	n/a	n/a	3650.000	1.727	0.7233	0.4712	1.068	n/a	n/a

Handwritten signature and date:
 6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision:
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC0621G
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:03

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14 Alpha prog. logfile: n/a
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611 Beta prog. attenuation: n/a

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b * m^a (a^{(mass-x0)})$		$y = b * m^a (a^{(mass-x0)})$	
Alpha b=	1.14100	Beta b=	1.0680
m=	0.99380	m=	0.9990
a=	0.9950	a=	0.9920
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk		Beta to Alpha X-talk	
$y = b * m^a - mass$		$y = b * mass + m$	
a -> b xtalk b=	0.2779	b -> a xtalk b=	-1.05E-05
a -> b xtalk m=	1.0004	b -> a xtalk m=	0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-2	6/21/2011 10:03	3.00	0.0	4.333	0.064	8.589	0.2180	1.141	n/a	n/a	3736.000	1.727	1.1864	0.4712	1.068	n/a	n/a

8
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Rev.12/01/08 JCP

Data file name: ABC0621H
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:07

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b \cdot m^a (a'(\text{mass} - x_0))$		$y = b \cdot m^a (a'(\text{mass} - x_0))$	
Alpha b=	1.14100	Beta b=	1.0680
m=	0.99380	m=	0.9990
a=	0.9950	a=	0.9920
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk		Beta to Alpha X-talk	
$y = b \cdot m^a \cdot \text{mass}$		$y = b \cdot \text{mass} + m$	
a -> b xtalk b=	0.2779	b -> a xtalk b=	-1.05E-05
a -> b xtalk m=	1.0004	b -> a xtalk m=	0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
C3	1118005-3	6/21/2011 10:07	3.00	0.0	2.667	0.064	8.452	0.2180	1.141	n/a	n/a	3676.667	1.727	0.7233	0.4712	1.068	n/a	n/a		

8
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC06211
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:11

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta attenuation calibration: ASR0610/0611
 Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b * m^a (a * (mass * x0))$		$y = b * m^a (a * (mass * x0))$	
Alpha b=	1.14100	Beta b=	1.0680
m=	0.99380	m=	0.9990
a=	0.9950	a=	0.9920
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk $y = b * m^a * mass$		Beta to Alpha X-talk $y = b * mass + m$	
a -> b xtalk b=	0.2779	b -> a xtalk b=	-1.05E-05
a -> b xtalk m=	1.0004	b -> a xtalk m=	0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtalk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtalk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-4	6/21/2011 10:11	3.00	0.0	2.000	0.064	8.639	0.2180	1.141	n/a	n/a	3757.667	1.727	0.5380	0.4712	1.068	n/a	n/a

S
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Rev.12/01/08 JCP

Data file name: ABC0621J
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:15

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b * m^a (a'(\text{mass}-x0))$		$y = b * m^a (a'(\text{mass}-x0))$	
Alpha b=	1.14100	Beta b=	1.0680
m=	0.99380	m=	0.9990
a=	0.9950	a=	0.9920
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk $y = b * m^a - \text{mass}$		Beta to Alpha X-talk $y = b * \text{mass} + m$	
a->b xtalk b=	0.2779	b->a xtalk b=	-1.05E-05
a->b xtalk m=	1.0004	b->a xtalk m=	0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
C3	1118005-5	6/21/2011 10:15	3.00	0.0	2.667	0.064	8.715	0.2180	1.141	n/a	n/a	3790.667	1.727	0.7233	0.4712	1.068	n/a	n/a		

8
6/27/11

Prepare a primary dilution of RSO #777 (Analytics #19573-307) in 0.1M HCl to a final volume of approx. 500mL

1) Prepare 0.1M HCl by diluting 8.3 ml HCl (12M) (Fisher Scientific Lot #055784) to a final volume of 1L.

2) Determine the density of 0.1M HCl

Weight of empty volumetric flask (100mL)	68.54g
Mass of flask + 100ml 0.1M HCl	168.31g
Mass of 100mL of 0.1M HCl	99.77g
÷ 100ml = density =	0.9977

3) Transfer #777 to a 500mL

Mass of bottle	47.9687g
Mass of bottle + std.	52.9150g
Mass of std.	4.9473g

4) Dilute to volume w/ 0.1M HCl

Mass of bottle + std. + soln	494.52g
Mass of bottle (from above)	47.9687g
Mass of soln	446.55g

5) Final activity (dpm/mL)

$$\frac{(3.812 \times 10^4 \text{ dps})(60 \text{ sec/min})(4.9473 \text{ g})}{(5.05960 \text{ g})(446.55 \text{ g})} = 5008.25 \text{ dpm/g}$$

Std ID: 777.3020.11

$$5008.25 \text{ dpm/g} \times 0.9977 \text{ g/mL} = 4999.42 \text{ dpm/mL}$$

Description: Sr-90
 Expiration: 2/27/07
 Activity: 4996.73
 2s Uncertainty: 99.93
 Ref. Date: 12/2/04
 Ref Time: N/A
 Prep Date: 2/8/06
 Matrix/Comp: 0.1 M HCl
 Half Life (y): 2.88E+01

dpm/mL
 dpm/mL
 rep by: HB

ANALYSIS DATE = 06/10/06
 NEW EXP. DATE = 07/06/07
 Read and Understood:

Verification Log	Analysis Date	Initials	Expiration Date
	7/7/10	RG	7/7/11
	4/1/11	RG	4/1/12

Verification Log	Analysis Date	Initials	Expiration Date
	11/8/06	RG	11/8/07
	8/3/07	JLJ	8/3/08
	2/28/08	MBC	2/25/09
	1/30/09	RG	1/30/2010
	7/17/09	RG	7/17/2010

Signed: *Christen Barker*

Date: 2/8/06

Signed: *[Signature]*
 Date: 2/8/06

ANALYTICS

RSO #777
Rec'd 12/9/04
JCS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 • U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

69573-307

Sr-90 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE: Sr-90
ACTIVITY (dps): 3.812 E4
HALF-LIFE: 28.79 years
CALIBRATION DATE: December 2, 2004 12:00 EST
RELATIVE EXPANDED
UNCERTAINTY (k=2): 2.0%

Impurities: γ -impurities <0.1%

5.05960 grams in 0.1M HCl solution with 30 μ g/g Sr carrier.

This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

P O NUMBER 71069, Item 1

SOURCE PREPARED BY:

M. Dimitrova
M. Dimitrova, Radiochemist

Q A APPROVED:

JMM 12-6-04

Prepare an intermediate dilution of TH-230 ISO# 853 of approximately 1200 dpm/ml

- 1) Prepare 0.517 HNO₃, 31 ml H₂O and 969 ml DI water.
lot # 073602
- 2) Determine density of 0.517 HNO₃. Rel. 12

Mass of 100 ml vol. flask:	68.2999 g	
Mass of flask + 100 ml 0.517 HNO ₃ :	169.4539 g	
Net mass of 0.517 HNO ₃ :	101.153 g	✓

 $\rho = 1.0115 \text{ g/ml}$
- 3) Transfer contents of vial to 1000ml Nalgene Rel. 1d

Mass of full standard vial:	81.2827	
Mass of empty standard vial:	75.2327	
Net mass of standard transferred:	6.05 g	✓
- 4) Dilute with 0.5 M HNO₃ Rel. 36

Mass of Nalgene w/ lid (empty):	73.66g	73.70g	
Mass of Nalgene with standard:		78.71g	
Mass of Nalgene, standard and diluent:		1085.0	✓
Net mass of standard:		1011.54g	

5) Final activity calculation

$$\begin{aligned}
 & (1.983 \times 10^4 \text{ Bq}) \cdot (5.1519 \text{ g}) = 3849.60 \text{ Bq/g} \cdot \left(\frac{1605}{2 \text{ MIN}}\right) = 230,975.455 \text{ dpm} \\
 & (3849.60 \text{ Bq/g}) \cdot \left(\frac{5.05 \text{ g}}{1011.54 \text{ g}}\right) \cdot (1.0115 \text{ g/ml}) = 1166.33 \text{ dpm/ml} \\
 & \text{Final Activity} = 1166.33 \text{ dpm/ml}
 \end{aligned}$$

Std ID: 853.3020.89

Description: Th-230
 Expiration: 2/5/2009
 Activity: 1166.38 dpm/mL
 2s Uncertainty: 23.33 dpm/mL
 Ref. Date: 11/6/2007
 Ref Time: NIA
 Prep Date: 12/12/2007 Prep by: DC
 Matrix/Comp: 0.5 M HNO₃
 Half Life (y): 7.70E+04

Reverification Log		
Analysis Date	Initials	Expiration Date
5/5/09	RG	5/5/2010
11/19/10	RG	11/19/2011

Signed: *[Signature]*

Date: 12/12/07

Read and Understood By: *[Signature]*

Date: 7/13/08



Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytiscinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

76253-307

Th-230 5 mL Liquid in Flame Sealed Vial

RSO #
853
Rec 11/26/07

Customer: Paragon Analytics / Fort Collins, CO
P.O. No.: 72905-REL 10-30-07, Item 1

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

Isotope:	Th-230
Activity (Bq):	1.983 E4
Half-Life:	7.838 E4 years
Calibration Date:	November 6, 2007 12:00 EST
Relative Expanded Uncertainty (k=2):	2.0%

Comments:

Impurities: γ -impurities <0.1%, α -impurities <0.01%.
5.15119 grams 0.5M HNO3 solution.

Source Prepared By: *N. E. Kiesman*
N. E. Kiesman, Radiochemist

QA Approved: *D. M. Montgomery*
D. M. Montgomery, QA Manager

Date: 11-19-07

End of Certificate

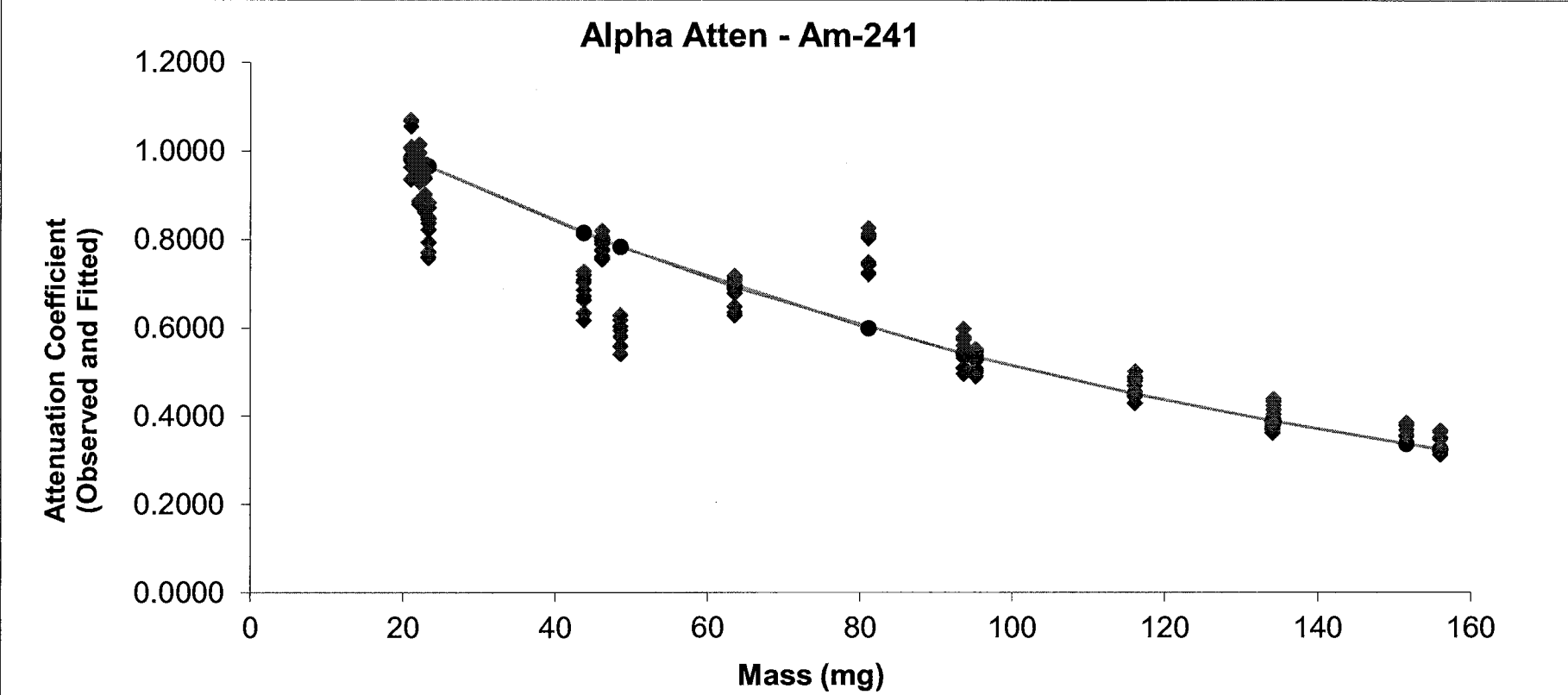
Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

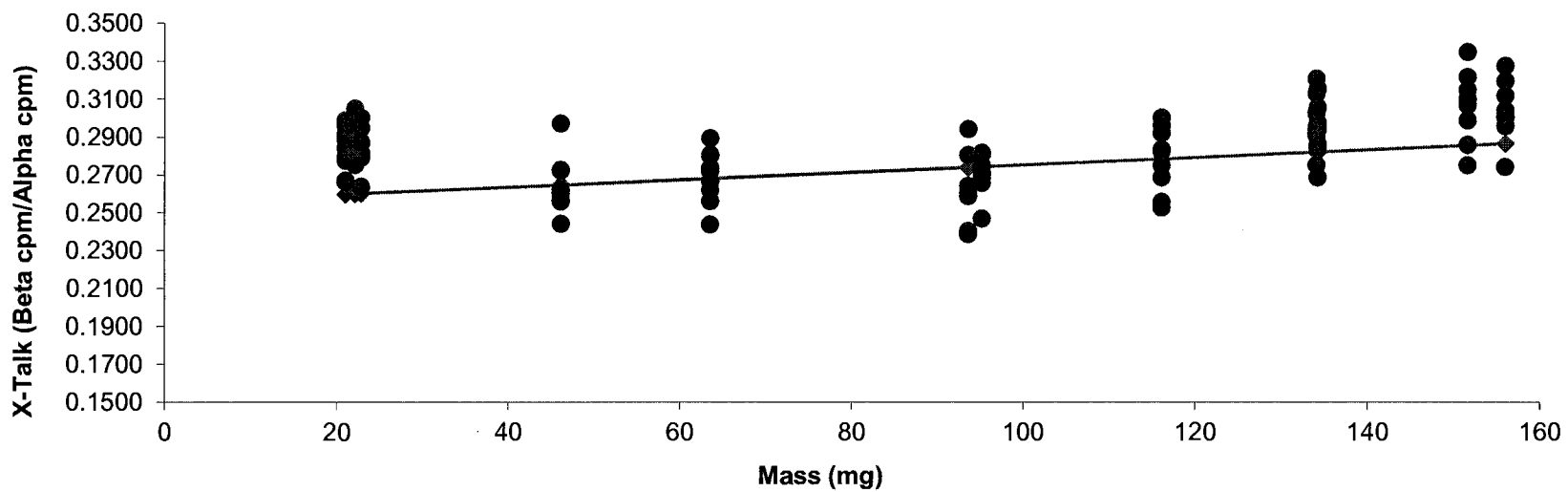
Mass Attenuation Curves

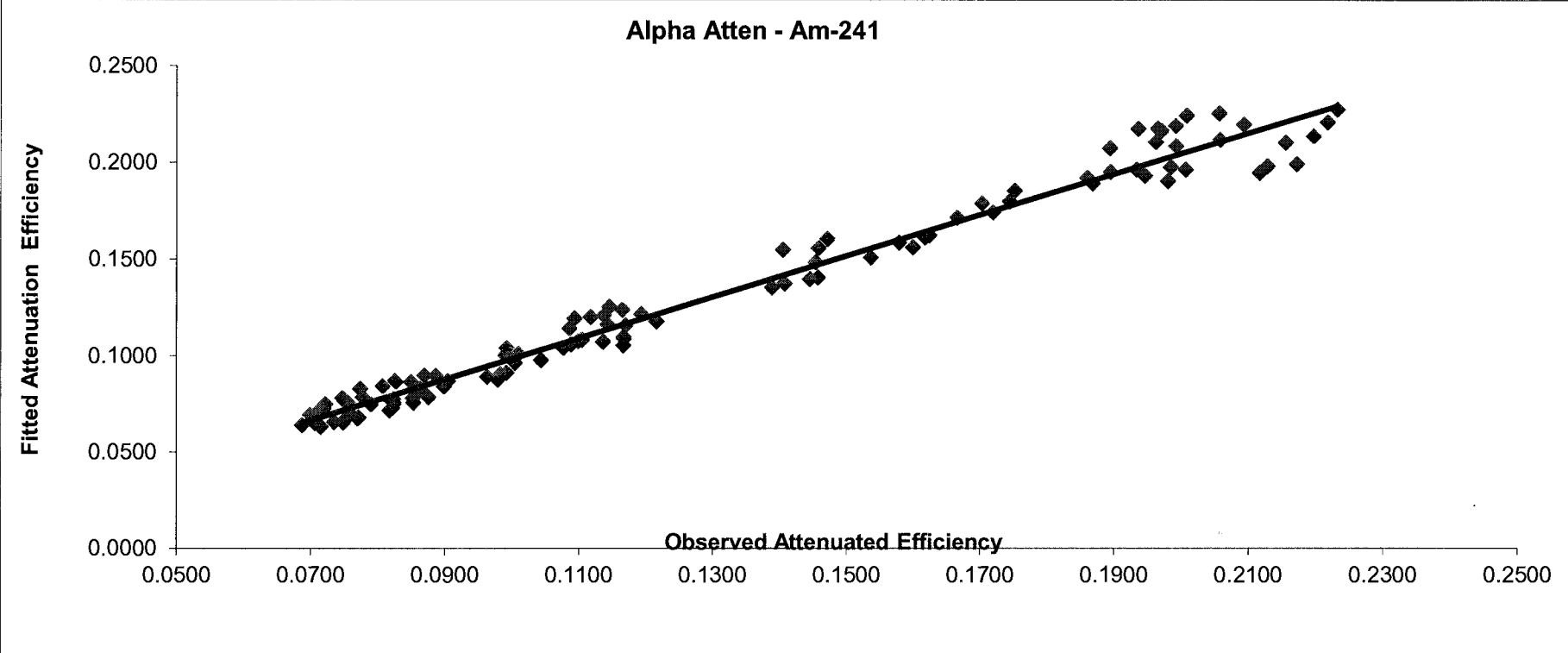
LB4100C Alpha Attenuation Curve -- Am-241

WO # 1223001			Spike Information				Attenuation Equation $y=b*m^a*(x-x_0)$							Cross-Talk Equation $y=b*m^a*x$						
Mass Range Low 21.0 mg High 156.0 mg			Std. ID 955.4095.10	Ref. Date 10/25/2011	Half-life 433 yrs	Activity 55161.33 dpm/mL	$b = 0.9797$ $m = 0.9902$ $a = 0.8336$ $x_0 = 21.5$ % Diff Max. = 12.5%							$b = 0.2560$ $m = 0.9993$ % Diff Max. = 14.8%						
OUTLIERS																				
AAM1206	A1	1223001-1	23.3	12/6/2016 8:13	10009	2831	10.6	944.123283	264.94347	0.1952	5471.12	0.1726	0.1684	1.0919	0.8840	0.9653	-9.2%	0.2806	0.2604	7.2%
AAM1206	A2	1223001-1	23.3	12/6/2016 8:35	10005	2998	10.76	929.676714	276.59554	0.2235	5471.12	0.1699	0.2157	1.2697	0.7603	0.9653	-27.0%	0.2975	0.2604	12.5%
AAM1206	A3	1223001-1	23.3	12/6/2016 9:03	10005	2872	10.38	963.748832	274.399593	0.2142	5471.12	0.1762	0.2068	1.1738	0.8224	0.9653	-17.4%	0.2847	0.2604	8.6%
AAM1206	A4	1223001-1	23.3	12/6/2016 9:31	10010	2990	10.84	923.336734	273.74126	0.2015	5471.12	0.1688	0.1945	1.1525	0.8375	0.9653	-15.3%	0.2965	0.2604	12.2%
AAM1206	B1	1223001-1	23.3	12/6/2016 10:01	10004	3090	9.93	1007.34717	309.26025	0.2176	5471.12	0.1841	0.2100	1.1408	0.8461	0.9653	-14.1%	0.3070	0.2604	15.2%
AAM1206	B3	1223001-1	23.3	12/6/2016 10:32	10013	2875	10.25	976.744049	278.2838	0.2248	5471.12	0.1785	0.2170	1.2155	0.7942	0.9653	-21.6%	0.2849	0.2604	8.6%
AAM1206	B4	1223001-1	23.3	12/6/2016 11:05	10015	2813	10.62	942.874015	263.05259	0.2028	5471.12	0.1723	0.1958	1.1359	0.8498	0.9653	-13.6%	0.2790	0.2604	6.7%
AAM1206	C1	1223001-1	23.3	12/6/2016 11:37	10005	2968	10.58	945.528174	278.5283	0.1982	5471.12	0.1728	0.1913	1.1071	0.8720	0.9653	-10.7%	0.2946	0.2604	11.6%
AAM1206	C3	1223001-1	23.3	12/6/2016 12:08	10006	2960	10.23	977.988617	287.62206	0.2316	5471.12	0.1788	0.2236	1.2507	0.7718	0.9653	-25.1%	0.2941	0.2604	11.5%
AAM1206	A1	1223001-8	43.7	12/6/2016 13:36	10002	2776	12.86	777.638498	213.73114	0.1952	5471.12	0.1421	0.1693	1.1206	0.7282	0.8160	-12.1%	0.2748	0.2643	3.9%
AAM1206	A2	1223001-8	43.7	12/6/2016 14:04	10007	2808	13.25	755.089283	209.89553	0.2235	5471.12	0.1380	0.1824	1.3214	0.6175	0.8160	-32.1%	0.2780	0.2643	4.9%
AAM1206	A3	1223001-8	43.7	12/6/2016 14:29	10003	2635	12.69	788.134471	205.35381	0.2142	5471.12	0.1441	0.1748	1.2133	0.6725	0.8160	-21.3%	0.2606	0.2643	-1.4%
AAM1206	A4	1223001-8	43.7	12/6/2016 14:52	10005	2779	12.81	780.935445	214.85089	0.2015	5471.12	0.1427	0.1644	1.1519	0.7084	0.8160	-15.2%	0.2751	0.2643	3.9%
AAM1206	B1	1223001-8	43.7	12/6/2016 15:10	10000	2932	12.22	818.225606	238.01653	0.2176	5471.12	0.1496	0.1776	1.1872	0.6873	0.8160	-18.7%	0.2909	0.2643	9.2%
AAM1206	B3	1223001-8	43.7	12/6/2016 8:14	10005	2830	12.26	815.934515	228.62797	0.2248	5471.12	0.1491	0.1834	1.2300	0.6634	0.8160	-23.0%	0.2802	0.2643	5.7%
AAM1206	B4	1223001-8	43.7	12/6/2016 8:36	10000	2434	12.5	799.842	192.895	0.2028	5471.12	0.1462	0.1655	1.1319	0.7209	0.8160	-13.2%	0.2412	0.2643	-9.6%
AAM1206	C1	1223001-8	43.7	12/6/2016 9:05	10005	2961	13.11	763.033895	223.85712	0.1982	5471.12	0.1395	0.1617	1.1596	0.7037	0.8160	-16.0%	0.2934	0.2643	9.9%
AAM1206	C3	1223001-8	43.7	12/6/2016 9:33	10006	2999	12.46	802.934759	238.96721	0.2316	5471.12	0.1468	0.1890	1.2877	0.6337	0.8160	-28.8%	0.2976	0.2643	11.2%
AAM1206	A1	1223001-6	48.5	12/6/2016 14:05	10010	2856	15.16	660.168237	186.2585	0.1952	5471.12	0.1207	0.1531	1.2688	0.6182	0.7843	-26.9%	0.2821	0.2652	6.0%
AAM1206	A2	1223001-6	48.5	12/6/2016 14:31	10003	3208	15.12	661.418074	210.14031	0.2235	5471.12	0.1209	0.1753	1.4500	0.5409	0.7843	-45.0%	0.3177	0.2652	16.5%
AAM1206	A3	1223001-6	48.5	12/6/2016 14:54	10012	2938	14.7	680.964435	197.57395	0.2142	5471.12	0.1245	0.1680	1.3498	0.5811	0.7843	-35.0%	0.2901	0.2652	8.6%
AAM1206	A4	1223001-6	48.5	12/6/2016 15:13	10003	3051	15.03	665.440595	200.90501	0.2015	5471.12	0.1216	0.1580	1.2994	0.6036	0.7843	-29.9%	0.3019	0.2652	12.2%
AAM1206	B1	1223001-6	48.5	12/6/2016 8:16	10005	3250	14.13	707.962941	228.08908	0.2176	5471.12	0.1294	0.1707	1.3189	0.5947	0.7843	-31.9%	0.3222	0.2652	17.7%
AAM1206	B3	1223001-6	48.5	12/6/2016 8:38	10002	3015	14.52	688.708975	205.44063	0.2248	5471.12	0.1259	0.1763	1.4007	0.5600	0.7843	-40.1%	0.2983	0.2652	11.1%
AAM1206	B4	1223001-6	48.5	12/6/2016 9:07	10008	2734	14.62	684.383724	185.1791	0.2028	5471.12	0.1251	0.1591	1.2716	0.6168	0.7843	-27.2%	0.2706	0.2652	2.0%
AAM1206	C1	1223001-6	48.5	12/6/2016 9:35	10000	3047	14.64	682.936109	206.12742	0.1982	5471.12	0.1248	0.1555	1.2454	0.6298	0.7843	-24.5%	0.3018	0.2652	12.1%
AAM1206	C3	1223001-6	48.5	12/6/2016 10:05	10004	3089	14.14	707.381464	216.73527	0.2316	5471.12	0.1293	0.1816	1.4049	0.5583	0.7843	-40.5%	0.3064	0.2652	13.4%
AAM1206	A1	1223001-11	81.1	12/6/2016 12:09	10019	2669	11.36	881.832225	232.81518	0.1952	5471.12	0.1612	0.1170	0.7261	0.8257	0.5996	27.4%	0.2640	0.2716	-2.9%
AAM1206	A2	1223001-11	81.1	12/6/2016 12:38	10008	2688	11.33	883.162623	235.21725	0.2235	5471.12	0.1614	0.1340	0.8302	0.7222	0.5996	17.0%	0.2663	0.2716	-2.0%
AAM1206	A3	1223001-11	81.1	12/6/2016 13:07	10015	2681	11.41	877.614826	232.67933	0.2142	5471.12	0.1604	0.1284	0.8007	0.7489	0.5996	19.9%	0.2651	0.2716	-2.4%
AAM1206	A4	1223001-11	81.1	12/6/2016 13:35	10018	2637	11.31	885.66981	231.0675	0.2015	5471.12	0.1619	0.1208	0.7463	0.8034	0.5996	25.4%	0.2609	0.2716	-4.1%
AAM1206	B1	1223001-11	81.1	12/6/2016 14:01	10022	2832	10.36	967.269517	271.44107	0.2176	5471.12	0.1768	0.1305	0.7380	0.8125	0.5996	26.2%	0.2806	0.2716	3.2%
AAM1206	B3	1223001-11	81.1	12/6/2016 14:27	10009	2816	10.95	913.929927	254.96495	0.2248	5471.12	0.1670	0.1348	0.8069	0.7431	0.5996	19.3%	0.2790	0.2716	2.7%
AAM1206	B4	1223001-11	81.1	12/6/2016 14:50	10002	2510	11.15	896.882359	223.28711	0.2028	5471.12	0.1639	0.1216	0.7418	0.8063	0.5996	25.8%	0.2490	0.2716	-9.1%
AAM1206	C1	1223001-11	81.1	12/6/2016 15:09	10007	2870	11.45	873.849799	248.65402	0.1982	5471.12	0.1597	0.1198	0.7440	0.8059	0.5996	25.6%	0.2846	0.2716	-4.6%
AAM1206	C3	1223001-11	81.1	12/6/2016 8:13	10004	2794	10.89	918.525955	254.84266	0.2316	5471.12	0.1679	0.1389	0.8271	0.7249	0.5996	17.3%	0.2774	0.2716	2.1%



Alpha > Beta Cross-Talk - Am-241





LB4100A Beta Attenuation Curve -- Sr-90

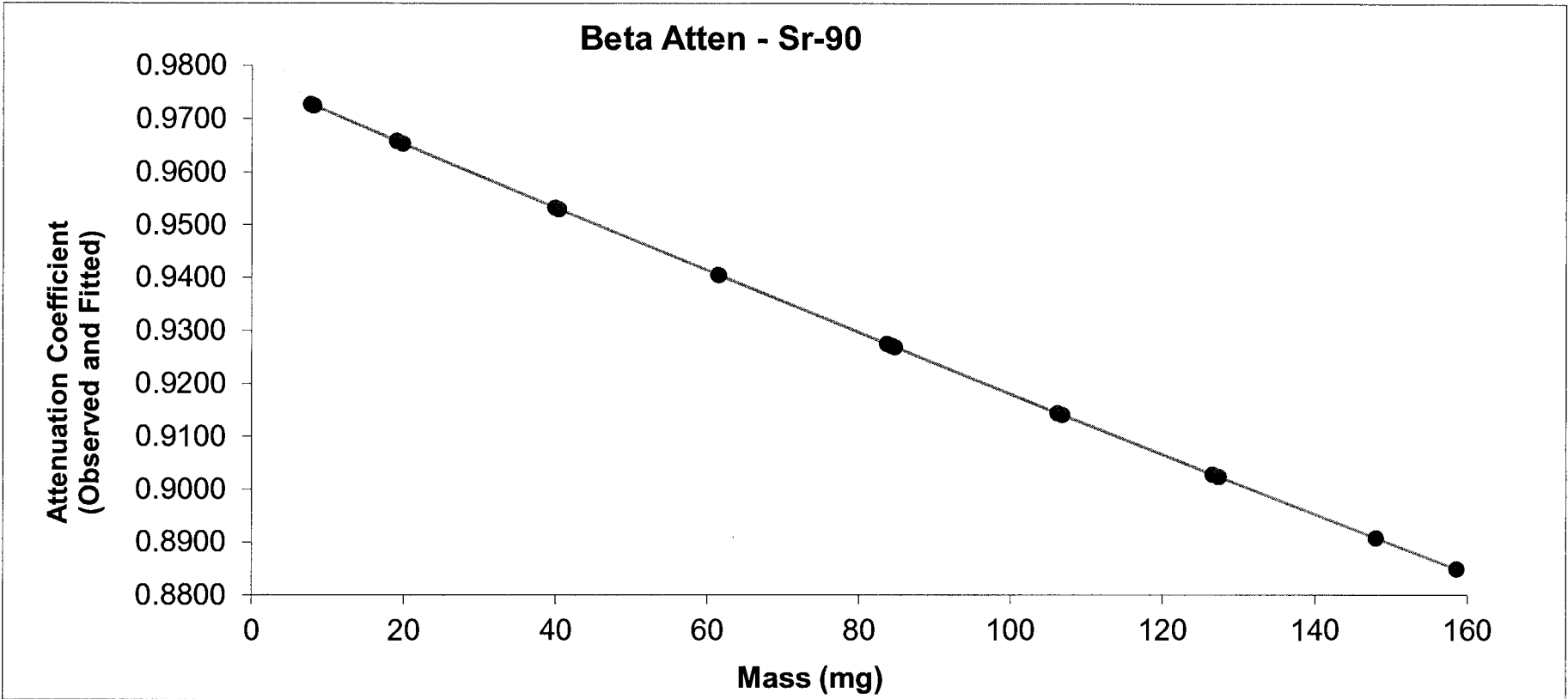
WO #:	1118007
Nuclide:	Sr-90
Std. ID:	777.3020.11
Ref. Date:	02/08/06
Half-life:	28.5 yrs
Activity:	4996.73 dpm/mL
Vol.:	2 mL

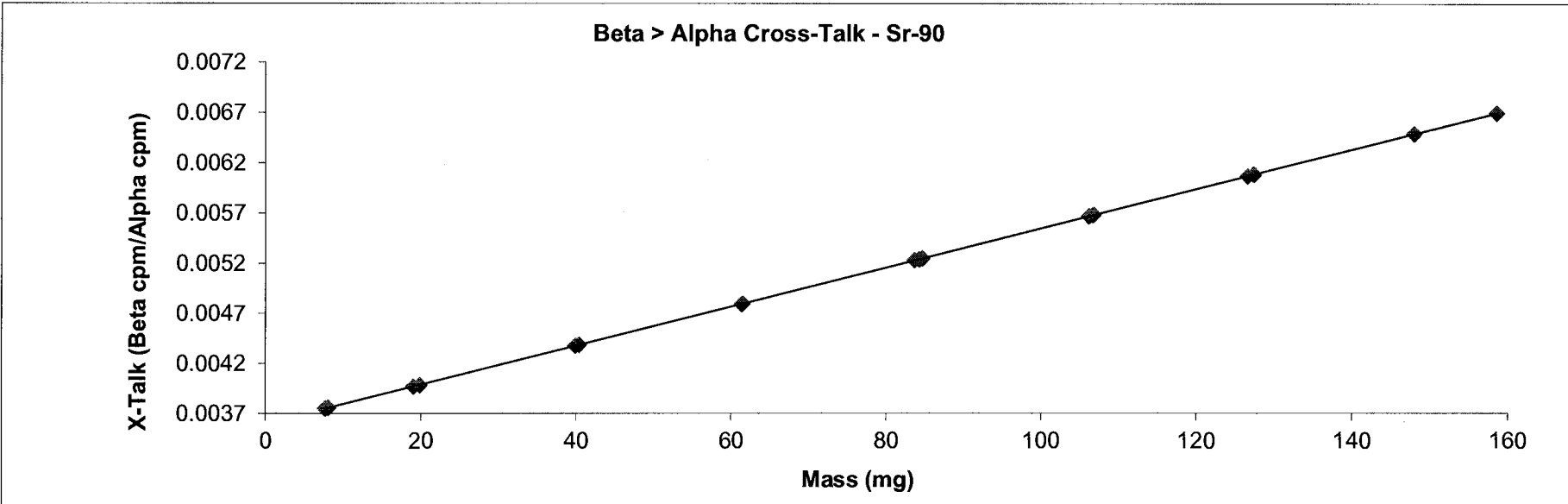
Calibrated Mass Range		
Low	7.7	mg
High	158.6	mg

Attenuation Equation $y=b*m^a(x)$	
b =	0.9775
m =	0.9994
a =	1.0249
% Diff Max. = 6.5%	

Cross-Talk Equation $y=b*x+m$	
b =	1.9480E-05
m =	0.0036
% Diff Max. = 77.8%	

ASR1205	C1	1118007-14	106.8	12/5/2016 13:11	31	10030	3.33	0.4247	9.185309	3010.011	7680.43	0.3919	0.9228	0.9141	0.9%	0.0031	0.0057	-46.3%
ASR1205	C3	1118007-15	106.8	12/5/2016 13:20	17	10032	3.23	0.4339	5.148158	3104.159	7680.43	0.4042	0.9315	0.9141	1.9%	0.0017	0.0057	-70.8%
ASR1205	A1	1118007-1	126.6	12/5/2016 11:42	22	10013	3.29	0.4167	6.56493	3041.333	7680.46	0.3960	0.9503	0.9028	5.3%	0.0022	0.0061	-64.4%
ASR1205	A2	1118007-3	126.6	12/5/2016 11:58	35	10044	3.33	0.4244	10.35451	3014.187	7680.45	0.3924	0.9247	0.9028	2.4%	0.0034	0.0061	-43.4%
ASR1205	A3	1118007-5	126.6	12/5/2016 12:14	18	10045	3.22	0.4357	5.466062	3117.275	7680.45	0.4059	0.9315	0.9028	3.2%	0.0018	0.0061	-71.1%
ASR1205	A4	1118007-7	126.6	12/5/2016 12:26	21	10029	3.28	0.4396	6.307439	3055.533	7680.44	0.3978	0.9050	0.9028	0.2%	0.0021	0.0061	-66.0%
ASR1205	B1	1118007-9	126.6	12/5/2016 12:36	30	10046	3.18	0.4431	9.328962	3157.201	7680.44	0.4111	0.9277	0.9028	2.8%	0.0030	0.0061	-51.3%
ASR1205	B3	1118007-11	126.6	12/5/2016 12:42	34	10020	3.3	0.4262	10.16903	3034.16	7680.44	0.3951	0.9269	0.9028	2.7%	0.0034	0.0061	-44.8%
ASR1205	B4	1118007-13	126.6	12/5/2016 12:50	50	10028	3.37	0.4167	14.6788	2973.843	7680.44	0.3872	0.9292	0.9028	2.9%	0.0049	0.0061	-18.6%
ASR1205	C1	1118007-14	126.6	12/5/2016 13:00	35	10025	3.31	0.4247	10.45002	3026.7	7680.43	0.3941	0.9279	0.9028	2.8%	0.0035	0.0061	-43.1%
ASR1205	C3	1118007-15	126.6	12/5/2016 13:11	42	10032	3.21	0.4339	12.96911	3123.511	7680.43	0.4067	0.9373	0.9028	3.8%	0.0042	0.0061	-31.6%
ASR1205	A1	1118007-1	127.4	12/5/2016 11:34	31	10026	3.29	0.4167	9.300492	3045.284	7680.46	0.3965	0.9515	0.9024	5.4%	0.0031	0.0061	-49.8%
ASR1205	A2	1118007-3	127.4	12/5/2016 11:42	27	10013	3.25	0.4244	8.151692	3078.894	7680.46	0.4009	0.9446	0.9024	4.7%	0.0026	0.0061	-56.5%
ASR1205	A3	1118007-6	127.4	12/5/2016 11:58	17	10008	3.2	0.4357	5.1885	3125.21	7680.45	0.4069	0.9339	0.9024	3.5%	0.0017	0.0061	-72.7%
ASR1205	A4	1118007-7	127.4	12/5/2016 12:14	30	10021	3.29	0.4396	9.023541	3043.808	7680.45	0.3963	0.9015	0.9024	-0.1%	0.0030	0.0061	-51.3%
ASR1205	B1	1118007-9	127.4	12/5/2016 12:26	37	10035	3.17	0.4431	11.56692	3163.697	7680.44	0.4119	0.9296	0.9024	3.0%	0.0037	0.0061	-39.9%
ASR1205	B3	1118007-11	127.4	12/5/2016 12:36	35	10048	3.25	0.4262	10.63523	3089.488	7680.44	0.4023	0.9438	0.9024	4.6%	0.0034	0.0061	-43.4%
ASR1205	B4	1118007-13	127.4	12/5/2016 12:42	57	10021	3.36	0.4167	16.80629	2980.615	7680.44	0.3881	0.9313	0.9024	3.2%	0.0056	0.0061	-7.3%
ASR1205	C1	1118007-14	127.4	12/5/2016 12:50	19	10017	3.28	0.4247	5.668683	3051.962	7680.44	0.3974	0.9356	0.9024	3.7%	0.0019	0.0061	-69.5%
ASR1205	C3	1118007-15	127.4	12/5/2016 13:00	29	10047	3.25	0.4339	8.808077	3089.662	7680.43	0.4023	0.9271	0.9024	2.7%	0.0029	0.0061	-53.1%
ASR1205	A1	1118007-1	148	12/5/2016 11:02	24	10005	3.31	0.4167	7.128755	3020.527	7680.47	0.3933	0.9438	0.8908	5.9%	0.0024	0.0065	-63.6%
ASR1205	A2	1118007-3	148	12/5/2016 11:18	25	10013	3.45	0.4244	7.090377	2900.29	7680.47	0.3776	0.8898	0.8908	-0.1%	0.0024	0.0065	-62.3%
ASR1205	A3	1118007-6	148	12/5/2016 11:34	23	10008	3.35	0.4357	6.741672	2985.173	7680.46	0.3887	0.8921	0.8908	0.1%	0.0023	0.0065	-65.2%
ASR1205	A4	1118007-7	148	12/5/2016 11:42	23	10006	3.33	0.4396	6.811907	3002.716	7680.46	0.3910	0.8893	0.8908	-0.2%	0.0023	0.0065	-65.0%
ASR1205	B1	1118007-9	148	12/5/2016 11:58	38	10028	3.32	0.4431	11.34078	3018.564	7680.45	0.3930	0.8870	0.8908	-0.4%	0.0038	0.0065	-42.0%
ASR1205	B3	1118007-11	148	12/5/2016 12:14	33	10005	3.31	0.4262	9.835789	3020.455	7680.45	0.3933	0.9227	0.8908	3.6%	0.0033	0.0065	-49.8%
ASR1205	B4	1118007-13	148	12/5/2016 12:27	56	10016	3.58	0.4167	15.48446	2795.94	7680.44	0.3640	0.8736	0.8908	-1.9%	0.0055	0.0065	-14.6%
ASR1205	C1	1118007-16	148	12/5/2016 12:37	29	10020	3.45	0.4247	8.281797	2902.347	7680.44	0.3779	0.8898	0.8908	-0.1%	0.0029	0.0065	-56.0%
ASR1205	C3	1118007-15	148	12/5/2016 12:42	23	10024	3.41	0.4339	6.629868	2937.866	7680.44	0.3825	0.8816	0.8908	-1.0%	0.0023	0.0065	-65.2%
ASR1205	A1	1118007-1	158.6	12/5/2016 11:18	32	10017	3.39	0.4167	9.317528	2952.735	7680.47	0.3844	0.9226	0.8849	4.5%	0.0032	0.0067	-52.8%
ASR1205	A2	1118007-3	158.6	12/5/2016 11:34	23	10025	3.39	0.4244	6.628661	2955.198	7680.46	0.3848	0.9066	0.8849	2.5%	0.0022	0.0067	-66.5%
ASR1205	A3	1118007-6	158.6	12/5/2016 11:42	17	10033	3.25	0.4357	5.106769	3084.787	7680.46	0.4016	0.9218	0.8849	4.2%	0.0017	0.0067	-75.3%
ASR1205	A4	1118007-8	158.6	12/5/2016 11:58	26	10022	3.32	0.4396	7.736325	3016.586	7680.45	0.3928	0.8935	0.8849	1.0%	0.0026	0.0067	-61.7%
ASR1205	B1	1118007-9	158.6	12/5/2016 12:14	39	10032	3.21	0.4431	12.04453	3123.316	7680.45	0.4067	0.9178	0.8849	3.7%	0.0039	0.0067	-42.4%
ASR1205	B3	1118007-11	158.6	12/5/2016 12:27	28	10033	3.33	0.4262	8.274408	3010.709	7680.44	0.3920	0.9197	0.8849	3.9%	0.0027	0.0067	-58.9%
ASR1205	B4	1118007-13	158.6	12/5/2016 12:37	61	10003	3.41	0.4167	17.73056	2931.606	7680.44	0.3817	0.9160	0.8849	3.5%	0.0060	0.0067	-9.6%
ASR1205	C1	1118007-16	158.6	12/5/2016 12:42	28	10014	3.32	0.4247	8.309735	3014.264	7680.44	0.3925	0.9241	0.8849	4.4%	0.0028	0.0067	-58.8%
ASR1205	C3	1118007-15	158.6	12/5/2016 12:50	17	10018	3.27	0.4339	5.083777	3061.886	7680.44	0.3987	0.9188	0.8849	3.8%	0.0017	0.0067	-75.2%





~~TP 12/5/16~~ 12/5/16 TP 12/5/16
Am-241 Eff. Calibration (gross 2)
Benchsheet: AB121109-1 source ID 626

Logfile Am241R-11/16

Sources	Detectors	filenames
1223001-20	A1 B1 C1	EAM ¹²⁰⁵ 1224 <u>TP 12/5/16</u>
↓ -22	A2 B3 C3	↓ b
↓ -23	A3 B4	↓ c
↓ -24	A4	

Sr-90 Eff. Calibration (gross F)
Benchsheet: AB160616-3 source ID 627
MA11-22-16

Logfile Sr90R-11/16

Sources	Detectors	filenames
1118005-2	A1 B1 C1	ESR ¹²⁰⁵ 1224 <u>TP 12/5/16</u>
↓ -3	A2 B3 C3	↓ b
↓ -4	A3 B4	↓ c
↓ -5	A4	

Sr90 Mass Attenuation Curve 12/5/16
Benchsheet: AB110619-4 Sources: 1180071-16
Filename: ASR1205

Det	10:17	10:58	11:14	11:30	11:39	11:54	12:10	12:23	12:33	12:39	12:47	12:56	13:07	13:16	13:24	13:34
A1	1	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
A2	2	1	16	15	14	13	12	11	10	9	8	7	6	5	4	3
A3	3	2	1	16	15	14	13	12	11	10	9	8	7	6	5	4
A4	4	3	2	1	16	15	14	13	12	11	10	9	8	7	6	5
B1	5	4	3	2	1	16	15	14	13	12	11	10	9	8	7	6
B3	6	5	4	3	2	1	16	15	14	13	12	11	10	9	8	7
B4	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9	8
C1	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
C3	9	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10

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12/5/16

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12/5/2016

Signed

Date

8:01 JP12/16/16

12/16/16
 Am 241 Mass Ath Curve
 Benchsheet: AB121109-1 Source: 1223001-1-4, 714, 16-19
 Filename: AAM1206
 6, 8, 14 JP12/16/16

Def	8:23	8:52	9:20	9:50	10:21	10:57	11:26	11:57	12:26	12:55	13:23	13:49	14:15	14:39	14:57		
A1	1	19	18	17	16	14	13	12	11	10	9	8	7	4	3	2	
A2	2	1	19	18	17	16	14	13	12	11	10	9	8	7	6	4	3
A3	3	2	1	19	18	17	16	14	13	12	11	10	9	8	7	6	4
A4	4	3	2	1	19	18	17	16	14	13	12	11	10	9	8	7	6
B1	7	6	4	3	2	1	19	18	17	16	14	13	12	11	10	9	8
B3	8	7	6	4	3	2	1	19	18	17	16	14	13	12	11	10	9
B4	9	8	7	6	4	3	2	1	19	18	17	16	14	13	12	11	10
C1	10	9	8	7	6	4	3	2	1	19	18	17	16	14	13	12	11
E2	11	10	9	8	7	6	4	3	2	1	19	18	17	16	14	13	12

} JP12/16/16

C5 JP12/16/16

12/7/16

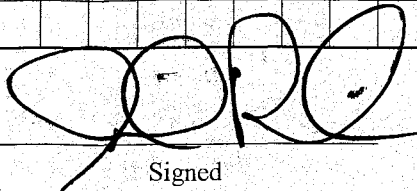
Gross Alpha (Th-230) EFF Calibration
 Benchsheet: AB150603-5 Source ID: 628
 Log file: Th-230-12/16

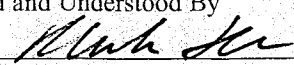
Sources	Detectors	File names
1518003-1	A1 B1 C1	ETH1207A
-2	A2 B3 C3	B
-3	A3 B4	C
-4	A4	

Gross Beta (Cs-137) EFF Calibration
 Benchsheet: AB150310-2 Source ID: 629
 Log file: Cs137-12/16

Sources	Detectors	File names
1515003-1	A1 B1 C1	ECS1207A
-3	A2 B3 C3	B
-4	A3 B4	C
-5	A4	

Continued on Page

 12/8/16
 Signed Date

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12-12-16 of 328
 Date

Date 12/5/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									α
7									P
8									
9									
10									α
11									P
12									α
13	OL				α				
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK42066			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply	P-10 Flow	
Tank 1	1000	Dr A	10
		Dr B	
Tank 2	2056	Dr C	
		Dr D	

Comments:

Date 12/5/16

SOP 724r 1.1

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100A

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-12	Daily EF			30	6:38	JP	EFAI205	JP
1-12	Daily BKs			60	6:52	JP	BKA1205	JP
1-4	626	AB121109-1	α EF	30	8:04	JP	FAM1205A	JP
5,7,8					8:19	JP		
9,11					8:31	JP		B
9,11	627	AB110616-3	B-EF	30	8:05	JP	ESR1205C	
1-4					8:20	JP		A
5,7,8					8:32	JP		B
1	1610549-1	RA161201-1	R226	90	9:02	JP	RAA1205	JP
2	552-1							
3	554-1							
4	556-1							
5	557-1							
7	584-1							
9	-2							
11	-3							
14,5,7	1118007-1-76	AB110619-4	BATTN	30	10:47	JP	ASR1205	
8,9,11								

Comments:

Page No.: 468565 B
 (cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date JP 12/6/16

Date 12/6/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									α
7									P
8									
9									
10									α
11									P
12									α
13	OL				OL				
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BKA1201W			
Dr B				
Dr C				
Dr D	OL			

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow	
Tank 1	660	Dr A	10	
		Dr B		
Tank 2	2050	Dr C		
		Dr D		

Comments:

Date 12/6/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-12	Daily Eff	—	—	30	4:08	JP	EEA1206	JP
1-12	Daily Bkg	—	—	60	4:33	JP	BKA1206	JP
1-4,5,7	1223001-1-9,6	4B121109-1	Am241	30	7:42	JP	AAM1206	JP
8,9,11	1223001-8-14,16-19	1	Attn	1	8:00	↓	↓	↓
JP 12/6/16								

Comments:

Page No.: 468566 **B**
(cont. from page MP B)

Form 780r8.doc (6/23/06)

Reviewed By / Date JP 12/7/16

Date 12/2/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									OL
7									P
8									
9									
10									OL
11									P
12									OL
13	OL				OL				
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BKAR201W			
Dr B				
Dr C				
Dr D	OL			

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow
Tank 1	0	Dr A	10
		Dr B	
Tank 2	2050	Dr C	
		Dr D	

Comments:

Detector ID	Sample ID	Alpha	Beta	Guard	Count Time	Event	Voltage	TOD	ALPHA CPM	BETA CPM
A1	21	10024	2753	6624	8.44	0	1402.5	12/6/16 14:48	1187.556	324.0528
A1	22.1	10011	2826	7001	9.24	0	1402.5	12/6/16 15:07	1083.32	303.7122
A1	22.8	10007	2815	7945	9.79	0	1402.5	12/6/16 14:26	1022.043	285.4063
A1	23.3	10009	2831	7560	10.6	0	1402.5	12/6/16 8:13	944.1233	264.9435
A1	43.7	10002	2776	10231	12.86	0	1402.5	12/6/16 13:36	777.6385	213.7311
A1	46.1	10005	2749	8497	11.43	0	1402.5	12/6/16 13:07	875.2061	238.3754
A1	48.5	10010	2856	12045	15.16	0	1402.5	12/6/16 14:05	660.1682	186.2585
A1	63.5	10004	2748	9569	13.17	0	1402.5	12/6/16 12:40	759.4832	206.524
A1	81.1	10019	2669	8376	11.36	0	1402.5	12/6/16 12:09	881.8322	232.8152
A1	93.6	10006	2425	11151	15.68	0	1402.5	12/6/16 11:43	638.0158	152.5236
A1	95.2	10010	2742	12640	16.99	0	1402.5	12/6/16 11:12	589.0481	159.2571
A1	116.1	10004	2878	14162	18.68	0	1402.5	12/6/16 10:40	535.424	151.9365
A1	134.1	10005	3080	17809	24.22	0	1402.5	12/6/16 10:15	412.9664	125.0356
A1	134.2	10004	3024	15593	21.43	0	1402.5	12/6/16 9:42	466.7002	138.9786
A1	151.6	10003	3050	16553	22.75	0	1402.5	12/6/16 9:15	439.5703	131.9339
A1	156	10002	3016	19554	25.57	0	1402.5	12/6/16 8:49	391.0395	115.8187
A2	116.1	10002	2863	13696	18.46	0	1402.5	12/6/16 11:13	541.6642	153.0631
A2	21	10009	2908	6627	8.74	0	1402.5	12/6/16 15:06	1145.039	330.6941
A2	22.1	10012	2957	6625	9.31	0	1402.5	12/6/16 8:11	1075.247	315.5865
A2	22.8	10002	2957	7633	9.73	0	1402.5	12/6/16 14:49	1027.799	301.8764
A2	23.3	10005	2998	7992	10.76	0	1402.5	12/6/16 8:35	929.6767	276.5955
A2	43.7	10007	2808	10438	13.25	0	1402.5	12/6/16 14:04	755.0893	209.8955
A2	46.1	10010	2731	9031	11.35	0	1402.5	12/6/16 13:35	881.7823	238.5877
A2	48.5	10003	3208	12250	15.12	0	1402.5	12/6/16 14:31	661.4181	210.1403
A2	63.5	10010	2696	9691	13.02	0	1402.5	12/6/16 13:09	768.6612	205.0371
A2	81.1	10008	2688	8173	11.33	0	1402.5	12/6/16 12:38	883.1626	235.2172
A2	93.6	10007	2622	11705	16.08	0	1402.5	12/6/16 12:14	622.1699	161.0307
A2	95.2	10004	2735	11887	16.72	0	1402.5	12/6/16 11:44	598.1694	161.5476
A2	134.1	10002	3274	18047	24.25	0	1402.5	12/6/16 10:45	412.2976	132.9813
A2	134.2	10001	2987	15800	21.52	0	1402.5	12/6/16 10:12	464.5745	136.7721
A2	151.6	10001	3038	16881	23.16	0	1402.5	12/6/16 9:44	431.6661	129.1454
A2	156	9999	3174	18525	25.55	0	1402.5	12/6/16 9:18	391.1943	122.198
A3	21	10012	2694	6081	8.49	0	1402.5	12/6/16 8:11	1179.146	315.0245
A3	22.1	10006	2797	6836	9.18	0	1402.5	12/6/16 8:33	1089.854	302.3941
A3	22.8	10012	2835	7337	9.66	0	1402.5	12/6/16 15:07	1036.315	291.1883
A3	23.3	10005	2872	7518	10.38	0	1402.5	12/6/16 9:03	963.7488	274.3959
A3	43.7	10003	2635	10284	12.69	0	1402.5	12/6/16 14:29	788.1345	205.3538
A3	46.1	10002	2507	8757	11.14	0	1402.5	12/6/16 14:01	897.7216	222.7549
A3	48.5	10012	2938	11150	14.7	0	1402.5	12/6/16 14:54	680.9644	197.5739
A3	63.5	10007	2592	10032	12.58	0	1402.5	12/6/16 13:36	795.345	203.7513
A3	81.1	10015	2681	8483	11.41	0	1402.5	12/6/16 13:07	877.6148	232.6793
A3	93.6	10000	2423	11369	15.62	0	1402.5	12/6/16 12:43	640.0809	152.8316
A3	95.2	10002	2698	12190	16.83	0	1402.5	12/6/16 12:15	594.1719	158.019
A3	116.1	10002	2570	12866	18.2	0	1402.5	12/6/16 11:45	549.4364	138.9188
A3	134.1	10004	2988	17295	23.63	0	1402.5	12/6/16 11:18	423.2361	124.1594
A3	134.2	10002	2894	15932	21.18	0	1402.5	12/6/16 10:42	472.114	134.3483
A3	151.6	10005	2805	16427	22.37	0	1402.5	12/6/16 10:13	447.1268	123.1011
A3	156	10000	3105	19053	26.12	0	1402.5	12/6/16 9:47	382.7244	116.5844
A4	21	10013	2817	6408	8.6	0	1402.5	12/6/16 8:32	1164.207	325.4691
A4	22.1	10014	2914	6437	9.12	0	1402.5	12/6/16 9:02	1097.931	317.4285
A4	22.8	10015	2842	6881	9.66	0	1402.5	12/6/16 8:12	1036.654	292.1139
A4	23.3	10010	2990	7954	10.84	0	1402.5	12/6/16 9:31	923.3367	273.7413
A4	43.7	10005	2779	9809	12.81	0	1402.5	12/6/16 14:52	780.9354	214.8509
A4	46.1	10001	2627	9112	11.3	0	1402.5	12/6/16 14:27	884.9492	230.3889
A4	48.5	10003	3051	11296	15.03	0	1402.5	12/6/16 15:13	665.4406	200.905
A4	63.5	10011	2650	9944	12.66	0	1402.5	12/6/16 14:03	790.6633	207.2317
A4	81.1	10018	2637	8995	11.31	0	1402.5	12/6/16 13:35	885.6698	231.0675
A4	93.6	10008	2436	11677	15.67	0	1402.5	12/6/16 13:12	638.5776	153.3673
A4	95.2	10007	2752	12118	16.64	0	1402.5	12/6/16 12:44	601.2872	163.2956
A4	116.1	10002	2790	13514	18.6	0	1402.5	12/6/16 12:16	537.6469	147.911
A4	134.1	10005	3184	17443	24.47	0	1402.5	12/6/16 11:51	408.773	128.0295
A4	134.2	10003	2909	15768	21.46	0	1402.5	12/6/16 11:16	466.028	133.4655
A4	151.6	10003	3011	16983	22.67	0	1402.5	12/6/16 10:44	441.1489	130.7297

A4	156	10002	3069	18983	25.87	0	1402.5	12/6/16 10:17	386.5304	116.5426
B1	21	10012	3010	6050	8.33	0	1500	12/6/16 9:01	1201.816	359.4265
B1	22.1	9999	3069	6408	8.88	0	1500	12/6/16 9:30	1125.909	343.6901
B1	22.8	10017	2973	6790	9.33	0	1500	12/6/16 8:33	1073.528	316.7315
B1	23.3	10004	3090	7220	9.93	0	1500	12/6/16 10:01	1007.347	309.2602
B1	43.7	10000	2932	8731	12.22	0	1500	12/6/16 15:10	818.2256	238.0165
B1	46.1	10002	2748	7746	10.63	0	1500	12/6/16 14:50	940.8169	256.5956
B1	48.5	10005	3250	10247	14.13	0	1500	12/6/16 8:16	707.9629	228.0891
B1	63.5	10011	2835	8622	11.91	0	1500	12/6/16 14:28	840.4492	236.1173
B1	81.1	10022	2832	7554	10.36	0	1500	12/6/16 14:01	967.2695	271.4411
B1	93.6	10000	2672	10885	15.03	0	1500	12/6/16 13:39	665.231	175.8598
B1	95.2	10007	2850	11626	16	0	1500	12/6/16 13:12	625.3325	176.207
B1	116.1	10005	2957	12504	17.52	0	1500	12/6/16 12:44	570.9566	166.8605
B1	134.1	9999	3076	16443	22.64	0	1500	12/6/16 12:20	441.5469	133.9477
B1	134.2	10003	2896	14429	20.34	0	1500	12/6/16 11:47	491.6846	140.4615
B1	151.6	10000	3126	15671	21.77	0	1500	12/6/16 11:16	459.2427	141.6741
B1	156	9999	3052	17239	24.1	0	1500	12/6/16 10:45	414.7913	124.721
B3	21	10010	2863	5932	8.25	0	1500	12/6/16 9:29	1213.199	344.8263
B3	22.1	10015	3057	6676	9.19	0	1500	12/6/16 10:00	1089.637	330.4402
B3	22.8	10012	2898	6878	9.45	0	1500	12/6/16 9:02	1059.337	304.4627
B3	23.3	10013	2875	7485	10.25	0	1500	12/6/16 10:32	976.744	278.2838
B3	43.7	10005	2830	8894	12.26	0	1500	12/6/16 8:14	815.9345	228.628
B3	46.1	10005	2758	7943	11.16	0	1500	12/6/16 15:09	896.3714	244.9286
B3	48.5	10002	3015	10456	14.52	0	1500	12/6/16 8:38	688.709	205.4406
B3	63.5	10005	2766	9168	12.54	0	1500	12/6/16 14:52	797.7129	218.3702
B3	81.1	10009	2816	7937	10.95	0	1500	12/6/16 14:27	913.9299	254.9649
B3	93.6	10005	2640	11128	15.32	0	1500	12/6/16 14:05	652.9339	170.1198
B3	95.2	10000	2718	11884	16.35	0	1500	12/6/16 13:40	611.4868	164.0345
B3	116.1	10009	2731	13140	18.11	0	1500	12/6/16 13:14	552.5441	148.5967
B3	134.1	10002	3141	16568	23.16	0	1500	12/6/16 12:50	431.7313	133.4178
B3	134.2	10009	2911	14625	20.22	0	1500	12/6/16 12:18	494.8709	141.7624
B3	151.6	10004	3043	15793	22.19	0	1500	12/6/16 11:49	450.6997	134.9298
B3	156	10002	3085	18281	25.38	0	1500	12/6/16 11:20	393.9558	119.3484
B4	21	10018	2686	6083	8.43	0	1500	12/6/16 9:59	1188.217	316.799
B4	22.1	10021	2777	6739	9.23	0	1500	12/6/16 10:30	1085.541	299.0417
B4	22.8	10007	2657	6838	9.46	0	1500	12/6/16 9:30	1057.664	279.0418
B4	23.3	10015	2813	7652	10.62	0	1500	12/6/16 11:05	942.874	263.0526
B4	43.7	10000	2434	8996	12.5	0	1500	12/6/16 8:36	799.842	192.895
B4	46.1	10008	2643	8207	11.26	0	1500	12/6/16 8:13	888.6519	232.8997
B4	48.5	10008	2734	10559	14.62	0	1500	12/6/16 9:07	684.3837	185.1791
B4	63.5	10008	2463	8978	12.55	0	1500	12/6/16 15:10	797.2922	194.43
B4	81.1	10002	2510	8134	11.15	0	1500	12/6/16 14:50	896.8824	223.2871
B4	93.6	10005	2433	11315	15.67	0	1500	12/6/16 14:32	638.3232	153.4398
B4	95.2	10002	2499	11992	16.55	0	1500	12/6/16 14:07	604.1925	149.172
B4	116.1	10002	2591	13392	18.43	0	1500	12/6/16 13:42	542.5441	138.761
B4	134.1	9999	2796	17172	23.49	0	1500	12/6/16 13:19	425.5125	117.2044
B4	134.2	10003	2728	14927	20.88	0	1500	12/6/16 12:48	478.9129	128.8263
B4	151.6	10003	2775	16418	22.62	0	1500	12/6/16 12:20	442.0613	120.854
B4	156	9999	2791	17737	24.85	0	1500	12/6/16 11:52	402.2162	110.4889
C1	21	10007	2981	6323	8.64	0	1530	12/6/16 10:30	1158.094	343.0221
C1	22.1	9999	3018	6989	9.39	0	1530	12/6/16 11:04	1064.732	319.4048
C1	22.8	10004	3024	7202	9.83	0	1530	12/6/16 10:00	1017.577	305.6287
C1	23.3	10005	2968	7731	10.58	0	1530	12/6/16 11:37	945.5282	278.5283
C1	43.7	10005	2961	9706	13.11	0	1530	12/6/16 9:05	763.0339	223.8571
C1	46.1	10002	2998	8338	11.58	0	1530	12/6/16 8:35	863.6066	256.8936
C1	48.5	10000	3047	10478	14.64	0	1530	12/6/16 9:35	682.9361	206.1274
C1	63.5	10004	2829	9533	12.99	0	1530	12/6/16 8:15	770.0069	215.7819
C1	81.1	10007	2870	8391	11.45	0	1530	12/6/16 15:09	873.8498	248.654
C1	93.6	10008	2841	11889	16.1	0	1530	12/6/16 14:55	621.4909	174.4586
C1	95.2	10003	2847	12420	16.8	0	1530	12/6/16 14:33	595.2927	167.4633
C1	116.1	10005	3045	13954	18.99	0	1530	12/6/16 14:09	526.7322	158.3466
C1	134.1	10002	3261	18226	24.36	0	1530	12/6/16 13:47	410.4671	131.866
C1	134.2	10000	3202	16676	22.29	0	1530	12/6/16 13:18	448.5077	141.6509
C1	151.6	10003	3243	17025	23.26	0	1530	12/6/16 12:50	429.9276	137.4229
C1	156	10000	3333	19492	26.58	0	1530	12/6/16 12:24	376.0987	123.394

C3	21	10004	2930	6091	8.19	0	1530	12/6/16 11:03	1221.375	356.0304
C3	22.1	10004	2993	6476	8.89	0	1530	12/6/16 11:36	1125.194	334.9474
C3	22.8	10019	2970	6861	9.37	0	1530	12/6/16 10:30	1069.149	315.2461
C3	23.3	10006	2960	7377	10.23	0	1530	12/6/16 12:08	977.9886	287.6221
C3	43.7	10006	2999	8992	12.46	0	1530	12/6/16 9:33	802.9348	238.9672
C3	46.1	10003	2858	8482	11.35	0	1530	12/6/16 9:04	881.2066	250.0832
C3	48.5	10004	3089	10298	14.14	0	1530	12/6/16 10:05	707.3815	216.7353
C3	63.5	9999	2915	8949	12.42	0	1530	12/6/16 8:36	804.9575	232.9791
C3	81.1	10004	2794	8005	10.89	0	1530	12/6/16 8:13	918.526	254.8427
C3	93.6	10010	2974	11693	15.97	0	1530	12/6/16 15:14	626.6853	184.5012
C3	95.2	10003	2914	12188	16.47	0	1530	12/6/16 14:56	607.2317	175.2047
C3	116.1	10003	2996	13638	18.43	0	1530	12/6/16 14:34	542.6414	160.838
C3	134.1	10003	3294	17196	23.5	0	1530	12/6/16 14:13	425.5446	138.4472
C3	134.2	10002	3096	15417	20.62	0	1530	12/6/16 13:44	484.948	148.4225
C3	151.6	10000	3110	16616	22.2	0	1530	12/6/16 13:18	450.3355	138.3671
C3	156	10000	3242	18563	25.31	0	1530	12/6/16 12:52	394.9858	126.3687

Detector ID	Sample ID	Alpha	Beta	Guard	Count Time	Event	Voltage	TOD	ALPHA CPM	BETA CPM
A1	7.7	31	10029	2170	3.1	0	1402.5	12/5/16 13:37	9.878	3233.029
A1	8.1	26	10047	2267	3.05	0	1402.5	12/5/16 10:51	8.40259	3291.966
A1	19	27	10047	2307	3.05	0	1402.5	12/5/16 13:20	8.730459	3291.966
A1	19.8	22	10024	2315	3.16	0	1402.5	12/5/16 13:27	6.840025	3170.02
A1	39.9	22	10009	2309	3.26	0	1402.5	12/5/16 13:11	6.626466	3068.113
A1	40.4	23	10031	2276	3.23	0	1402.5	12/5/16 13:00	6.998743	3103.441
A1	61.4	27	10036	2441	3.19	0	1402.5	12/5/16 12:50	8.34195	3143.95
A1	61.5	23	10042	2577	3.25	0	1402.5	12/5/16 12:42	6.954923	3087.714
A1	83.7	22	10008	2536	3.22	0	1402.5	12/5/16 12:36	6.710298	3105.943
A1	84.3	21	10004	2229	3.22	0	1402.5	12/5/16 12:26	6.399739	3104.7
A1	106.2	28	10061	2461	3.27	0	1402.5	12/5/16 12:14	8.440691	3074.626
A1	106.8	26	10015	2639	3.39	0	1402.5	12/5/16 11:58	7.547617	2952.145
A1	126.6	22	10013	2319	3.29	0	1402.5	12/5/16 11:42	6.56493	3041.333
A1	127.4	31	10026	2650	3.29	0	1402.5	12/5/16 11:34	9.300492	3045.284
A1	148	24	10005	2411	3.31	0	1402.5	12/5/16 11:02	7.128755	3020.527
A1	158.6	32	10017	2472	3.39	0	1402.5	12/5/16 11:18	9.317528	2952.735
A2	7.7	32	10040	2337	3.15	0	1402.5	12/5/16 10:51	10.00273	3185.273
A2	8.1	26	10055	2264	3.11	0	1402.5	12/5/16 11:02	8.204129	3231.09
A2	19	35	10019	2255	3.07	0	1402.5	12/5/16 13:27	11.24465	3261.489
A2	19.8	43	10033	2231	3.2	0	1402.5	12/5/16 13:38	13.2815	3133.284
A2	39.9	28	10004	2485	3.3	0	1402.5	12/5/16 13:20	8.328848	3029.486
A2	40.4	24	10026	2378	3.37	0	1402.5	12/5/16 13:11	6.965662	2973.045
A2	61.4	32	10029	2292	3.25	0	1402.5	12/5/16 13:00	9.690154	3083.817
A2	61.5	34	10045	2500	3.26	0	1402.5	12/5/16 12:50	10.27345	3079.259
A2	83.7	35	10028	2523	3.19	0	1402.5	12/5/16 12:42	10.81579	3141.545
A2	84.3	30	10031	2575	3.27	0	1402.5	12/5/16 12:36	9.018312	3065.555
A2	106.2	31	10007	2265	3.26	0	1402.5	12/5/16 12:26	9.353202	3067.603
A2	106.8	27	10011	2497	3.32	0	1402.5	12/5/16 12:14	7.97653	3013.332
A2	126.6	35	10044	2598	3.33	0	1402.5	12/5/16 11:58	10.35451	3014.187
A2	127.4	27	10013	2294	3.25	0	1402.5	12/5/16 11:42	8.151692	3078.894
A2	148	25	10013	2513	3.45	0	1402.5	12/5/16 11:18	7.090377	2900.29
A2	158.6	23	10025	2723	3.39	0	1402.5	12/5/16 11:34	6.628661	2955.198
A3	7.7	30	10018	2230	3.07	0	1402.5	12/5/16 11:02	9.647987	3260.902
A3	8.1	26	10034	2220	3.04	0	1402.5	12/5/16 11:18	8.428632	3298.368
A3	19	24	10031	2091	2.98	0	1402.5	12/5/16 13:37	7.929691	3363.817
A3	19.8	20	10025	2345	3.16	0	1402.5	12/5/16 10:51	6.205114	3170.178
A3	39.9	26	10002	2362	3.21	0	1402.5	12/5/16 13:27	7.975688	3113.598
A3	40.4	26	10005	2430	3.22	0	1402.5	12/5/16 13:20	7.950534	3104.853
A3	61.4	30	10045	2264	3.19	0	1402.5	12/5/16 13:11	9.280389	3146.613
A3	61.5	21	10031	2327	3.29	0	1402.5	12/5/16 13:00	6.258979	3046.646
A3	83.7	25	10043	2402	3.13	0	1402.5	12/5/16 12:50	7.86322	3206.336
A3	84.3	38	10012	2555	3.22	0	1402.5	12/5/16 12:42	11.67724	3107.027
A3	106.2	13	10033	2545	3.23	0	1402.5	12/5/16 12:36	3.900768	3103.902
A3	106.8	21	10031	2253	3.24	0	1402.5	12/5/16 12:26	6.357481	3093.698
A3	126.6	18	10045	2434	3.22	0	1402.5	12/5/16 12:14	5.466062	3117.275
A3	127.4	17	10008	2516	3.2	0	1402.5	12/5/16 11:58	5.1885	3125.21
A3	148	23	10008	2685	3.35	0	1402.5	12/5/16 11:34	6.741672	2985.173
A3	158.6	17	10033	2294	3.25	0	1402.5	12/5/16 11:42	5.106769	3084.787
A4	7.7	39	10026	2284	3.13	0	1402.5	12/5/16 11:18	12.36506	3201.106
A4	8.1	28	10033	2467	3.08	0	1402.5	12/5/16 11:34	8.995909	3255.379
A4	19	25	10024	2269	3.04	0	1402.5	12/5/16 10:51	8.128684	3295.279
A4	19.8	36	10010	2327	3.19	0	1402.5	12/5/16 11:02	11.19027	3135.842
A4	39.9	31	10018	2328	3.32	0	1402.5	12/5/16 13:38	9.242349	3015.381
A4	40.4	29	10026	2446	3.33	0	1402.5	12/5/16 13:27	8.613709	3008.722
A4	61.4	29	10018	2395	3.18	0	1402.5	12/5/16 13:20	9.024497	3148.225
A4	61.5	25	10029	2351	3.32	0	1402.5	12/5/16 13:11	7.43512	3018.694
A4	83.7	29	10007	2271	3.22	0	1402.5	12/5/16 13:00	8.911211	3105.675
A4	84.3	25	10028	2491	3.25	0	1402.5	12/5/16 12:50	7.597308	3083.449
A4	106.2	17	10023	2605	3.28	0	1402.5	12/5/16 12:42	5.087927	3053.704
A4	106.8	25	10015	2627	3.35	0	1402.5	12/5/16 12:37	7.367687	2987.463
A4	126.6	21	10029	2283	3.28	0	1402.5	12/5/16 12:26	6.307439	3055.533
A4	127.4	30	10021	2477	3.29	0	1402.5	12/5/16 12:14	9.023541	3043.808
A4	148	23	10006	2359	3.33	0	1402.5	12/5/16 11:42	6.811907	3002.716

A4	158.6	26	10022	2594	3.32	0	1402.5	12/5/16 11:58	7.736325	3016.586
B1	7.7	25	10041	2132	2.92	0	1500	12/5/16 11:33	8.456644	3436.781
B1	8.1	44	10049	2108	2.97	0	1500	12/5/16 11:41	14.70981	3381.584
B1	19	41	10010	2158	2.98	0	1500	12/5/16 11:01	13.65339	3357.142
B1	19.8	49	10034	2150	3.02	0	1500	12/5/16 11:18	16.12017	3320.599
B1	39.9	35	10024	2304	3.13	0	1500	12/5/16 10:51	11.07711	3200.638
B1	40.4	38	10021	2255	3.09	0	1500	12/5/16 13:37	12.19273	3241.124
B1	61.4	52	10031	2243	3.09	0	1500	12/5/16 13:27	16.72348	3244.36
B1	61.5	34	10026	2248	3.16	0	1500	12/5/16 13:20	10.65449	3170.867
B1	83.7	42	10045	2266	3.1	0	1500	12/5/16 13:11	13.44339	3238.405
B1	84.3	42	10038	2247	3.13	0	1500	12/5/16 12:59	13.31353	3205.111
B1	106.2	27	10048	2276	3.13	0	1500	12/5/16 12:50	8.521198	3208.306
B1	106.8	39	10041	2349	3.18	0	1500	12/5/16 12:42	12.15915	3155.629
B1	126.6	30	10046	2240	3.18	0	1500	12/5/16 12:36	9.328962	3157.201
B1	127.4	37	10035	2320	3.17	0	1500	12/5/16 12:26	11.56692	3163.697
B1	148	38	10028	2330	3.32	0	1500	12/5/16 11:58	11.34078	3018.564
B1	158.6	39	10032	2376	3.21	0	1500	12/5/16 12:14	12.04453	3123.316
B3	7.7	36	10022	2143	3.02	0	1500	12/5/16 11:41	11.78653	3316.339
B3	8.1	27	10047	2206	3.12	0	1500	12/5/16 11:58	8.519846	3217.988
B3	19	34	10023	2209	3.09	0	1500	12/5/16 11:18	10.86924	3241.485
B3	19.8	36	10029	2341	3.2	0	1500	12/5/16 11:34	11.116	3131.859
B3	39.9	32	10013	2326	3.2	0	1500	12/5/16 11:02	9.866	3126.859
B3	40.4	37	10010	2400	3.27	0	1500	12/5/16 10:51	11.18098	3058.958
B3	61.4	33	10013	2359	3.21	0	1500	12/5/16 13:38	10.14637	3117.111
B3	61.5	27	10011	2367	3.26	0	1500	12/5/16 13:27	8.148209	3068.655
B3	83.7	37	10008	2255	3.17	0	1500	12/5/16 13:20	11.53792	3154.894
B3	84.3	24	10007	2388	3.29	0	1500	12/5/16 13:11	7.160833	3039.437
B3	106.2	32	10008	2327	3.25	0	1500	12/5/16 13:00	9.712154	3077.181
B3	106.8	36	10040	2383	3.27	0	1500	12/5/16 12:50	10.87517	3068.132
B3	126.6	34	10020	2429	3.3	0	1500	12/5/16 12:42	10.16903	3034.16
B3	127.4	35	10048	2294	3.25	0	1500	12/5/16 12:36	10.63523	3089.488
B3	148	33	10005	2446	3.31	0	1500	12/5/16 12:14	9.835789	3020.455
B3	158.6	28	10033	2441	3.33	0	1500	12/5/16 12:27	8.274408	3010.709
B4	7.7	62	10043	2303	3.27	0	1500	12/5/16 11:58	18.80224	3069.429
B4	8.1	67	10033	2390	3.22	0	1500	12/5/16 12:14	20.64945	3114.014
B4	19	62	10018	2333	3.19	0	1500	12/5/16 11:34	19.27774	3138.614
B4	19.8	58	10012	2294	3.25	0	1500	12/5/16 11:42	17.68815	3078.79
B4	39.9	65	10017	2447	3.39	0	1500	12/5/16 11:18	19.01604	2953.042
B4	40.4	74	10018	2443	3.38	0	1500	12/5/16 11:02	21.73549	2962.08
B4	61.4	86	10028	2459	3.34	0	1500	12/5/16 10:51	25.5905	3000.57
B4	61.5	64	10004	2497	3.39	0	1500	12/5/16 13:38	18.72106	2949.207
B4	83.7	43	10037	2410	3.32	0	1500	12/5/16 13:27	12.79381	3021.368
B4	84.3	49	10031	2404	3.37	0	1500	12/5/16 13:20	14.38206	2974.733
B4	106.2	48	10028	2468	3.4	0	1500	12/5/16 13:11	13.95965	2947.587
B4	106.8	66	10024	2446	3.42	0	1500	12/5/16 13:00	19.14025	2929.169
B4	126.6	50	10028	2443	3.37	0	1500	12/5/16 12:50	14.6788	2973.843
B4	127.4	57	10021	2475	3.36	0	1500	12/5/16 12:42	16.80629	2980.615
B4	148	56	10016	2612	3.58	0	1500	12/5/16 12:27	15.48446	2795.94
B4	158.6	61	10003	2428	3.41	0	1500	12/5/16 12:37	17.73056	2931.606
C1	7.7	27	10009	2287	3.09	0	1530	12/5/16 12:14	8.613864	3237.158
C1	8.1	27	10032	2262	3.07	0	1530	12/5/16 12:26	8.670788	3265.751
C1	19	40	10024	2319	3.13	0	1530	12/5/16 11:42	12.65555	3200.555
C1	19.8	31	10008	2270	3.2	0	1530	12/5/16 11:58	9.5635	3125.499
C1	39.9	29	10015	2424	3.22	0	1530	12/5/16 11:34	8.882211	3108.247
C1	40.4	31	10026	2412	3.3	0	1530	12/5/16 11:18	9.269939	3036.181
C1	61.4	33	10027	2389	3.22	0	1530	12/5/16 11:02	10.12445	3111.974
C1	61.5	34	10009	2401	3.26	0	1530	12/5/16 10:51	10.30545	3068.244
C1	83.7	36	10009	2465	3.29	0	1530	12/5/16 13:38	10.81825	3040.248
C1	84.3	23	10025	2431	3.3	0	1530	12/5/16 13:27	6.845697	3035.878
C1	106.2	30	10019	2311	3.25	0	1530	12/5/16 13:20	9.106769	3080.768
C1	106.8	31	10030	2495	3.33	0	1530	12/5/16 13:11	9.185309	3010.011
C1	126.6	35	10025	2407	3.31	0	1530	12/5/16 13:00	10.45002	3026.7
C1	127.4	19	10017	2416	3.28	0	1530	12/5/16 12:50	5.668683	3051.962
C1	148	29	10020	2512	3.45	0	1530	12/5/16 12:37	8.281797	2902.347
C1	158.6	28	10014	2475	3.32	0	1530	12/5/16 12:42	8.309735	3014.264

C3	7.7	31	10020	2231	3.03	0	1530	12/5/16 12:26	10.11602	3305.208
C3	8.1	25	10037	2224	3.04	0	1530	12/5/16 12:36	8.108684	3299.922
C3	19	32	10029	2207	3.09	0	1530	12/5/16 11:58	10.24099	3243.908
C3	19.8	27	10028	2300	3.12	0	1530	12/5/16 12:14	8.538846	3212.38
C3	39.9	23	10023	2397	3.24	0	1530	12/5/16 11:42	6.983765	3091.796
C3	40.4	19	10010	2385	3.16	0	1530	12/5/16 11:34	5.897658	3165.999
C3	61.4	27	10029	2324	3.19	0	1530	12/5/16 11:18	8.34895	3142.164
C3	61.5	29	10006	2376	3.2	0	1530	12/5/16 11:02	8.9475	3125.152
C3	83.7	25	10015	2386	3.23	0	1530	12/5/16 10:51	7.624938	3098.896
C3	84.7	29	10006	2395	3.2	0	1530	12/5/16 13:38	8.9475	3125.152
C3	106.2	18	10011	2376	3.2	0	1530	12/5/16 13:27	5.51	3126.715
C3	106.8	17	10032	2293	3.23	0	1530	12/5/16 13:20	5.148158	3104.159
C3	126.6	42	10032	2412	3.21	0	1530	12/5/16 13:11	12.96911	3123.511
C3	127.4	29	10047	2356	3.25	0	1530	12/5/16 13:00	8.808077	3089.662
C3	148	23	10024	2538	3.41	0	1530	12/5/16 12:42	6.629868	2937.866
C3	158.6	17	10018	2403	3.27	0	1530	12/5/16 12:50	5.083777	3061.886

Gross Alpha!!

Prep Procedure: GAB

Eff. & ATTN calibration.

Analytical QASS / NCR? Y N Wk

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes		
1	1223001-1	SMP	200	200	ml	PCVL	23.3											See Runlog 3974 pg 3E	
1	1223001-2	SMP	200	200	ml	PCVL	22.1												
1	1223001-3	SMP	200	200	ml	PCVL	21												
1	1223001-4	SMP	200	200	ml	PCVL	22.8												
1	1223001-5	SMP	200	200	ml	PCVL	22.7												
1	1223001-6	SMP	200	200	ml	PCVL	48.5												outlier - don't use
1	1223001-7	SMP	200	200	ml	PCVL	47.5												See Runlog 3974 pg 3E
1	1223001-8	SMP	200	200	ml	PCVL	43.7												
1	1223001-9	SMP	200	200	ml	PCVL	46.1												
1	1223001-10	SMP	200	200	ml	PCVL	63.5												
1	1223001-11	SMP	200	200	ml	PCVL	81.1												
1	1223001-12	SMP	200	200	ml	PCVL	93.6												
1	1223001-13	SMP	200	200	ml	PCVL	95.2												
1	1223001-14	SMP	200	200	ml	PCVL	116.1												
1	1223001-15	SMP	200	200	ml	PCVL	90.7												
1	1223001-16	SMP	200	200	ml	PCVL	134.1												
1	1223001-17	SMP	200	200	ml	PCVL	134.2												
1	1223001-18	SMP	200	200	ml	PCVL	151.6												
1	1223001-19	SMP	200	200	ml	PCVL	156												
1	1223001-20	SMP	200	200	ml	PCVL	21.3												
1	1223001-21	SMP	200	200	ml	PCVL	21.8												
1	1223001-22	SMP	200	200	ml	PCVL	19.7												
1	1223001-23	SMP	200	200	ml	PCVL	20.5												
1	1223001-24	SMP	200	200	ml	PCVL	21.2												
1	1223001-25	SMP	200	200	ml	PCVL	21.1												
1	1223001-26	SMP	200	200	ml	PCVL	21.5												
1	1223001-27	SMP	200	200	ml	PCVL	20.7												

Use for Eff. Calibration

172 of 328

AB1118 1 Wk

A |
B |
C | JP

AB1119 1 Wk

A |
B |
C |

OUTLIER don't use

JP 12/12/16

Wk

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1


















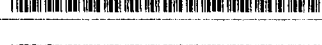
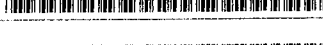








Prep Procedure: **GAB**

Analytical QASS / NCR? Y **N** *MM*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
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Spike Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/09/12	0.1 ml	RS-008

Sample Barcodes

1223001-1 AB121109-1PS1		1223001-2 AB121109-1PS2		1223001-3 AB121109-1PS3	
1223001-4 AB121109-1PS4		1223001-5 AB121109-1PS5		1223001-6 AB121109-1PS6	
1223001-7 AB121109-1PS7		1223001-8 AB121109-1PS8		1223001-9 AB121109-1PS9	
1223001-10 AB121109-1PS10		1223001-11 AB121109-1PS11		1223001-12 AB121109-1PS12	
1223001-13 AB121109-1PS13		1223001-14 AB121109-1PS14		1223001-15 AB121109-1PS15	
1223001-16 AB121109-1PS16		1223001-17 AB121109-1PS17		1223001-18 AB121109-1PS18	
1223001-19 AB121109-1PS19		1223001-20 AB121109-1PS20		1223001-21 AB121109-1PS21	
1223001-22 AB121109-1PS22		1223001-23 AB121109-1PS23		1223001-24 AB121109-1PS24	
1223001-25 AB121109-1PS25		1223001-26 AB121109-1PS26		1223001-27 AB121109-1PS27	

173 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Reporting Units

LabID:	TstGrpName:	RptUnits:
1223001-1	GrossAlpha/Beta	PCI/L
1223001-2	GrossAlpha/Beta	PCI/L
1223001-3	GrossAlpha/Beta	PCI/L
1223001-4	GrossAlpha/Beta	PCI/L
1223001-5	GrossAlpha/Beta	PCI/L
1223001-6	GrossAlpha/Beta	PCI/L
1223001-7	GrossAlpha/Beta	PCI/L
1223001-8	GrossAlpha/Beta	PCI/L
1223001-9	GrossAlpha/Beta	PCI/L
1223001-10	GrossAlpha/Beta	PCI/L
1223001-11	GrossAlpha/Beta	PCI/L
1223001-12	GrossAlpha/Beta	PCI/L
1223001-13	GrossAlpha/Beta	PCI/L
1223001-14	GrossAlpha/Beta	PCI/L
1223001-15	GrossAlpha/Beta	PCI/L
1223001-16	GrossAlpha/Beta	PCI/L
1223001-17	GrossAlpha/Beta	PCI/L
1223001-18	GrossAlpha/Beta	PCI/L
1223001-19	GrossAlpha/Beta	PCI/L
1223001-20	GrossAlpha/Beta	PCI/L
1223001-21	GrossAlpha/Beta	PCI/L
1223001-22	GrossAlpha/Beta	PCI/L
1223001-23	GrossAlpha/Beta	PCI/L
1223001-24	GrossAlpha/Beta	PCI/L
1223001-25	GrossAlpha/Beta	PCI/L
1223001-26	GrossAlpha/Beta	PCI/L
1223001-27	GrossAlpha/Beta	PCI/L

174 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: **GAB**

Reviewed By: *jil* *SM*

Review Date: 11/15/2012

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 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10
 Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1223001-1	SMP		200	200	Unfiltered	S1	
2	1	1223001-2	SMP		200	200	Unfiltered	S1	
3	1	1223001-3	SMP		200	200	Unfiltered	S1	
4	1	1223001-4	SMP		200	200	Unfiltered	S1	
5	1	1223001-5	SMP		200	200	Unfiltered	S1	
6	1	1223001-6	SMP		200	200	Unfiltered	S1	
7	1	1223001-7	SMP		200	200	Unfiltered	S1	
8	1	1223001-8	SMP		200	200	Unfiltered	S1	
9	1	1223001-9	SMP		200	200	Unfiltered	S1	
10	1	1223001-10	SMP		200	200	Unfiltered	S1	
11	1	1223001-11	SMP		200	200	Unfiltered	S1	
12	1	1223001-12	SMP		200	200	Unfiltered	S1	
13	1	1223001-13	SMP		200	200	Unfiltered	S1	
14	1	1223001-14	SMP		200	200	Unfiltered	S1	
15	1	1223001-15	SMP		200	200	Unfiltered	S1	
16	1	1223001-16	SMP		200	200	Unfiltered	S1	
17	1	1223001-17	SMP		200	200	Unfiltered	S1	
18	1	1223001-18	SMP		200	200	Unfiltered	S1	
19	1	1223001-19	SMP		200	200	Unfiltered	S1	
20	1	1223001-20	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
21	1	1223001-21	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
22	1	1223001-22	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
23	1	1223001-23	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
24	1	1223001-24	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
25	1	1223001-25	SMP		200	200	Unfiltered	S1	0.05 mL of 10 mg/mL natural Uranium
26	1	1223001-26	SMP		200	200	Unfiltered	S1	0.05 mL of 10 mg/mL natural Uranium
27	1	1223001-27	SMP		200	200	Unfiltered	S1	0.05 mL of 10 mg/mL natural Uranium

SM 11/15/12

SM 11/15/12

175 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: GAB

Reviewed By: jtl

Review Date: 11/15/2012

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10

Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
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Comments
Calibration planchets and mass attenuation curve.

Spiked By: Steve Workman Date: 11/8/2012

Witnessed By: N/A Date: N/A

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1	ml	RS-008

Reagent Solution IDs*

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

176 of 328

Radiochemistry Gravimetric Worksheet

ALS Environmental -- FC

Prep Batch: **AB121109-1**

Prep Procedure: **GAB**

Reviewed By: jtl *SN*

Review Date: 11/15/2012

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1223001-1	SMP	10	9.1050	0.0000	0	200	200	200	9.1283	23.3	0.5	
1	2	1223001-2	SMP	10	9.0995	0.0000	0	200	200	200	9.1216	22.1	0.5	
1	3	1223001-3	SMP	10	9.0872	0.0000	0	200	200	200	9.1082	21	0.5	
1	4	1223001-4	SMP	10	9.1198	0.0000	0	200	200	200	9.1426	22.8	0.5	
1	5	1223001-5	SMP	10	9.1442	0.0000	0	200	200	200	9.1669	22.7	0.5	
1	6	1223001-6	SMP	10	9.1142	0.0000	0	200	200	200	9.1627	48.5	1	
1	7	1223001-7	SMP	10	9.1346	0.0000	0	200	200	200	9.1821	47.5	1	
1	8	1223001-8	SMP	10	9.0877	0.0000	0	200	200	200	9.1314	43.7	1.5	
1	9	1223001-9	SMP	10	9.0922	0.0000	0	200	200	200	9.1383	46.1	1.5	
1	10	1223001-10	SMP	10	9.0712	0.0000	0	200	200	200	9.1347	63.5	2	
1	11	1223001-11	SMP	10	9.1302	0.0000	0	200	200	200	9.2113	81.1	2	
1	12	1223001-12	SMP	10	9.1044	0.0000	0	200	200	200	9.1980	93.6	2.5	
1	13	1223001-13	SMP	10	9.1418	0.0000	0	200	200	200	9.2370	95.2	2.5	
1	14	1223001-14	SMP	10	9.1031	0.0000	0	200	200	200	9.2192	116.1	3	
1	15	1223001-15	SMP	10	9.1182	0.0000	0	200	200	200	9.2089	90.7	3	
1	16	1223001-16	SMP	10	9.1173	0.0000	0	200	200	200	9.2515	134.2	3.5	
1	17	1223001-17	SMP	10	9.0956	0.0000	0	200	200	200	9.2298	134.2	3.5	
1	18	1223001-18	SMP	10	9.1276	0.0000	0	200	200	200	9.2792	151.6	4	
1	19	1223001-19	SMP	10	9.1131	0.0000	0	200	200	200	9.2691	156	4	
1	20	1223001-20	SMP	10	9.0751	0.0000	0	200	200	200	9.0964	21.3	0.5	
1	21	1223001-21	SMP	10	9.1113	0.0000	0	200	200	200	9.1331	21.8	0.5	
1	22	1223001-22	SMP	10	9.0713	0.0000	0	200	200	200	9.0910	19.7	0.5	
1	23	1223001-23	SMP	10	9.1326	0.0000	0	200	200	200	9.1531	20.5	0.5	
1	24	1223001-24	SMP	10	9.1320	0.0000	0	200	200	200	9.1532	21.2	0.5	
1	25	1223001-25	SMP	10	9.1188	0.0000	0	200	200	200	9.1399	21.1	0.5	
1	26	1223001-26	SMP	10	9.0872	0.0000	0	200	200	200	9.1087	21.5	0.5	
1	27	1223001-27	SMP	10	9.1133	0.0000	0	200	200	200	9.1340	20.7	0.5	

177 of 328

Gross α standards

mg mass	Std					
21.3	1	20mg R1	0.5ml salt, 0.1ml 955,4095.10		.0751	.0964
1.8	2	R2			.1113	.1331
9.7	3	R3			.0713	.0910
20.5	4	R4			.1326	.1531
21.2	5	R5			.1320	.1532
21.1	6	20mg + U	0.05ml of 10mg/ml rat. U		.1188	.1399
21.5	7				.0872	.1087
20.7	8				.1133	.134

Project 955.4095.10 Am-241
Continued from Page _____

Working Intermediate Standard
MEL 11/8/11

MEL 11/8/11

Prepare a working dilution of 955, Am-241

1. Density of 1M HCl, lot # K22032

Mass of 100mL vol. flask:	<u>66.4295g</u>	Balance #	<u>12</u>
Mass of flask & 100mL acid:	<u>167.9701g</u>	Balance#	<u>12</u>
Net Mass:	<u>101.5406g</u>		
Density:	<u>1.0154g/mL</u>		

2. Mass of 955 transferred:

Mass of empty voa vial:	<u>21.3568g</u>	Balance#	<u>12</u>
Mass of voa vial & standard:	<u>26.4318g</u>	Balance#	<u>12</u>
Net mass of standard transferred:	<u>5.0750g</u>		

MEL 11/8/11

MEL 11/8/11

3. Dilute to final volume:

Mass of vial, standard, & diluent:	<u>42.8085g</u>	Balance#	<u>12</u>
Mass of empty voa vial:	<u>21.3568g</u>	Balance#	<u>12</u>
Net mass of new dilution:	<u>21.4517g</u>		

4. Final activity calculation:

$$(1.965 \times 10^4 \text{ Bq}) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{5.0750 \text{ g}}{5.1341 \text{ g}} \right) \left(\frac{1.0154 \text{ g/mL}}{21.4517 \text{ g}} \right) = 55,161.32 \text{ dpm/mL}$$

MEL 11/8/11
55,161.33 dpm/mL

MEL 11/8/11

Std ID: 955.4095.10

RG 11/29/11

RG 11/29/11

Description: Am-241

Expiration: 11/11/2012

Activity: 55161.33 dpm/mL

2s Uncertainty: 992.90 dpm/mL

Ref. Date: 10/25/2011

Ref Time: N/A

Prep Date: 11/8/2011 Prep by: MEL

Matrix/Comp. 3M HCl

Half Life (y): 4.33E+02

RG 11/29/11

RG 11/29/11

Reverification Log		
Analysis Date	Initials	Expiration Date

Continued on Page

Megan Jones
Signed

11/8/11
Date

Read and Understood By
Renee Holley
Signed

11/29/11



Eckert & Ziegler
Analytics

RS# 955
Rec 10-31-11

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

85983-307

Am-241 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u _A	u _B	U	
Am-241	1.580E+05	1.965E+04	0.1	0.9	1.8	10/25/2011

***Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %, α -impurities < 0.1 %. 5.13441 g 1M HCl solution, carrier free.

Source Prepared by: *M. I. Taskaeva*
M. I. Taskaeva, Radiochemist

QA Approved: *J. D. McCorvey*
J. D. McCorvey, QA Manager Alternate

Date: 26 Oct 11

ANA Form 005 Rev. 11/00

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318

Prep Procedure: GROSS_BETA MASS ATTEN. CALIB.

Analytical QASS / NCR? Y **N** *WA*

Prep Num	LabID	QC Type	Init Aliq	Fin Aliq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1118007-1	SMP	200	200	ml	pCi/l	8.1	See Runlog 3974 pg 37										
1	1118007-2	SMP	200	200	ml	pCi/l	7.7											
1	1118007-3	SMP	200	200	ml	pCi/l	19.8											
1	1118007-4	SMP	200	200	ml	pCi/l	19											
1	1118007-5	SMP	200	200	ml	pCi/l	39.9											
1	1118007-6	SMP	200	200	ml	pCi/l	40.4											
1	1118007-7	SMP	200	200	ml	pCi/l	61.4											
1	1118007-8	SMP	200	200	ml	pCi/l	61.5											
1	1118007-9	SMP	200	200	ml	pCi/l	83.7											
1	1118007-10	SMP	200	200	ml	pCi/l	84.3											
1	1118007-11	SMP	200	200	ml	pCi/l	106.2											
1	1118007-12	SMP	200	200	ml	pCi/l	106.8											
1	1118007-13	SMP	200	200	ml	pCi/l	126.6											
1	1118007-14	SMP	200	200	ml	pCi/l	127.4											
1	1118007-15	SMP	200	200	ml	pCi/l	158.6											
1	1118007-16	SMP	200	200	ml	pCi/l	148											

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.018	DPM/ml	06/19/11	1	ml	RS-005

Sample Barcodes

1118007-1 AB110619-4PS1		1118007-2 AB110619-4PS2		1118007-3 AB110619-4PS3	
1118007-4 AB110619-4PS4		1118007-5 AB110619-4PS5		1118007-6 AB110619-4PS6	
1118007-7 AB110619-4PS7		1118007-8 AB110619-4PS8		1118007-9 AB110619-4PS9	
1118007-10 AB110619-4PS10		1118007-11 AB110619-4PS11		1118007-12 AB110619-4PS12	

Page 1 of 3

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110619-4

Prep Procedure: GROSS_BETA

Analytical QASS / NCR? Y N NA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1118007-13 AB110619-4PS13																		
								1118007-14 AB110619-4PS14										
														1118007-15 AB110619-4PS15				
1118007-16 AB110619-4PS16																		

Reporting Units

LabID:	TstGrpName:	RptUnits:
1118007-1	GrossBeta	pCi/l
1118007-2	GrossBeta	pCi/l
1118007-3	GrossBeta	pCi/l
1118007-4	GrossBeta	pCi/l
1118007-5	GrossBeta	pCi/l
1118007-6	GrossBeta	pCi/l
1118007-7	GrossBeta	pCi/l
1118007-8	GrossBeta	pCi/l
1118007-9	GrossBeta	pCi/l
1118007-10	GrossBeta	pCi/l
1118007-11	GrossBeta	pCi/l
1118007-12	GrossBeta	pCi/l
1118007-13	GrossBeta	pCi/l
1118007-14	GrossBeta	pCi/l
1118007-15	GrossBeta	pCi/l
1118007-16	GrossBeta	pCi/l

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110619-4

Prep Procedure: GROSS_BETA

Reviewed By: gdw

Review Date: 6/20/2011

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Gabriel D. Wagner gdw Balance: 13
 Prep SOP: NONE Prep Date: 6/19/2011 Balance: _____
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118007-1	SMP		200	200	Unfiltered	S1	
2	1	1118007-2	SMP		200	200	Unfiltered	S1	
3	1	1118007-3	SMP		200	200	Unfiltered	S1	
4	1	1118007-4	SMP		200	200	Unfiltered	S1	
5	1	1118007-5	SMP		200	200	Unfiltered	S1	
6	1	1118007-6	SMP		200	200	Unfiltered	S1	
7	1	1118007-7	SMP		200	200	Unfiltered	S1	
8	1	1118007-8	SMP		200	200	Unfiltered	S1	
9	1	1118007-9	SMP		200	200	Unfiltered	S1	
10	1	1118007-10	SMP		200	200	Unfiltered	S1	
11	1	1118007-11	SMP		200	200	Unfiltered	S1	
12	1	1118007-12	SMP		200	200	Unfiltered	S1	
13	1	1118007-13	SMP		200	200	Unfiltered	S1	
14	1	1118007-14	SMP		200	200	Unfiltered	S1	
15	1	1118007-15	SMP		200	200	Unfiltered	S1	
16	1	1118007-16	SMP		200	200	Unfiltered	S1	

SOP 06-20-11

gdw
06-20-11

Comments

Gross beta mass attenuation curve. All samples desiccated on 06/19/2011 @ 14:48.

Spiked By: Gabriel D. Wagner gdw Date: 6/19/2011

Witnessed By: Justin D. Anderson Date: 6/19/2011

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.018	DPM/ml	06/19/11	1	ml	RS-005

183 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110619-4

Prep Procedure: GROSS_BETA

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 702 Rev: 20

Prep Analyst: Gabriel D. Wagner GPW

Balance: 13

Prep SOP: NONE

Prep Date: 6/19/2011

Balance:

Matrix Class: liquid

Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118007-1	SMP		0	0	Unfiltered	S1	
2	1	1118007-2	SMP		0	0	Unfiltered	S1	
3	1	1118007-3	SMP		0	0	Unfiltered	S1	
4	1	1118007-4	SMP		0	0	Unfiltered	S1	
5	1	1118007-5	SMP		0	0	Unfiltered	S1	
6	1	1118007-6	SMP		0	0	Unfiltered	S1	
7	1	1118007-7	SMP		0	0	Unfiltered	S1	
8	1	1118007-8	SMP		0	0	Unfiltered	S1	
9	1	1118007-9	SMP		0	0	Unfiltered	S1	
10	1	1118007-10	SMP		0	0	Unfiltered	S1	
11	1	1118007-11	SMP		0	0	Unfiltered	S1	
12	1	1118007-12	SMP		0	0	Unfiltered	S1	
13	1	1118007-13	SMP		0	0	Unfiltered	S1	
14	1	1118007-14	SMP		0	0	Unfiltered	S1	
15	1	1118007-15	SMP		0	0	Unfiltered	S1	
16	1	1118007-16	SMP		0	0	Unfiltered	S1	

Comments

Gross beta mass attenuation curve. All samples desiccated on 06/19/11 @ 14:48. TRAY#3

Spiked By: Gabriel D. Wagner GPW Date: 06/19/11

Witnessed By: JDA Date: 6/19/11

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.018	DPM/ml	06/19/11	1	ml	RS-005

Exp: 4/1/12

Radiochemistry Gravimetric Worksheet

ALS Environmental -- FC

Prep Batch: **AB110619-4**

Prep Procedure: **GROSS_BETA**

Reviewed By: *gdw*

Review Date: **6/20/2011**

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1118007-1	SMP	10	9.1792	0.0000	0	200	200	200	9.1873	8.1	0.25	
1	2	1118007-2	SMP	10	9.1459	0.0000	0	200	200	200	9.1536	7.7	0.25	
1	3	1118007-3	SMP	10	9.1322	0.0000	0	200	200	200	9.1520	19.8	0.5	
1	4	1118007-4	SMP	10	9.1795	0.0000	0	200	200	200	9.1985	19	0.5	
1	5	1118007-5	SMP	10	9.1387	0.0000	0	200	200	200	9.1786	39.9	1	
1	6	1118007-6	SMP	10	9.1305	0.0000	0	200	200	200	9.1709	40.4	1	
1	7	1118007-7	SMP	10	9.1189	0.0000	0	200	200	200	9.1804	61.5	1.5	
1	8	1118007-8	SMP	10	9.1427	0.0000	0	200	200	200	9.2042	61.5	1.5	
1	9	1118007-9	SMP	10	9.1715	0.0000	0	200	200	200	9.2552	83.7	2	
1	10	1118007-10	SMP	10	9.1351	0.0000	0	200	200	200	9.2194	84.3	2	
1	11	1118007-11	SMP	10	9.1447	0.0000	0	200	200	200	9.2509	106.2	2.5	
1	12	1118007-12	SMP	10	9.1506	0.0000	0	200	200	200	9.2574	106.8	2.5	
1	13	1118007-13	SMP	10	9.1339	0.0000	0	200	200	200	9.2605	126.6	3	
1	14	1118007-14	SMP	10	9.1621	0.0000	0	200	200	200	9.2895	127.4	3	
1	15	1118007-15	SMP	10	9.0634	0.0000	0	200	200	200	9.2220	158.6	3.5	
1	16	1118007-16	SMP	10	9.2095	0.0000	0	200	200	200	9.3575	148	3.5	

185 of 388

Prepare a primary dilution of RSO #777 (Analytics #69573-307) in 0.1M HCl to a final volume of approx. 500mL.

- 1) Prepare 0.1M HCl by diluting 8.3 mL HCl (12M) (Fisher Scientific Lot #055784) to a final volume of 1L.
- 2) Determine the density of 0.1M HCl

Weight of empty volumetric flask (100mL) 68.54g
 Mass of flask + 100mL 0.1M HCl 168.31g
 - Mass of 100mL of 0.1M HCl 99.77g
 ÷ 100mL = density = 0.9977

3) Transfer #777 to a 500mL

Mass of bottle 47.9687g
 - Mass of bottle + std. 52.9160g
 Mass of std. 4.9473g

4) Dilute to volume w/ 0.1M HCl

Mass of bottle + std. + soln 494.52g
 Mass of bottle (from above) 47.9487g
 mass of soln 446.5713g

5) Final activity (dpm/mL)

$$\frac{(3.82 \times 10^4 \text{ dps}) (60 \text{ sec/min}) (4.9473 \text{ g})}{(5.05960 \text{ g}) (446.5713 \text{ g})} = 5010.94 \text{ dpm}$$

Std ID: 777.3020.11

$$5010.94 \text{ dpm} \times 0.9977 \text{ g} = 4999.12 \text{ dpm}$$

Description: Sr-90
 Expiration: 2/27/07
 Activity: 4996.73 dpm/mL
 2a Uncertainty: 99.93 dpm/mL
 Ref. Date: 12/2/04
 Ref Time: N/A
 Prep Date: 2/8/06
 Matrix/Comp: 0.1 M HCl
 Half Life (yr): 2.88E+01
 Rep by: HB

ANALYST DATE = 06/10/06
 NEW EXP. DATE = 07/10/07
 07/10/06

Reverification Log	Analysis Date	Initials	Expiration Date
	7/7/11	RG	7/7/11
	4/1/12	RG	4/1/12
	12/28/12	JP	12/28/12
	01/20/13	JP	01/20/13
	08/30/13	JP	08/30/13
	10/24/14	JP	10/24/14
	10/24/15	JP	10/24/15

Reverification Log	Analysis Date	Initials	Expiration Date	to
	4/13/15	JP	4/13/2016	
	11/25/15	JP	11/25/2016	
	11/12/16	JP	11/12/2017	

Signed: *Heather Barker*

Date: 2/8/06

Signed: *[Signature]*

Date: 2/8/06



ANALYTICS

RSO #777
Rec'd 12/9/04
JCS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30316 - U.S.A.

Phone (404) 382-8877
Fax (404) 382-2887

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

69573-307

Sr-90 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Sr-90
ACTIVITY (dps):	3.812 H4
HALF-LIFE:	28.79 years
CALIBRATION DATE:	December 2, 2004 12:00 EST
RELATIVE EXPANDED UNCERTAINTY (k=2):	2.0%

Impurities: γ -impurities <0.1%

5.05960 grams in 0.1M HCl solution with 30 μ g/g Sr carrier.

This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

P O NUMBER 71059, Item 1

SOURCE PREPARED BY: M. Dimitrova
M. Dimitrova, Radiochemist

Q A APPROVED: 12-6-04

Internal Calculation Verifications

ICBs

&

ICVs

Gross Alpha/Beta LB4100A ICV's/ICB's AM241/SR90

Atten. Constants		b	m	a	x0
Alpha		0.9797	0.9902	0.8336	21.5
Beta		0.9775	0.9994	1.0249	0.0

X-Talk Constants		m	b
$\alpha > \beta$		0.9993	0.2560
$\beta > \alpha$		0.0036	1.948E-05

Detector	Sample ID	Initial Aliquot	Final Sam. Size	Count Date	Count Dur.	Residual Mass (mg)	Alpha					Beta						
							Gross CPM	Bkg CPM	$\beta > \alpha$ X-Talk	Net CPM	Atten.	Efficiency	Gross CPM	Bkg CPM	$\alpha > \beta$ X-Talk	Net CPM	Atten.	Efficiency
A1	1224001-1	0.200	0.200	12/11/2016	1000	21.4	16.301	0.122	0.165	16.014	0.981	0.1952	43.138	2.132	4.2044	36.8016	0.9647	0.4167
B3	1224001-2	0.200	0.200	12/11/2016	1000	43.8	14.956	0.134	0.189	14.633	0.816	0.2248	44.666	2.204	3.9126	38.5494	0.9515	0.4262
C1	1224001-3	0.200	0.200	12/11/2016	1000	64.0	13.036	0.124	0.009	12.903	0.691	0.1982	43.479	2.001	3.4570	38.0210	0.9398	0.4247
A4	1224001-4	0.200	0.200	12/11/2016	1000	91.2	12.689	0.095	0.223	12.371	0.553	0.2015	43.636	2.089	3.4367	38.1103	0.9242	0.4396
A2	AB121206-3AMB	0.200	0.200	12/11/2016	1000	22.4	0.157	0.156	0.000	0.001	0.972	0.2235	2.121	2.029	0.0003	0.0917	0.9641	0.4244
B4	AB121206-3BMB	0.200	0.200	12/11/2016	1000	46.4	0.169	0.158	0.001	0.010	0.799	0.2028	1.979	1.825	0.0029	0.1511	0.9500	0.4167
A3	AB121206-3CMB	0.200	0.200	12/11/2016	1000	69.8	0.139	0.124	0.001	0.014	0.659	0.2142	2.394	2.290	0.0040	0.1000	0.9364	0.4357
C3	AB121206-3EMB	0.200	0.200	12/11/2016	1000	96.0	0.143	0.115	0.002	0.026	0.531	0.2316	2.102	1.723	0.0077	0.3713	0.9214	0.4339

Spike Information				
Alpha Std ID	Ref. Date	Act (dpm/ml)	Spike Vol (mL)	Decay Corr. Spike Act. Added
616.4095.13	4/18/2002	100.000	1.0	97.677

Spike Information				
Beta Std ID	Ref. Date	Act (dpm/ml)	Spike Vol (mL)	Decay Corr. Spike Act. Added
931.4095.33	4/11/2011	51.950	1.0	45.323

Acceptance criteria for LCS's --> 70-130%

Sample ID	Alpha					Beta				
	Act (pCi/L)	TPU (2 sig)	MDC	% Recov.	Act<MDCa	Act (pCi/L)	TPU (2 sig)	MDC	% Recov.	Act<MDCa
1224001-1	188.45	30.2	0.96	85.7%	NA	206.19	32.9	2.09	101.0%	NA
1224001-2	179.71	28.8	1.06	81.7%	NA	214.09	34.2	2.03	104.9%	NA
1224001-3	212.15	34.0	0.93	96.4%	NA	214.56	34.3	1.95	105.1%	NA
1224001-4	250.12	40.1	1.73	113.7%	NA	211.28	33.7	1.93	103.5%	NA
AB121206-3AMB	0.01	0.4	0.63	0.0%	PASS	0.50	0.7	1.17	NA	PASS
AB121206-3BMB	0.14	0.5	0.85	0.1%	PASS	0.86	0.7	1.15	NA	PASS
AB121206-3CMB	0.23	0.0	0.87	0.1%	PASS	0.55	0.0	1.24	NA	PASS
AB121206-3EMB	0.47	0.0	0.97	0.2%	PASS	2.09	0.0	1.10	NA	B3

Alpha CU (1 sig)	Alpha TPU (1 sig)	Beta CU (1 sig)	Beta TPU (1 sig)
1.5156	15.0808	1.2462	16.4640
1.5190	14.3887	1.2515	17.0922
1.8868	16.9964	1.2483	17.1286
2.3060	20.0477	1.2292	16.8667
0.1834	0.1834	0.3546	0.3569
0.2517	0.2520	0.3510	0.3577

OK JP 12/12/16

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.05/09/13 JP

Data file name: ABA1211
 Batch ID: AB121206-3
 Count Preset (m): 1000
 Batch Ended: 12/12/16 2:06

Background logfile: BKGABW
 Date of Bkg. Cal: 12/2/16
 Alpha efficiency logfile: Am241R-11/16
 Alpha attenuation calibration: AAM1206
 Beta efficiency logfile: Sr90R-11/16
 Beta attenuation calibration: ASR1205

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration y = b*m^(a*(mass-x0))	Beta Attenuation Calibration y = b*m^(a*(mass-x0))
Alpha b= 0.97970	Beta b= 0.9775
m= 0.99020	m= 0.9994
a= 0.8336	a= 1.0249
x0= 21.5000	x0= 0.0000
Alpha to Beta X-talk y = b*m^x	Beta to Alpha X-talk y = b*mass + m
a -> b xtalk b= 0.2560	b -> a xtalk b= 1.948E-05
a -> b xtalk m= 0.9993	b -> a xtalk m= 0.0036

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	AB121206-3EMB	12/12/16 2:03	1000.00	96.0	0.143	0.115	0.002	0.2316	0.531	n/a	n/a	2.102	1.723	0.0077	0.4339	0.921	n/a	n/a
C1	1224001-3	12/12/16 2:03	1000.00	64.0	13.036	0.124	0.201	0.1982	0.691	n/a	n/a	43.479	2.001	3.4570	0.4247	0.940	n/a	n/a
A2	AB121206-3AMB	12/12/16 2:03	1000.00	22.4	0.157	0.156	0.000	0.2235	0.972	n/a	n/a	2.121	2.029	0.0003	0.4244	0.964	n/a	n/a
A1	1224001-1	12/12/16 2:03	1000.00	21.4	16.301	0.122	0.165	0.1952	0.981	n/a	n/a	43.138	2.132	4.2044	0.4167	0.965	n/a	n/a
A3	AB121206-3CMB	12/12/16 2:03	1000.00	69.8	0.139	0.124	0.001	0.2142	0.659	n/a	n/a	2.394	2.290	0.0040	0.4357	0.936	n/a	n/a
A4	1224001-4	12/12/16 2:03	1000.00	91.2	12.689	0.095	0.223	0.2015	0.553	n/a	n/a	43.636	2.089	3.4367	0.4396	0.924	n/a	n/a
B4	AB121206-3BMB	12/12/16 2:06	1000.00	46.4	0.169	0.158	0.001	0.2028	0.799	n/a	n/a	1.979	1.825	0.0029	0.4167	0.950	n/a	n/a
B3	1224001-2	12/12/16 2:06	1000.00	43.8	14.956	0.134	0.189	0.2248	0.816	n/a	n/a	44.666	2.204	3.9126	0.4262	0.952	n/a	n/a

M 12/12/16

Date

12/12/16

SOP 724r

11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5						(H)	JP	(H)	OL
6						P			OL
7									P
8									
9									
10									OL
11									P
12									OL
13	OL				OL				
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BKA1201W			
Dr B				
Dr C				
Dr D	a			

Dr = Drawer

Gas Supply

	P-10 Supply	P-10 Flow	
Tank 1	0	Dr A	10
		Dr B	
Tank 2	1000	Dr C	
		Dr D	

Comments:

Date 12/11/16

SOP 724r/1

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100A

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-12	Daib EP	---	---	30	7:44	JP	EF1211	JP
1-12	Daib Bks	---	---	60	7:57	JP	BK1211	JP
5	Daib BKs	---	---	60	9:17	JP	BK1211A	JP
1	224001-1	AB121206-3	α13	1000	9:19	JP	AB1211	JP
7	-2							
9	-3							
4	-4							
2	AB121206-3AMB							
3	BMB							
3	CMB							
11	EMB							

JP 12/12/16

Comments:

Page No.: 468571 B
 (cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date JP 12/12/16

Date 12/12/16

SOP 724r 11

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100A

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	TV	P			TV	P			P
2									
3									
4									
5						(H ₂)			OL
6						(L ₂)			
7						P			P
8									
9									
10									OL
11									P
12						(H ₂)			OL
13	α								
14									
15									
16									

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BKA1701W			
Dr B				
Dr C				
Dr D	OL			

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow
Tank 1	0	Dr A	10
		Dr B	
Tank 2	750	Dr C	
		Dr D	

Comments:

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121206-3

Prep Procedure: GAB ICB's, ICV's

Analytical QASS/NCR? Y N *W*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1224001-1	SMP	200	200	ml	PCI/L	21.4											
1	1224001-2	SMP	200	200	ml	PCI/L	43.8											
1	1224001-3	SMP	200	200	ml	PCI/L	64											
1	1224001-4	SMP	200	200	ml	PCI/L	91.2											
1	AB121206-3A	MB	200	200	ml	PCI/L	22.4											
1	AB121206-3B	MB	200	200	ml	PCI/L	46.4											
1	AB121206-3C	MB	200	200	ml	PCI/L	69.8											
1	AB121206-3E	MB	200	200	ml	PCI/L	96											

ABA1211 1 JP
 7
 9
 4
 2
 5
 3
 11

/

J012/12/k

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.4095.13	98.308	DPM/ml	12/06/12	1	ml	RS-016
S2	Sr-90	931.4095.33	49.916	DPM/ml	12/06/12	1	ml	RS-016

Sample Barcodes

1224001-1 AB121206-3PS1		1224001-2 AB121206-3PS2	
1224001-4 AB121206-3PS4		AB121206-3AMB AB121206-3PS5	
AB121206-3CMB AB121206-3PS7		AB121206-3EMB AB121206-3PS8	

Reporting Units

LabID:	TstGrpName:	RptUnits:
1224001-1	GrossAlpha/Beta	PCI/L
1224001-2	GrossAlpha/Beta	PCI/L
1224001-3	GrossAlpha/Beta	PCI/L
1224001-4	GrossAlpha/Beta	PCI/L

194 of 398

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: **AB121206-3**

Prep Procedure: **GAB**

Reviewed By: *jtl JK*

Review Date: 12/6/2012

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 702 Rev: 20 Prep Analyst: Jeffrey T. Lee Balance: 13
 Prep SOP: NONE Prep Date: 12/6/2012 Balance:
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1224001-1	SMP		200	200	Unfiltered	S1,S2	
2	1	1224001-2	SMP		200	200	Unfiltered	S1,S2	
3	1	1224001-3	SMP		200	200	Unfiltered	S1,S2	
4	1	1224001-4	SMP		200	200	Unfiltered	S1,S2	
5	1	AB121206-3A	MB		200	200	Unfiltered		<i>in 12/6/12</i>
6	1	AB121206-3B	MB		200	200	Unfiltered		<i>in 12/6/12</i>
7	1	AB121206-3C	MB		200	200	Unfiltered		
8	1	AB121206-3E	MB		200	200	Unfiltered		

Comments

ICV/CBs. Samples desiccated on 12/6/12 @ 17:15.

Spiked By: Jeffrey T. Lee Date: 12/6/2012
 Witnessed By: Eric K. Gobel Date: 12/6/2012

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.4095.13	98.308	DPW/ml	12/06/12	1	ml	RS-016
S2	Sr-90	931.4095.33	49.916	DPW/ml	12/06/12	1	ml	RS-016

Reagent Solutions

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

195 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: **AB121206-8**

Prep Procedure: **GAB**

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 702 Rev: 20

Prep Analyst: Jeffrey T. Lee

Balance: 13

Prep SOP: NONE

Prep Date: 12/6/2012 *JTL*

Balance:

Matrix Class: liquid

Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1224001-1	SMP		200	200	Unfiltered	S1,S2	
2	1	1224001-2	SMP		200	200	Unfiltered	S1,S2	
3	1	1224001-3	SMP		200	200	Unfiltered	S1,S2	
4	1	1224001-4	SMP		200	200	Unfiltered	S1,S2	
5	1	AB121206-3A	MB		200	200	Unfiltered		
6	1	AB121206-3B	MB		200	200	Unfiltered		
7	1	AB121206-3C	MB		200	200	Unfiltered		
8	1	AB121206-3E	MB		200	200	Unfiltered		

Comments

Spiked By: *JTL*

Date: *12/6/12*

Witnessed By: *ERG*

Date: *12/6/12*

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.4095.13	98.308	DPM/ml	12/06/12	1	ml	RS-016
S2	Sr-90	931.4095.33	49.916	DPM/ml	12/06/12	1	ml	RS-016

S1: 4/12/13
S2: 9/18/13

Reagent Solution IDs:

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

Radiochemistry Gravimetric Worksheet

ALS Environmental – FC

Prep Batch: **AB121206-3**

Prep Procedure: **GAB**

Reviewed By: jtl *JN*

Review Date: 12/6/2012

Prep Num	Planc. Num	LabiD	QC Type	Test Aliq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Aliq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1224001-1	SMP	10	9.1723	0.0000	0	200	200	200	9.1937	21.4	0.5	
1	2	1224001-2	SMP	10	9.1914	0.0000	0	200	200	200	9.2352	43.8	1	
1	3	1224001-3	SMP	10	9.2220	0.0000	0	200	200	200	9.2860	64	1.5	
1	4	1224001-4	SMP	10	9.1331	0.0000	0	200	200	200	9.2243	91.2	2	
1	5	AB121206-3A	MB	10	9.1271	0.0000	0	200	200	200	9.1495	22.4	0.5	
1	6	AB121206-3B	MB	10	9.2092	0.0000	0	200	200	200	9.2556	46.4	1	
1	7	AB121206-3C	MB	10	9.1743	0.0000	0	200	200	200	9.2441	69.8	1.5	
1	8	AB121206-3E	MB	10	9.2158	0.0000	0	200	200	200	9.3118	96	2	

MEL 1/6/12

Prepare a working dilution of 616.2382.91

1. Density of 1M HCl, lot # K43J20
 Mass of 100mL vol. flask: 56.4421g Balance # 12
 Mass of flask & 100mL acid: 157.7445g Balance# 12
 Net Mass: 101.3024g
 Density: 1.0130g/mL

2. Mass of 616.2382.91 transferred:
 Mass of open empty nalgene: 74.7685g Balance# 12
 Mass of nalgene & standard: 78.4340g Balance# 12
 Net mass of standard transferred: 3.6655g Balance# NA

3. Dilute to final volume:
 Mass of nalgene, standard, & diluent: 1084.8g Balance# 26
 Mass of empty nalgene (from above): 74.7685g Balance# 12
 Net mass of new dilution: 1010.0315g Balance# NA

4. Final activity calculation:

$$27,201.49 \text{ dpm/g} \left(\frac{3.6655\text{g}}{1010.0315\text{g}} \right) (1.0130\text{g/mL}) = 100.00 \text{ dpm/mL}$$

MEL 1/6/12

JP 5/11/12

Std ID: 616.4095.13

Description: Am-241
 Expiration: 4/21/2013
 Activity: 100.00 dpm/mL
 2s Uncertainty: 3.30 dpm/mL
 Ref. Date: 4/18/2002
 Ref Time: N/A
 Prep Date: 4/21/2012 Prep by: TE
 Matrix/Comp. 1M HCl
 Half Life (y): 4.32E+02

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 5/11/12

JP 5/11/12

JP 5/11/12

Continued on Page _____

Megan Law
Signed

1/6/12
Date

[Signature]
Read and Understood By
Signed

05/01/12
Date

Am-241 intermediate dilution

Prepare an intermediate dilution of 616.2382.38 by diluting with 1M HCl (1st 430's)

(1) Determine the density of 1M HCl

mass of 100 ml class A volumetric flask	127.5757g (600)
mass of flask and 1M HCl	168.8580g
net mass of 1M HCl	101.2823

$\rho = 1.0128 \text{ g/ml}$

(2) Transfer Am-241 (616.2382.38) to a 40 ml NOA vial

mass of empty NOA vial without lid & 50 ml beaker	54.0248g (200)
mass of standard, transfer pipet & 50 ml beaker (initial)	95.0640g
mass of standard, transfer pipet & 50 ml beaker after transfer	75.0076g
net mass of standard transferred	20.0564g

(3) Dilute to final volume with 1M HCl

mass of empty NOA vial w/o lid & 50 ml beaker (from above)	54.0248g (200)
mass of standard, 1M HCl, NOA vial & 50 ml beaker	92.4609g
net mass of standard	38.4361g

(4) final activity calculation

$$\frac{52.2896}{38.4361 \text{ g}} \times (20.0564 \text{ g}) = 27.168 \text{ dpm/g}$$

MC 11/1/07
27,201.49

Continued on Page _____

Read and Understood By

C Moncarage

4/25/03

Benedict

5/5/03

Signed

Date

Signed

Date

Am-241 primary dilution

prepare a primary dilution of RSN 1010 (NIST: ~~SRM 4331~~ ^{SRM-1402} SR 5 1031051-307) by diluting w/ 1M HCl

DB 10/16/04

1) Determine the density of 1M HCl (Lot # 42223 & Lot # 42216)

mass of 100ml vol flask	102.472 g (bal 12)
mass of flask + 1M HCl	113.802 g
Net mass of std ^{1M HCl}	11.33000 g

2) Transfer contents of ampule to 40 ml vol vial

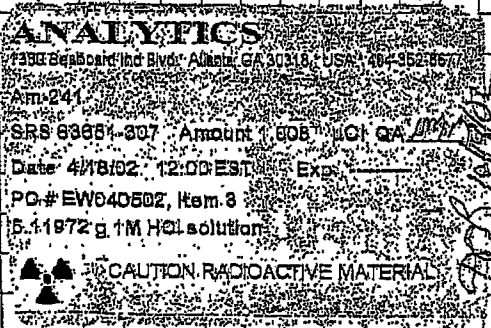
mass of vna vial w/o lid	22.3577 g (bal 12)
mass of ampule + mass of std ^{1M HCl} + 30ml beaker	37.9238 g
mass of beaker + empty ampule	32.9862 g
Net mass of std transferred	4.937600 g

3) Dilute std to final vol w/ 1M HCl

mass of vna vial w/o lid (from above)	22.3577 g (bal 12)
mass of std + vna vial + 1M HCl	103.7403 g
Net mass of diluted std	41.382600 g

4) Final Activity Calc

$$\frac{(3.728 \times 10^4 \text{ dps}) \left(\frac{100 \text{ dps}}{\text{dps}} \right) (4.9376 \text{ g})}{5.11972 \text{ g}} = \frac{52,066 \text{ dps}}{52,128.96 \text{ dps/g}}$$



Continued on Page

Read and Understood By

DB 10-14-02 R. Kelly 2/4/03

Signed _____ Date _____ Signed _____ Date _____



ANALYTIX

1880 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 U.S.A.

Phone (404) 852-8577
Fax (404) 852-2837

PAI FO 0616
rec'd 4-22-02

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

63651-307

Am-241 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTIX maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Am-241
ACTIVITY (dps):	3.728 E4
HALF-LIFE:	4.322 E2 years
CALIBRATION DATE:	April 18, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.3%
SYSTEMATIC:	3.0%
RANDOM:	0.3%

*99% confidence level.

Impurities: γ -impurities <0.1%

5.11972 grams IN HCl solution.

P O NUMBER: BW040502, Item 3

SOURCE PREPARED BY: *M. Taskasva*
M. Taskasva, Radiochemist

Q A APPROVED: *M. Rutz* 4-19-02

Prepare a working dilution of 931.4095.11 ^{18 9/8/12}

1. Density of 0.1 M HCl lot # 109031
 Mass of 100mL vol. flask: 68.5649g
 Mass of flask & 100mL acid: 168.4557g
 Net Mass: 99.8908g
 Density: 0.9989 g/mL

Balance # 12
 Balance# 12

2. Mass of 931.4095.11 transferred:
 Mass of open empty nalgene: 75.0081g
 Mass of nalgene & standard: 76.5548g
 Net mass of standard transferred: 1.5467g

Balance# 12
 Balance# 12
 Balance# NA

3. Dilute to final volume:
 Mass of nalgene, standard, & diluent: 1085.2g
 Mass of empty nalgene (from above): 75.0081g
 Net mass of new dilution: 1010.1919g

Balance# 26
 Balance# 12
 Balance# NA

4. Final activity calculation:

$$33,966.93 \text{ dpm/g} (0.9989 \text{ g/mL}) \left(\frac{1.5467 \text{ g}}{1010.1919 \text{ g}} \right) = 51.95 \text{ dpm/mL}$$

MC
10/17/2012

MC
10/17/2012

Std ID: 931.4095.33

Description: Sr-90
 Expiration: 9/8/2013
 Activity: 51.95 dpm/mL

2s Uncertainty: 93.51 dpm/mL
 Ref. Date: 4/11/2011
 Ref Time: N/A
 Prep Date: 9/8/2012 Prep by: TE
 Matrix/Comp. 0.1 M HCl
 Half Life (y): 2.88E+01

Reverification Log		
Analysis Date	Initials	Expiration Date

MC
10/17/2012

MC
10/17/2012

Continued on Page _____

TEcht 9/8/12
 Signed Date

Read and Understood By [Signature] 9/8/12
 Signed Date

MEL 12/14/11

Prepare an intermediate dilution of 931 Sr-90

1. Density of 0.1 M HCl, lot # K30039
 Mass of 100mL vol. flask: 66.4305 g Balance # 12
 Mass of flask & 100mL acid: 166.2718 g Balance# 12
 Net Mass: 99.8413 g
 Density: 0.9984 g/mL

2. Mass of 931 transferred:
 Mass of open empty 40mL Voa vial: 21.7293 g Balance# 12
 Mass of Voa vial and standard: 27.0645 g Balance# 12
 Net mass of standard transferred: 5.3352 g

3. Dilute to final volume:
 Mass of open empty 40mL Voa vial: 21.7293 g Balance# 12
 Mass of vial, standard, & diluent: 56.1105 g Balance# 12
 Net mass of new dilution: 34.3812 g

4. Final activity calculation:

$$1.967 \times 10^4 \text{ Bq} \left(\frac{5.3352 \text{ g}}{5.39174 \text{ g}} \right) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{0.9984 \text{ g/mL}}{34.3812 \text{ g}} \right) = \frac{33,966.73 \text{ dpm/g}}{33,912.59 \text{ dpm/mL}}$$

JP 6/20/12

MEL 12/14/11

MEL 12/14/11

MEL 12/14/11

JP 6/20/12

Std ID: 931.4095.11

Description: Sr-90
 Expiration: 1/19/2013
 Activity: 33912.59 dpm/mL
 2s Uncertainty: 610.43 dpm/mL
 Ref. Date: 4/11/2011
 Ref Time: N/A
 Prep Date: 12/14/2011 Prep by: ML
 Matrix/Comp. 0.1 M HCl JP 6/20/12
 Half Life (y): 2.88E+01

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 6/20/12

JP 6/20/12

JP 6/20/12

Continued on Page _____

Megan Lane 12/14/11
 Signed Date

Read and Understood By T. Elch 12/14/11
 Signed Date



Eckert & Ziegler

Analytics

rec
4-5-11 RSO# 931

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

84379-307

5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group/Fort Collins, CO
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Sta. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			U _k	U _a	U	
Sr-90	1.082E+04	1.967E+04	0.1	0.9	1.8	04/11/2011

*Uncertainty: U - Relative expanded uncertainty, k=2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %. 5.39174 grams 0.1M HCl solution with approximately 30 $\mu\text{g/g}$ each of Sr and Y carriers.

NOTE: This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

Source Prepared by: W. Mao
W. Mao, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 3/31/11



Single Isotope Certificate, Rev 1 9/28/2009

Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Instrument: LB4100-C

Calibration: Gross Alpha (Am-241) - ringed planchet
Gross Beta (Sr-90/Y-90) - ringed planchet

Date of Calibration: Gross Alpha 06/09/2017
Gross Beta 06/09/2017

Efficiency Log Files: **Am241R-06/17**
Sr90R-06/17

Efficiency Instrument Files: EAM0609A-D
ESR0609A-D

Source ID's: Am-241 → 955.4095.10
Sr-90/Y-90 → 777.3020.11

ICV ID's: Am-241 → 616.4095.13)
(Sr-90/Y-90 → 931.4095.33)

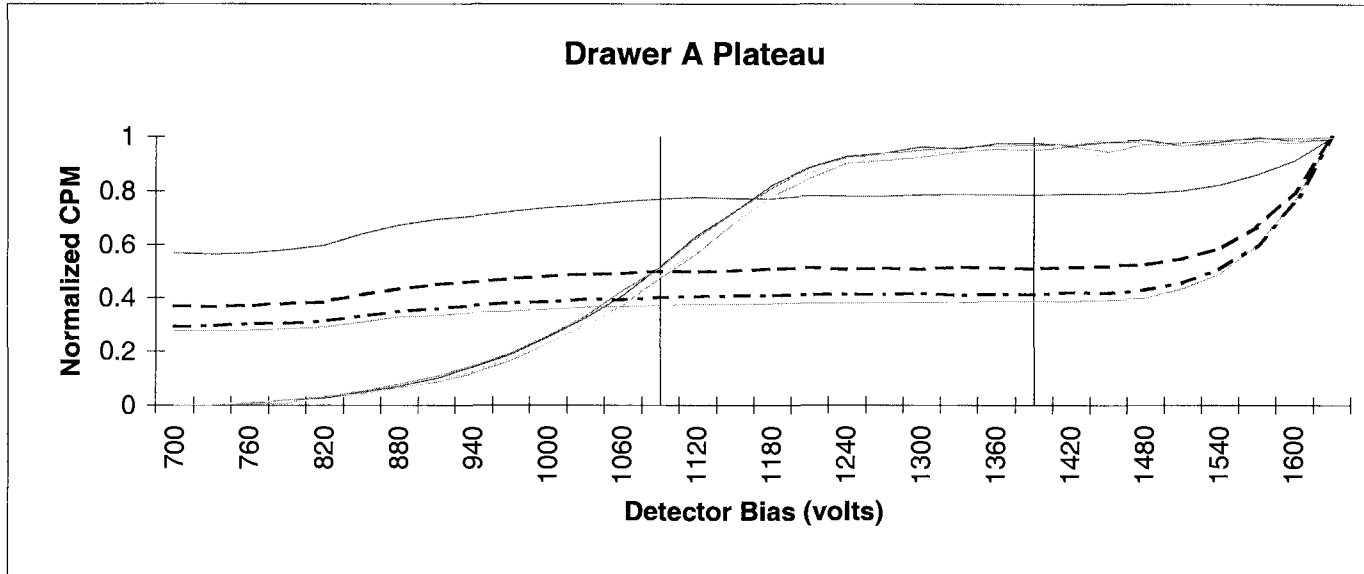
OK JP
6/13/17

Expires 06/05/2018

Instrument Plateaus

Unit Type: LB4100/W
 Date Performed: 6/6/17 08:23
 FileName: PTC0606A
 Batch ID: DRAWER A PLATEAU

Unit Id: Magenta
 Application Revision: 2
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage: **1402.5**

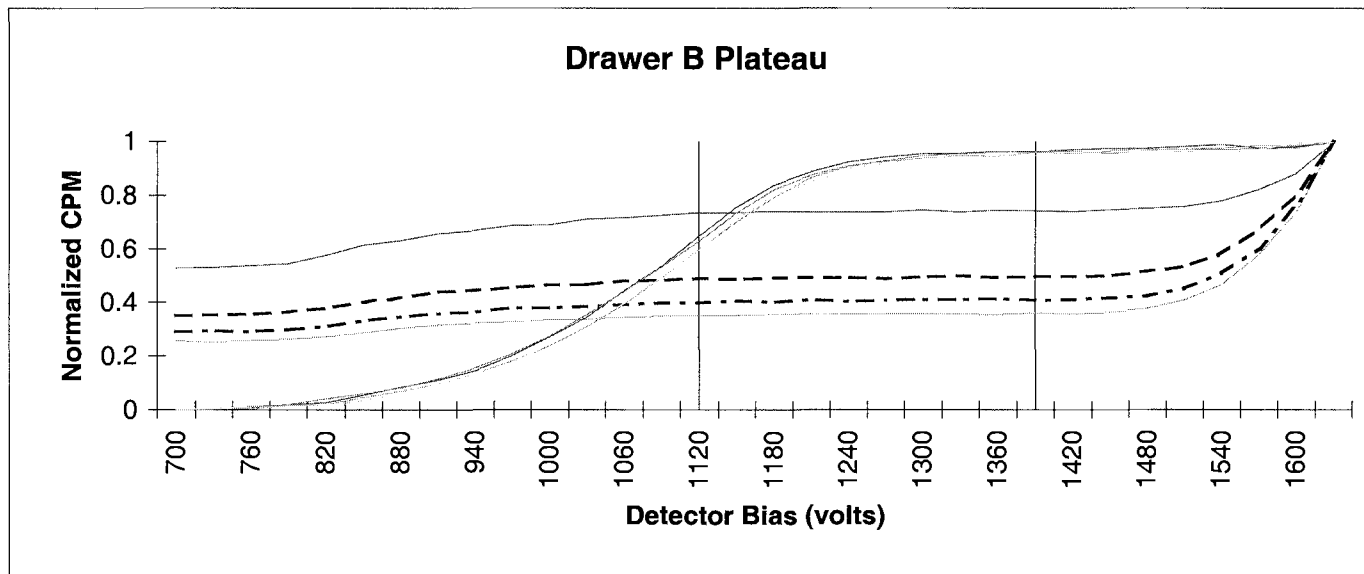
Optimum alpha only operating voltage: **1087.5**

	A1	A2	A3	A4
Beta slope at beta voltage	1.47%	1.71%	0.53%	3.64%
Alpha slope at beta voltage	0.19%	0.63%	1.60%	1.64%
Alpha slope at alpha voltage	3.18%	2.44%	3.36%	3.18%

Ok JP 6/9/17

Unit Type: LB4100/W
 Date Performed: 6/6/17 08:23
 FileName: PTC0606B
 Batch ID: DRAWER B PLATEAU

Unit Id: Magenta
 Application Revision: 2
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

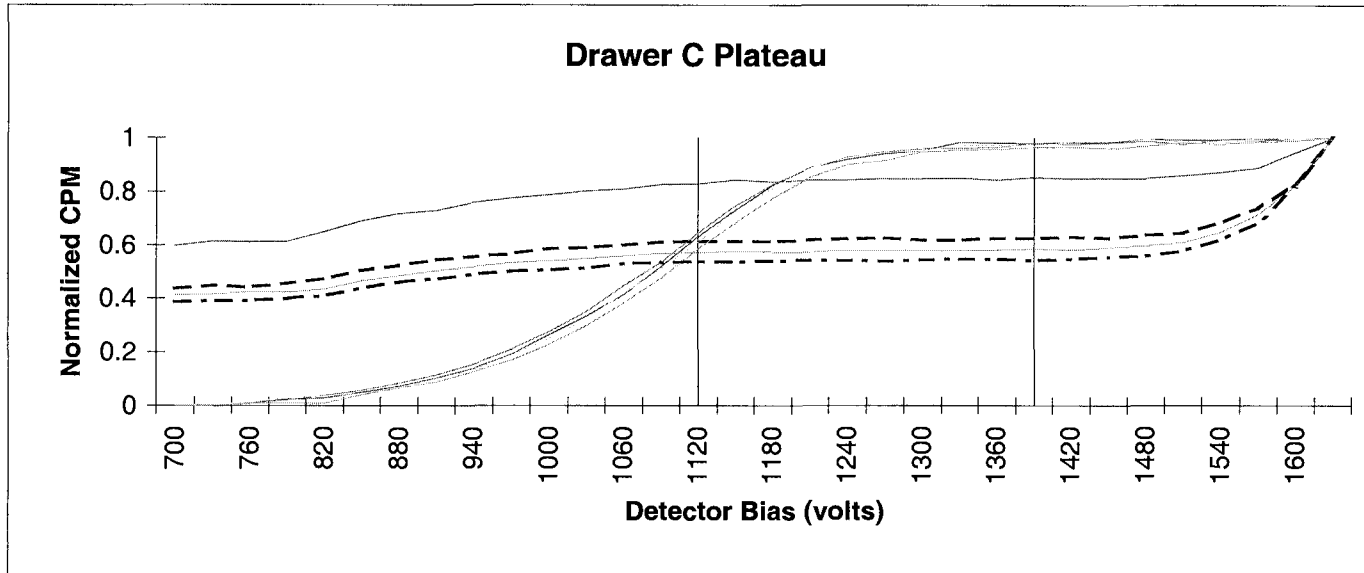
Optimum alpha only operating voltage:

	B1	B2	B3	B4
Beta slope at beta voltage	1.46%	0.21%	1.67%	1.02%
Alpha slope at beta voltage	0.74%	0.41%	1.47%	0.77%
Alpha slope at alpha voltage	2.44%	2.07%	2.12%	2.16%

OK JP 6/9/17

Unit Type: LB4100/W
 Date Performed: 6/5/17 16:24
 FileName: PTC0605C
 Batch ID: DRAWER C PLATEAU

Unit Id: Magenta
 Application Revision: 2
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

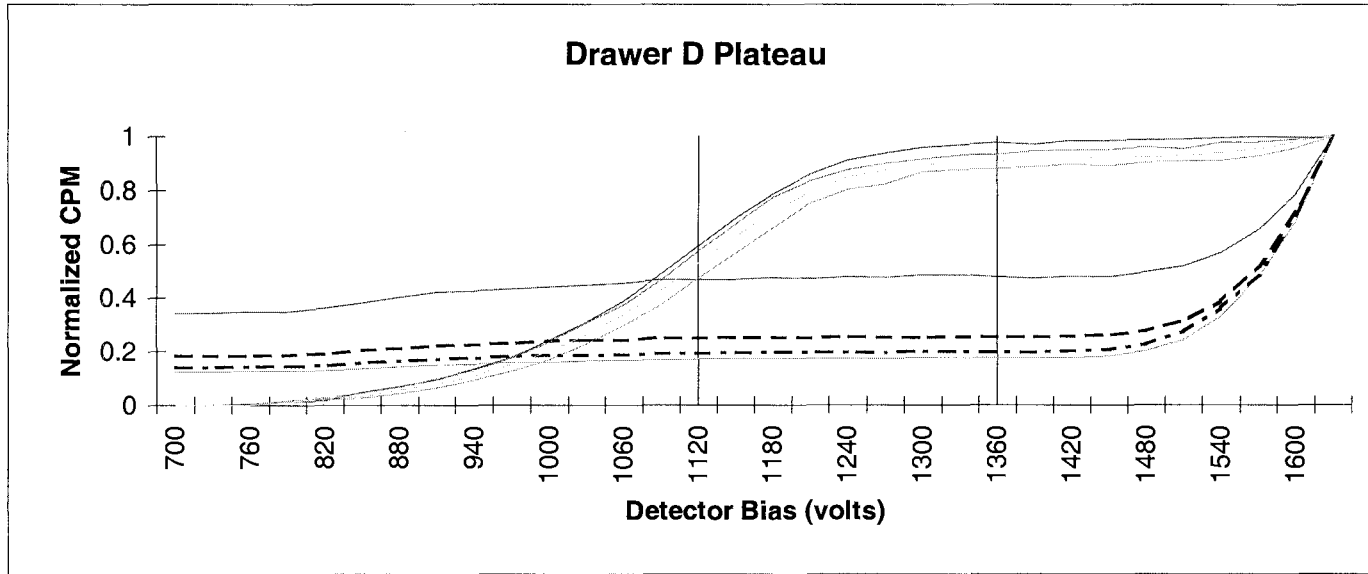
Optimum alpha only operating voltage:

	C1	C2	C3	C4
Beta slope at beta voltage	0.01%	1.81%	0.66%	1.49%
Alpha slope at beta voltage	0.09%	0.91%	1.33%	0.91%
Alpha slope at alpha voltage	2.85%	1.52%	2.04%	1.53%

OK JPL 6/19/17

Unit Type: LB4100/W
 Date Performed: 6/5/17 16:24
 FileName: PTC0605D
 Batch ID: DRAWER D PLATEAU

Unit Id: Magenta
 Application Revision: 2
 Application Version: Standard



Optimum alpha beta simultaneous operating voltage:

Optimum alpha only operating voltage:

	D1	D2	D3	D4
Beta slope at beta voltage	1.86%	2.83%	2.42%	2.14%
Alpha slope at beta voltage	-1.26%	0.56%	0.63%	0.33%
Alpha slope at alpha voltage	3.38%	3.01%	3.50%	3.06%

OK JP 6/9/17

Date 6/5/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JCS	P			JCS	P			P
2	↓	↓			↓	↓			↓
3	↓	↓			↓	↓			↓
4	↓	↓			↓	↓			↓
5	↓	↓			↓	↓			↓
6	↓	↓			↓	↓			↓
7	↓	↓			↓	↓			↓
8	↓	↓			↓	↓			↓
9	↓	↓				Hβ	JCS	P	↓
10	↓	↓				Pβ			↓
11	↓	↓				↓			↓
12	↓	↓				Hβ			OL
13	↓	↓				P			P
14	↓	↓			↓	↓			↓
15	↓	↓			↓	↓			↓
16	↓	↓			↓	↓			↓

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BCL0523 BCL0522W			
Dr B	↓			
Dr C				
Dr D				

Dr = Drawer

Gas Supply

P-10 Supply		P-10 Flow	
Tank 1		Dr A	10
		Dr B	↓
Tank 2		Dr C	
		Dr D	↓

Comments:

Date 6/5/17

SOP 724r 12

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Daily K135	-	-	30	820	JKB	PTC0605	JW
1-16	Daily B135	-	-	60	833	JKB	BK0605	JW
9	↓	-	-	60	925	JM	PTC0605A	↓
1-11	Alpha/Beta	Drawer A Plat.	Platenum	5 min/slp	1009		PTC0605A	↓
5-8	Beta/Alpha	Drawer B Platnum					PTC0605B	↓
9-12	Alpha/Beta	Drawer C Platnum			1630		PTC0605C	↓
13-16	Beta/Alpha	Drawer D Platnum			↓		PTC0605D	↓

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Comments:

4/4/17 Drawers A+B removal from Instrument and sent back to Canberra to fix guard detector / Slide tray connection so the 3 guard pins holding the two together dont become loose over time due to opening and closing the drawers resulting in ↑ beta cpm, ↓ guard cpm

5/11/17 Drawers A+B received back from Canberra. Drawers re-installed in the instrument, daily performance check β & α run after allowing time for the gas to purge. Weekly Long Background calibration performed. Drawers A+B are now back on line.

6/5/17 Voltage Plateau

Plateau Check run for drawers	A-D	sources used	detectors	β sources used
410	A1 B1 C1 D1	Am-241		Sr 90/Y90
411	A2 B2 C2 D2	17800 dpm		29600 dpm
412	A3 B3 C3 D3	2/16/95		9/15/95
413	A4 B4 C4 D4			

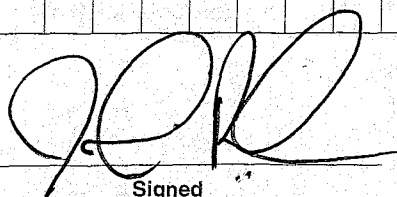
Parameters:

Starting voltage 700	Count preset 40000	File names:
Ending voltage 1650	Time between steps 0.1	PTC0605A
70V/step	Weak check time 0.1	PTC0605B
5 min/step	Weak check limits 20	

6/7/17

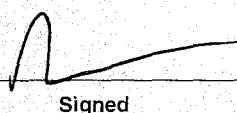
ROTS set for all drawers using Sr/Y-90 sources
 Sources → 406, 407, 408, + 409: over 40,000 counts achieved at each detector. α lower limit + β upper limit set to 50% to start.
 Both lower limit + β upper limit moved to achieve $\beta \rightarrow \alpha$ talk of 2.5%. α lower limit moved to achieve $\alpha \rightarrow \beta$ talk of 0.10%
 All ROTS archived

Continued on Page


Signed

6/11/17
Date

Read and Understood By


Signed

6/13/17
Date

Instrument ROIs

LB4100 -C Water Sample Counting Parameters

Certainty requirement for MDA and flags	95%	Action level for flags (pCi/l)	α	1.200E+02	
	Maximum count time (min)		360.00	Activity Multiplier	1.000E+00
	Typical Residual Mass (mg)		50.00	Mass Error (%)	1.00%
	Typical Sample Volume (l)		0.10	Volume Error (%)	1.00%

	Alpha			Beta		
	eff.	bkg.	MDA (pCi/l)	eff.	bkg.	MDA (pCi/l)
A1	15.92%	0.078	1.812E+00	37.98%	1.436	3.017E+00
A2	16.59%	0.094	1.889E+00	37.36%	1.336	2.958E+00
A3	16.06%	0.096	1.971E+00	37.67%	1.51	3.120E+00
A4	16.20%	0.083	1.831E+00	38.95%	1.532	3.039E+00

Batch Specific:

	Event	Recycle
Magenta	1	0

Drawer Specific:

	Date/Time	Official	Bias	Step
A	6-6-17 8:23	TRUE	1402.5	0
B	6-6-17 8:23	TRUE	1402.5	0
C	6-5-17 16:24	TRUE	1402.5	0
D	6-5-17 16:24	TRUE	1372.5	0

Detector Specific:

	Date/Time	Official	Threshold	bLL	bUL	aLL	aUL
A1	6-7-17 0:00	TRUE	0.1	0	40.07	80.17	100
A2	6-7-17 0:00	TRUE	0.1	0	38.87	77.48	100
A3	6-7-17 0:00	TRUE	0.1	0	36.33	74.84	100
A4	6-7-17 0:00	TRUE	0.1	0	35.53	72.18	100
B1	6-7-17 0:00	TRUE	0.1	0	39.75	79.58	100
B2	6-7-17 0:00	TRUE	0.1	0	40.63	77.85	100
B3	6-7-17 0:00	TRUE	0.1	0	36.99	75.53	100
B4	6-7-17 0:00	TRUE	0.1	0	36.53	74.87	100
C1	6-7-17 0:00	TRUE	0.1	0	36.53	73.52	100
C2	6-7-17 0:00	TRUE	0.1	0	37.82	75.5	100
C3	6-7-17 0:00	TRUE	0.1	0	33.33	70.13	100
C4	6-7-17 0:00	TRUE	0.1	0	35.45	72.25	100
D1	6-7-17 0:00	TRUE	0.1	0	25.76	53.3	100
D2	6-7-17 0:00	TRUE	0.1	0	24.2	46.69	100
D3	6-7-17 0:00	TRUE	0.1	0	18.87	40.7	100
D4	6-7-17 0:00	TRUE	0.1	0	22.24	47.03	100

OK JP 6/17

4/4/17 Drawers A+B removal from Instrument and sent back to Canberra to fix guard detector / Slide tray connection so the 3 guard pins holding the two together don't become loose over time due to opening and closing the drawers resulting in \uparrow beta cpm, \downarrow guard cpm

5/1/17 Drawers A+B received back from Canberra. Drawers re-installed in the instrument, daily performance check ~~run~~ run after allowing time for the gas to purge. ~~Weekly~~ Long Background calibration performed. Drawers A+B are now back on line.

6/5/17 Voltage Plateau

~~Plateau~~ Check run for drawers A-D

α sources used	detectors	β sources used
410 Am-241	A1 B1 C1 D1	406 Sr 90 / Y90
411 17800 dpm	A2 B2 C2 D2	407 29660 dpm
412 2/6/95	A3 B3 C3 D3	408 9/15/95
413	A4 B4 C4 D4	409

Parameters:

Start voltage 700

End voltage 1650

30V/step

5min/step

Count preset 40000

Time between steps 0.1

Weak check fines 0.1

Weak check limits 20

File names:

PTC0605A

PTC0605B

6/7/17

ROIs set for all drawers using Sr/Y-90 sources

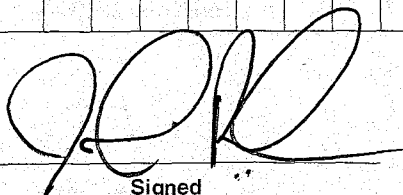
Sources \rightarrow 406, 407, 408, +409: over 40,000 counts achieved at each detector. α lower limit + β upper limit set to 50% to start

Both lower limit + β upper limit moved to achieve $\beta \rightarrow \alpha$ talk of

2.5%. α lower limit moved to achieve $\alpha \rightarrow \beta$ talk of 0.10%

All ROIs archived

Continued on Page

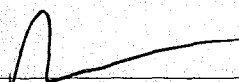


Signed

6/11/17

Date

Read and Understood By



Signed

6/13/17

Date
216 of 328

Calibration Efficiencies

Source Database for OSUM

Number of sources in table: 137

Application Revision:

Control ID	Isotope	Type	Half-Life	DPM	Std dev	Date	Status	Alpha/Beta Archive File
1076	Sr-90	Beta	10519.2	9993.46	199.86	2-Dec-04	ALS	Sr90R-06/17
1077	Am-241	Alpha	158153.25	5516.133	99.29	25-Oct-11	ALS	Am241R-06/17

Am-241 Ringed Planchet Efficiency Calibration

LB4100-C

Date: 6/9/2017

Source ID: 1077

Det ID	A1	A2	A3	A4	B1	B2	B3	B4
File Name	EAM0609A	EAM0609A	EAM0609A	EAM0609A	EAM0609B	EAM0609B	EAM0609B	EAM0609B
Cnt Time	9.08	8.24	8.71	8.85	9.32	8.35	8.97	9.12
Tot Cnts	10002	10005	10007	10005	10012	10007	10003	10010
Bkg CPM	0.078	0.094	0.096	0.083	0.091	0.117	0.084	0.100
CPM	1101.464	1214.105	1148.813	1130.425	1074.158	1198.326	1115.078	1097.488
Alpha Efficiency	0.201487	0.222092	0.210148	0.206784	0.196492	0.219205	0.203977	0.200759
Beta Efficiency	0.054817	0.054922	0.055946	0.056003	0.052699	0.055912	0.056737	0.051418
Efficiency	0.2015	0.2221	0.2101	0.2068	0.1965	0.2192	0.2040	0.2008

Det ID	C1	C2	C3	C4	D1	D2	D3	D4
File Name	EAM0609C	EAM0609C	EAM0609C	EAM0609C	EAM0609D	EAM0609D	EAM0609D	EAM0609D
Cnt Time	8.91	8.2	8.58	8.96	9.41	8.45	8.9	9.17
Tot Cnts	10007	10008	10009	10003	10009	10005	10007	10009
Bkg CPM	0.110	0.112	0.096	0.141	0.095	0.087	0.171	0.101
CPM	1123.010	1220.376	1166.454	1116.265	1063.561	1183.937	1124.211	1091.393
Alpha Efficiency	0.205428	0.223239	0.213375	0.204194	0.194553	0.216573	0.205648	0.199644
Beta Efficiency	0.056054	0.061847	0.054620	0.056022	0.051258	0.055320	0.053710	0.051651
Efficiency	0.2054	0.2232	0.2134	0.2042	0.1946	0.2166	0.2056	0.1996

Am241 EF

	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
offset	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	
NumRecs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
total time	9.08	8.24	8.71	8.85	9.32	8.35	8.97	9.12	8.91	8.2	8.58	8.96	9.41	8.45	8.9	9.17	
Alpha	total counts	10002	10005	10007	10005	10012	10007	10003	10010	10007	10008	10009	10003	10009	10005	10007	10009
	reduced chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
	CPM	1101.464	1214.105	1148.813	1130.425	1074.158	1198.326	1115.078	1097.488	1123.01	1220.376	1166.454	1116.265	1063.561	1183.937	1124.211	1091.393
	CPM var	242.6547	294.7823	263.9063	255.5461	230.6639	287.1528	248.6799	240.8195	252.1916	297.7991	272.0456	249.2353	226.171	280.3124	252.7587	238.1648
	Efficiency	0.201487	0.222092	0.210148	0.206784	0.196492	0.219205	0.203977	0.200759	0.205428	0.223239	0.213375	0.204194	0.194553	0.216573	0.205648	0.199644
	archived ST	0.004612	0.005084	0.00481	0.004733	0.004498	0.005018	0.004669	0.004595	0.004702	0.00511	0.004884	0.004674	0.004453	0.004957	0.004707	0.00457
	predicted ST	0.002015	0.00222	0.002101	0.002067	0.001964	0.002191	0.00204	0.002007	0.002054	0.002232	0.002133	0.002042	0.001945	0.002165	0.002056	0.001996
	actual STDE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Beta	total counts	2734	2485	2677	2723	2700	2566	2796	2578	2744	2786	2576	2770	2652	2569	2628	2604
	reduced chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
	CPM	299.6653	300.2417	305.8379	306.1516	288.0866	305.6554	310.1607	281.0844	306.4286	338.0971	298.5931	306.2548	280.2138	302.4167	293.6159	282.3625
	CPM var	42.22858	45.69548	44.73456	44.23496	39.47784	46.24835	44.46739	38.98725	44.05038	52.97875	44.00783	44.06393	37.89413	45.22378	41.89838	39.0327
	Efficiency	0.054817	0.054922	0.055946	0.056003	0.052699	0.055912	0.056737	0.051418	0.056054	0.061847	0.05462	0.056022	0.051258	0.05532	0.05371	0.051651
	archived ST	0.001545	0.001583	0.001585	0.00158	0.00149	0.0016	0.001591	0.00147	0.001579	0.001736	0.001562	0.001578	0.001456	0.001583	0.001529	0.001473
	predicted ST	0.001051	0.001104	0.001084	0.001076	0.001017	0.001107	0.001076	0.001016	0.001073	0.001175	0.001079	0.001069	0.000998	0.001094	0.001051	0.001015
	actual STDE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	

Sr-90 Ringed Planchet Efficiency Calibration

LB4100-C

Date: 6/9/2017

Source ID: 1076

Det ID	A1	A2	A3	A4	B1	B2	B3	B4
File Name	ESR0609A	ESR0609A	ESR0609A	ESR0609A	ESR0609B	ESR0609B	ESR0609B	ESR0609B
Cnt Time	3.20	3.20	3.06	3.17	3.19	3.29	3.16	3.23
Tot Cnts	10028	10031	10049	10045	10033	10032	10026	10023
Bkg CPM	1.436	1.336	1.510	1.532	1.613	1.650	1.545	1.591
CPM	3132.314	3133.352	3282.477	3167.238	3143.528	3047.590	3171.240	3101.505
Alpha Efficiency	0.000750	0.001171	0.001180	0.001311	0.001344	0.001094	0.000802	0.001117
Beta Efficiency	0.423645	0.423785	0.443955	0.428369	0.425162	0.412186	0.428910	0.419478
Efficiency	0.4236	0.4238	0.4440	0.4284	0.4252	0.4122	0.4289	0.4195

Det ID	C1	C2	C3	C4	D1	D2	D3	D4
File Name	ESR0609C	ESR0609C	ESR0609C	ESR0609C	ESR0609D	ESR0609D	ESR0609D	ESR0609D
Cnt Time	3.22	3.13	3.17	3.16	3.31	3.3	3.23	3.22
Tot Cnts	10037	10046	10033	10021	10037	10026	10027	10038
Bkg CPM	1.540	1.659	1.640	2.897	1.614	1.607	1.665	1.607
CPM	3115.541	3207.926	3163.344	3168.306	3030.712	3036.575	3102.669	3115.784
Alpha Efficiency	0.001245	0.000892	0.001139	0.000837	0.000723	0.000767	0.000312	0.000658
Beta Efficiency	0.421376	0.433871	0.427842	0.428513	0.409903	0.410696	0.419635	0.421409
Efficiency	0.4214	0.4339	0.4278	0.4285	0.4099	0.4107	0.4196	0.4214

Sr 90 Gross Beta EQ

	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
offset	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	
NumRecs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
total time	3.2	3.2	3.06	3.17	3.19	3.29	3.16	3.23	3.22	3.13	3.17	3.16	3.31	3.3	3.23	3.22	
Alpha	total counts	18	28	27	31	32	27	19	27	30	21	27	20	18	19	8	16
	reduced ch	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	CPM	5.547	8.656	8.727529	9.69618	9.940348	8.089687	5.928658	8.259133	9.20677	6.597265	8.42135	6.188114	5.343066	5.670576	2.30578	4.867944
	CPM var	1.761055	2.742125	2.891388	3.094561	3.154777	2.501286	1.906439	2.595054	2.902197	2.148149	2.694212	2.007031	1.645973	1.748122	0.767589	1.54572
	Efficiency	0.00075	0.001171	0.00118	0.001311	0.001344	0.001094	0.000802	0.001117	0.001245	0.000892	0.001139	0.000837	0.000723	0.000767	0.000312	0.000658
	archived S	0.00018	0.000225	0.000231	0.000239	0.000242	0.000215	0.000187	0.000219	0.000232	0.000199	0.000223	0.000192	0.000174	0.000179	0.000119	0.000169
	predicted S	0.000178	0.000222	0.000228	0.000237	0.000239	0.000212	0.000185	0.000216	0.000229	0.000196	0.00022	0.000189	0.000172	0.000177	0.000114	0.000166
	actual STD	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Beta	total counts	10028	10031	10049	10045	10033	10032	10026	10023	10037	10046	10033	10021	10037	10026	10027	10038
	reduced ch	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	chi-square	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	CPM	3132.314	3133.352	3282.477	3167.238	3143.528	3047.59	3171.24	3101.505	3115.541	3207.926	3163.344	3168.306	3030.712	3036.575	3102.669	3115.784
	CPM var	1961.337	1962.218	2151.657	2003.724	1975.13	1856.609	2010.704	1923.633	1939.658	2055.571	2000.132	2009.201	1835.613	1843.718	1924.785	1939.948
	Efficiency	0.423645	0.423785	0.443955	0.428369	0.425162	0.412186	0.42891	0.419478	0.421376	0.433871	0.427842	0.428513	0.409903	0.410696	0.419635	0.421409
	archived S	0.010376	0.010379	0.010872	0.01049	0.010413	0.010095	0.010505	0.010275	0.01032	0.010625	0.010479	0.010497	0.010039	0.010059	0.010278	0.010321
	predicted S	0.004232	0.004232	0.00443	0.004275	0.004246	0.004116	0.004285	0.004191	0.004207	0.00433	0.004272	0.004283	0.004093	0.004103	0.004192	0.004207
	actual STD	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

6/8/17

Sr90 flat Efficiency Calibration

Benchsheet: SR160216-1 Source ID: 1075

Logfile: SR00F - 6/17

Sources		detectors	File names
1613011-	2	A1 B1 C1 D1	ESR0608A
	3	A2 B2 C2 D2	B
	4	A3 B3 C3 D3	C
	5	A4 B4 C4 D4	D

6/9/17

Gross Alpha

Am-241 Eff. Calibration

Benchsheet: AB121109-1 Source ID => 1077

Logfile: Am241E-06/17

Sources		Detectors	File names
1223001-20		A1 B1 C1 D1	EAM0609A
	22	A2 B2 C2 D2	B
	23	A3 B3 C3 D3	C
	24	A4 B4 C4 D4	D

6/9/17

Gross Beta

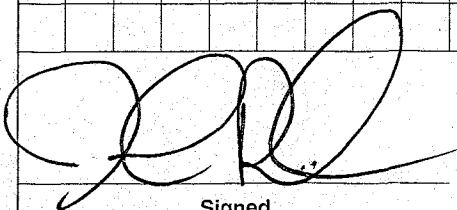
Sr-90 ringed planchet calibration

Benchsheet: AB110616-3 Source ID => 1076

Logfile: SR90E -> 06/17

Sources		Detector	File name
1118005-2		A1 B1 C1 D1	ESR0609A
	3	A2 B2 C2 D2	B
	4	A3 B3 C3 D3	C
	5	A4 B4 C4 D4	D

Continued on Page



Signed

6/13/17

Date

Read and Understood By



Signed

6/13/17

Date 6/9/17

SOP 724r 12

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: **LB4100C**

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	2015	P			2015				P
2		↓				Hα	2015	P	
3		↓				↓	↓	↓	
4		↓							
5		↓							
6		Hα	2015	P					
7		P							
8		↓							
9						Hβ	2015	P	
10									
11									
12									
13									
14									
15									
16	↓	↓			↓	Hβ	2015	(Hβ)	OLB

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	DKC0607W			
Dr B	↓			
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow
Tank 1	500	Dr A	10
	↓	Dr B	
Tank 2	2000	Dr C	
	↓	Dr D	↓

Comments:

Date 6/9/17

SOP 724r 17c

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Daily Eff			30	9:14	JMS	ET0609	JMS
6	↓			30	9:29	JMS	ET0609A	↓
1-16	Daily Bkgd			60	9:44	JMS	BK0609	↓
2,3,9,16	↓			60	11:07	J	BK0609A	↓
1-4	1077	AB121109-1	Am 241 eff cal	30	12:13	JMS	EAM0609A	JP
5-8	↓	↓	↓		12:28		EAM0609B	
9-12	↓	↓	↓		12:39		EAM0609C	
13-16	↓	↓	↓		12:53		EAM0609D	
13-16	1076	AB110616-3	Sm 232 eff cal		12:14		ESR0609D	
9-12	↓	↓	↓		12:19		ESR0609C	
5-8	↓	↓	↓		12:39		ESR0609B	
1-4	↓	↓	↓		12:29		ESR0609A	
1-4	1078	AB150603-5	Th 230 EFCal	30	13:54	JP	ETH0609A	
5-8	↓	↓	↓		14:10	JP	B	
9-12	↓	↓	↓		14:21	JP	C	
13-16	↓	↓	↓		14:45	JP	D	
13-16	1079	AB150810-2	Cs 137 EFCal		13:54	JP	ECS0609D	
9-12	↓	↓	↓		14:10	JP	C	
5-8	↓	↓	↓		14:21	JP	B	
1-4	↓	↓	↓		14:45	JP	A	

JMS
6/9/17

JP 6/10/17

Comments:

Page No.: 471491 B
(cont. from page NA B)

Form 780r8.doc (6/23/06)

Reviewed By / Date JP 6/10/17

Date 6/10/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16						(HB)			(HB)

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK0607W			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply	P-10 Flow	
Tank 1	0	Dr A	10
		Dr B	
Tank 2	2000	Dr C	
		Dr D	

Comments:

Prep Procedure: GAB

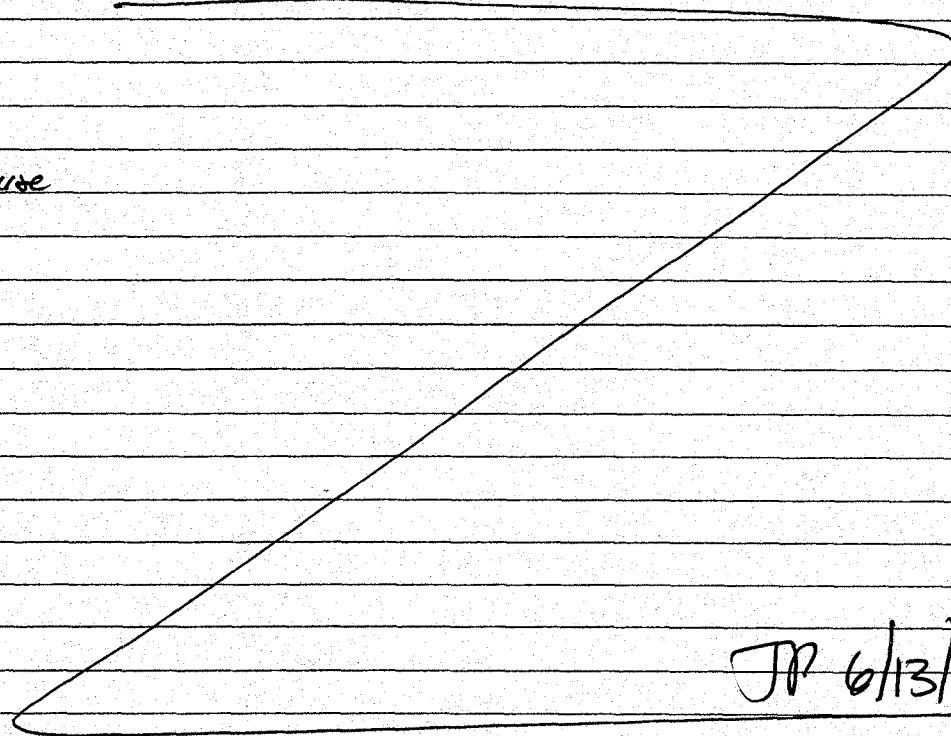
Gross Alpha!!

Eff. & ATTN calibration

Efficiency

Analytical QASS / NCR? Y N NA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	1223001-1	SMP	200	200	ml	PCI/L	23.3										
1	1223001-2	SMP	200	200	ml	PCI/L	22.1										
1	1223001-3	SMP	200	200	ml	PCI/L	21										
1	1223001-4	SMP	200	200	ml	PCI/L	22.8										
1	1223001-5	SMP	200	200	ml	PCI/L	22.7										don't use outlier - don't use
1	1223001-6	SMP	200	200	ml	PCI/L	48.5										
1	1223001-7	SMP	200	200	ml	PCI/L	47.5										
1	1223001-8	SMP	200	200	ml	PCI/L	43.7										
1	1223001-9	SMP	200	200	ml	PCI/L	46.1										
1	1223001-10	SMP	200	200	ml	PCI/L	63.5										
1	1223001-11	SMP	200	200	ml	PCI/L	81.1										
1	1223001-12	SMP	200	200	ml	PCI/L	93.6										
1	1223001-13	SMP	200	200	ml	PCI/L	95.2										
1	1223001-14	SMP	200	200	ml	PCI/L	116.1										
1	1223001-15	SMP	200	200	ml	PCI/L	90.7										don't use
1	1223001-16	SMP	200	200	ml	PCI/L	134.2										
1	1223001-17	SMP	200	200	ml	PCI/L	134.3										
1	1223001-18	SMP	200	200	ml	PCI/L	151.6										
1	1223001-19	SMP	200	200	ml	PCI/L	156										
1	1223001-20	SMP	200	200	ml	PCI/L	21.3										
1	1223001-21	SMP	200	200	ml	PCI/L	21.8										
1	1223001-22	SMP	200	200	ml	PCI/L	19.7										
1	1223001-23	SMP	200	200	ml	PCI/L	20.5										
1	1223001-24	SMP	200	200	ml	PCI/L	21.2										
1	1223001-25	SMP	200	200	ml	PCI/L	21.1										
1	1223001-26	SMP	200	200	ml	PCI/L	21.5										
1	1223001-27	SMP	200	200	ml	PCI/L	20.7										



JP 6/13/17

See Maintenance Log 3710 pg 82

AB1118 1 HK

A |
B |
C | JP

AB1119 1 HK

A |
B |
C |

OUTLIER don't use

use calibration

227 of 328

JP 6/13/17

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1




























Prep Procedure: GAB

Analytical QASS / NCR? Y N NA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
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Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1	ml	RS-008

Sample Barcodes

1223001-1 AB121109-1PS1		1223001-2 AB121109-1PS2		1223001-3 AB121109-1PS3	
1223001-4 AB121109-1PS4		1223001-5 AB121109-1PS5		1223001-6 AB121109-1PS6	
1223001-7 AB121109-1PS7		1223001-8 AB121109-1PS8		1223001-9 AB121109-1PS9	
1223001-10 AB121109-1PS10		1223001-11 AB121109-1PS11		1223001-12 AB121109-1PS12	
1223001-13 AB121109-1PS13		1223001-14 AB121109-1PS14		1223001-15 AB121109-1PS15	
1223001-16 AB121109-1PS16		1223001-17 AB121109-1PS17		1223001-18 AB121109-1PS18	
1223001-19 AB121109-1PS19		1223001-20 AB121109-1PS20		1223001-21 AB121109-1PS21	
1223001-22 AB121109-1PS22		1223001-23 AB121109-1PS23		1223001-24 AB121109-1PS24	
1223001-25 AB121109-1PS25		1223001-26 AB121109-1PS26		1223001-27 AB121109-1PS27	

228 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Reporting Units

LabID:	TstGrpName:	RptUnits:
1223001-1	GrossAlpha/Beta	PCI/L
1223001-2	GrossAlpha/Beta	PCI/L
1223001-3	GrossAlpha/Beta	PCI/L
1223001-4	GrossAlpha/Beta	PCI/L
1223001-5	GrossAlpha/Beta	PCI/L
1223001-6	GrossAlpha/Beta	PCI/L
1223001-7	GrossAlpha/Beta	PCI/L
1223001-8	GrossAlpha/Beta	PCI/L
1223001-9	GrossAlpha/Beta	PCI/L
1223001-10	GrossAlpha/Beta	PCI/L
1223001-11	GrossAlpha/Beta	PCI/L
1223001-12	GrossAlpha/Beta	PCI/L
1223001-13	GrossAlpha/Beta	PCI/L
1223001-14	GrossAlpha/Beta	PCI/L
1223001-15	GrossAlpha/Beta	PCI/L
1223001-16	GrossAlpha/Beta	PCI/L
1223001-17	GrossAlpha/Beta	PCI/L
1223001-18	GrossAlpha/Beta	PCI/L
1223001-19	GrossAlpha/Beta	PCI/L
1223001-20	GrossAlpha/Beta	PCI/L
1223001-21	GrossAlpha/Beta	PCI/L
1223001-22	GrossAlpha/Beta	PCI/L
1223001-23	GrossAlpha/Beta	PCI/L
1223001-24	GrossAlpha/Beta	PCI/L
1223001-25	GrossAlpha/Beta	PCI/L
1223001-26	GrossAlpha/Beta	PCI/L
1223001-27	GrossAlpha/Beta	PCI/L

229 of 328

NR

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: GAB

Reviewed By: *jil*

Review Date: 11/15/2012

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10
 Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fln Alq ml	Prep Basis	Standards	Prep Notes
1	1	1223001-1	SMP		200	200	Unfiltered	S1	<i>SM 11/14/12</i>
2	1	1223001-2	SMP		200	200	Unfiltered	S1	
3	1	1223001-3	SMP		200	200	Unfiltered	S1	
4	1	1223001-4	SMP		200	200	Unfiltered	S1	
5	1	1223001-5	SMP		200	200	Unfiltered	S1	
6	1	1223001-6	SMP		200	200	Unfiltered	S1	
7	1	1223001-7	SMP		200	200	Unfiltered	S1	
8	1	1223001-8	SMP		200	200	Unfiltered	S1	
9	1	1223001-9	SMP		200	200	Unfiltered	S1	
10	1	1223001-10	SMP		200	200	Unfiltered	S1	
11	1	1223001-11	SMP		200	200	Unfiltered	S1	
12	1	1223001-12	SMP		200	200	Unfiltered	S1	
13	1	1223001-13	SMP		200	200	Unfiltered	S1	
14	1	1223001-14	SMP		200	200	Unfiltered	S1	
15	1	1223001-15	SMP		200	200	Unfiltered	S1	
16	1	1223001-16	SMP		200	200	Unfiltered	S1	
17	1	1223001-17	SMP		200	200	Unfiltered	S1	
18	1	1223001-18	SMP		200	200	Unfiltered	S1	
19	1	1223001-19	SMP		200	200	Unfiltered	S1	
20	1	1223001-20	SMP		200	200	Unfiltered	S1	
21	1	1223001-21	SMP		200	200	Unfiltered	S1	
22	1	1223001-22	SMP		200	200	Unfiltered	S1	
23	1	1223001-23	SMP		200	200	Unfiltered	S1	
24	1	1223001-24	SMP		200	200	Unfiltered	S1	
25	1	1223001-25	SMP		200	200	Unfiltered	0.05 mL of 10 mg/mL natural Uranium	
26	1	1223001-26	SMP		200	200	Unfiltered	0.05 mL of 10 mg/mL natural Uranium	
27	1	1223001-27	SMP		200	200	Unfiltered	0.05 mL of 10 mg/mL natural Uranium	

230 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: GAB

Reviewed By: jtl

Review Date: 11/15/2012

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10

Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes

Comments

Calibration planchets and mass attenuation curve.

Spiked By: Steve Workman Date: 11/8/2012

Witnessed By: N/A Date: N/A

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1	ml	RS-008

Reagent Solution IDs*

J12036

Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

231 of 328

Radiochemistry Gravimetric Worksheet

ALS Environmental -- FC

Prep Batch: **AB121109-1**

Prep Procedure: **GAB**

Reviewed By: jtl *SN*

Review Date: 11/15/2012

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1223001-1	SMP	10	9.1050	0.0000	0	200	200	200	9.1283	23.3	0.5	
1	2	1223001-2	SMP	10	9.0995	0.0000	0	200	200	200	9.1216	22.1	0.5	
1	3	1223001-3	SMP	10	9.0872	0.0000	0	200	200	200	9.1082	21	0.5	
1	4	1223001-4	SMP	10	9.1198	0.0000	0	200	200	200	9.1426	22.8	0.5	
1	5	1223001-5	SMP	10	9.1442	0.0000	0	200	200	200	9.1669	22.7	0.5	
1	6	1223001-6	SMP	10	9.1142	0.0000	0	200	200	200	9.1627	48.5	1	
1	7	1223001-7	SMP	10	9.1346	0.0000	0	200	200	200	9.1821	47.5	1	
1	8	1223001-8	SMP	10	9.0877	0.0000	0	200	200	200	9.1314	43.7	1.5	
1	9	1223001-9	SMP	10	9.0922	0.0000	0	200	200	200	9.1383	46.1	1.5	
1	10	1223001-10	SMP	10	9.0712	0.0000	0	200	200	200	9.1347	63.5	2	
1	11	1223001-11	SMP	10	9.1302	0.0000	0	200	200	200	9.2113	81.1	2	
1	12	1223001-12	SMP	10	9.1044	0.0000	0	200	200	200	9.1980	93.6	2.5	
1	13	1223001-13	SMP	10	9.1418	0.0000	0	200	200	200	9.2370	95.2	2.5	
1	14	1223001-14	SMP	10	9.1031	0.0000	0	200	200	200	9.2192	116.1	3	
1	15	1223001-15	SMP	10	9.1182	0.0000	0	200	200	200	9.2089	90.7	3	
1	16	1223001-16	SMP	10	9.1173	0.0000	0	200	200	200	9.2515	134.2	3.5	
1	17	1223001-17	SMP	10	9.0956	0.0000	0	200	200	200	9.2298	134.2	3.5	
1	18	1223001-18	SMP	10	9.1276	0.0000	0	200	200	200	9.2792	151.6	4	
1	19	1223001-19	SMP	10	9.1131	0.0000	0	200	200	200	9.2691	156	4	
1	20	1223001-20	SMP	10	9.0751	0.0000	0	200	200	200	9.0964	21.3	0.5	
1	21	1223001-21	SMP	10	9.1113	0.0000	0	200	200	200	9.1331	21.8	0.5	
1	22	1223001-22	SMP	10	9.0713	0.0000	0	200	200	200	9.0910	19.7	0.5	
1	23	1223001-23	SMP	10	9.1326	0.0000	0	200	200	200	9.1531	20.5	0.5	
1	24	1223001-24	SMP	10	9.1320	0.0000	0	200	200	200	9.1532	21.2	0.5	
1	25	1223001-25	SMP	10	9.1188	0.0000	0	200	200	200	9.1399	21.1	0.5	
1	26	1223001-26	SMP	10	9.0872	0.0000	0	200	200	200	9.1087	21.5	0.5	
1	27	1223001-27	SMP	10	9.1133	0.0000	0	200	200	200	9.1340	20.7	0.5	

232 of 328

Gross α standards

no	std					
21.3	1	20mg R1	0.5ml salt, 0.1ml 955,4095.10		.0751	.0964
1.8	2	R2			.1113	.1331
9.7	3	R3			.0713	.0910
20.5	4	R4			.1326	.1531
21.2	5	R5			.1320	.1532
21.1	6	20mg + U	0.05ml of 10mg/ml rat. U		.1188	.1399
21.5	7				.0872	.1087
20.7	8				.1133	.134

OUTLIER TEST

FILE	DET	SAMPLE ID	Alpha CPM	Relative % diff. from mean	Within acceptability range	Outlier?
ABA1118	A1(1)	1223001-20	1163.818	0.71%	YES	NO
ABA1118A	A1(1)	1223001-21	1074.100	8.36%	YES	OUTLIER!
ABA1118B	A1(1)	1223001-22	1248.300	6.50%	YES	NO
ABA1118C	A1(1)	1223001-23	1203.900	2.71%	YES	NO
ABA1119	A1(1)	1223001-24	1170.500	0.14%	YES	NO

Mean of all five plachets:

Average= 1172.12 Upper
 Std dev= 64.21220433 Lower
 2 Std Dev= 128.42

Acceptability range

1300.55
 1043.70

relative range

+/- 10.96%

10.96%

Sample 1223001-21 rejected as outlier.

Criteria: Potential outliers fall outside acceptability range; which is the mean of all five measurements +/- 2 std dev per the Grubbs statistical test.

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Rev.12/29/03 JE

Data file name: ABA1118
 Batch ID: OUTLIER TEST
 Count Preset (m): 11
 Batch Ended: 11/18/12 16:44

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b'm^a(a'(mass-x^0))$	Beta Attenuation Calibration $y = b'm^a(a'(mass-x^0))$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.89320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b'm^a-x$	Beta to Alpha X-talk $y = b'mass + m$
a -> b xtalk b= 0.2550	b -> a xtalk b= -5.800E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity						Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-20	11/18/12 16:44	11.00	21.3	1163.818	0.114	0.060	0.2633	0.890	n/a	n/a	300.818	1.998	296.6420	0.3879	0.992	n/a	n/a

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-AW
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Rev. 12/29/03 JE

Data file name: ABA1118A
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:02

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m \cdot (a \cdot \text{mass} - x_0)$	Beta Attenuation Calibration $y = b \cdot m \cdot (a \cdot \text{mass} - x_0)$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.800E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
A1	1223001-21	11/18/12 17:02	10.00	21.8	1074.100	0.114	0.056	0.2833	0.887	n/a	n/a	280.100	1.998	273.7444	0.3879	0.992	n/a	n/a		

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Rev.12/29/03 JE

Data file name: ABA1118B
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:13

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a \cdot [a \cdot (\text{mass} - x_0)]$	Beta Attenuation Calibration $y = b \cdot m^a \cdot [a \cdot (\text{mass} - x_0)]$
Alpha b= 1.02810 m= 0.99328 a= 0.9951 x0= 0.0000	Beta b= 1.0002 m= 0.9995 a= 0.7685 x0= 0.0008
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560 a -> b xtalk m= 1.0002	b -> a xtalk b= -5.900E-09 b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity						Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-22	11/18/12 17:13	10.00	19.7	1248.300	0.114	0.070	0.2833	0.899	n/a	n/a	350.400	1.998	318.2792	0.3879	0.993	n/a	n/a

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1118C
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:37

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b'm^a [a'(mass-x_0)]$	Beta Attenuation Calibration $y = b'm^a [a'(mass-x_0)]$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b'm^a \cdot x$	Beta to Alpha X-talk $y = b'm^a + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.900E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
A1	1223001-23	11/18/12 17:37	10.00	20.5	1203.900	0.114	0.065	0.2633	0.895	n/a	n/a	332.000	1.998	306.9084	0.3879	0.992	n/a	n/a		

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-AW
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1119
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/19/12 9:42

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a [a \cdot (\text{mass} - x_0)]$	Beta Attenuation Calibration $y = b \cdot m^a [a \cdot (\text{mass} - x_0)]$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99326	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.900E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity						Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-24	11/19/12 9:42	10.00	21.2	1170.500	0.114	0.066	0.2633	0.890	n/a	n/a	331.800	1.998	298.3512	0.3879	0.992	n/a	n/a

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Prep Procedure: **GAB** *EFF CAL SET Drinking H₂O / Sr-90* Analytical QASS / NCR? Y / N _____

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1118005-1	SMP	200	200	ml	PC/L												<i>OUTLIER</i>
1	1118005-2	SMP	200	200	ml	PC/L												
1	1118005-3	SMP	200	200	ml	PC/L												
1	1118005-4	SMP	200	200	ml	PC/L												
1	1118005-5	SMP	200	200	ml	PC/L												
1	1118005-6	SMP	200	200	ml	PC/L												
1	1118005-7	SMP	200	200	ml	PC/L												<i>OUTLIER</i>
1	1118005-8	SMP	200	200	ml	PC/L												<i>JP 6/13/11</i>
1	1118005-9	SMP	200	200	ml	PC/L												
1	1118005-10	SMP	200	200	ml	PC/L												

if 90

See Maintenance Log 3710 pg 82

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009

Sample Barcodes

1118005-1 AB110616-3PS1	1118005-2 AB110616-3PS2	1118005-3 AB110616-3PS3
1118005-4 AB110616-3PS4	1118005-5 AB110616-3PS5	1118005-6 AB110616-3PS6
1118005-7 AB110616-3PS7	1118005-8 AB110616-3PS8	1118005-9 AB110616-3PS9
1118005-10 AB110616-3PS10		

240 of 328

Reporting Units

LabID:	TstGrpName:	RptUnits:
1118005-1	GrossAlpha/Beta	PCI/L
1118005-2	GrossAlpha/Beta	PCI/L
1118005-3	GrossAlpha/Beta	PCI/L
1118005-4	GrossAlpha/Beta	PCI/L
1118005-5	GrossAlpha/Beta	PCI/L
1118005-6	GrossAlpha/Beta	PCI/L
1118005-7	GrossAlpha/Beta	PCI/L
1118005-8	GrossAlpha/Beta	PCI/L
1118005-9	GrossAlpha/Beta	PCI/L
1118005-10	GrossAlpha/Beta	PCI/L

241 of 328

Radiochemistry Instrument Worksheet

Prep Batch: AB110616-3

ALS Environmental -- FC

Prep Procedure: GAB

Calib. SET (GROSS B) (GROSS X DPK 1120) OUTLIER TEST











Analytical QASS / NCR? Y / N

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
1	1118005-1	SMP	200	200	ml	PCVL	X	ABC0621	F	11	5	X					OUTLIER
1	1118005-2	SMP	200	200	ml	PCVL			G	11	5						
1	1118005-3	SMP	200	200	ml	PCVL			H	11	5						
1	1118005-4	SMP	200	200	ml	PCVL			I	11	5						
1	1118005-5	SMP	200	200	ml	PCVL			J	11	5						
1	1118005-6	SMP	200	200	ml	PCVL		ABC0621	A	6	5						
1	1118005-7	SMP	200	200	ml	PCVL	X		B	6	5	X					OUTLIER
1	1118005-8	SMP	200	200	ml	PCVL			C	6	5						
1	1118005-9	SMP	200	200	ml	PCVL			D	6	5						
1	1118005-10	SMP	200	200	ml	PCVL			E	6	5						

X Rejected as OUTLIER
5/6/21/11

Spike Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Pipet ID
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	RS-005
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	RS-009

Sample Barcodes

1118005-1 AB110616-3PS1		1118005-2 AB110616-3PS2		1118005-3 AB110616-3PS3	
1118005-4 AB110616-3PS4		1118005-5 AB110616-3PS5		1118005-6 AB110616-3PS6	
1118005-7 AB110616-3PS7		1118005-8 AB110616-3PS8		1118005-9 AB110616-3PS9	
1118005-10 AB110616-3PS10					

242 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Reporting Units

LabID:	TstGrpName:	RptUnits:
1118005-1	GrossAlpha/Beta	PCI/L
1118005-2	GrossAlpha/Beta	PCI/L
1118005-3	GrossAlpha/Beta	PCI/L
1118005-4	GrossAlpha/Beta	PCI/L
1118005-5	GrossAlpha/Beta	PCI/L
1118005-6	GrossAlpha/Beta	PCI/L
1118005-7	GrossAlpha/Beta	PCI/L
1118005-8	GrossAlpha/Beta	PCI/L
1118005-9	GrossAlpha/Beta	PCI/L
1118005-10	GrossAlpha/Beta	PCI/L

243 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-8

Prep Procedure: **GAB**

Reviewed By: gdw *GDW*

Review Date: 6/20/2011

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Gabriel D. Wagner *GDW* Balance: _____
 Prep SOP: NONE Prep Date: 6/16/2011 Balance: _____
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118005-1	SMP		200	200	Unfiltered	S1	
2	1	1118005-2	SMP		200	200	Unfiltered	S1	
3	1	1118005-3	SMP		200	200	Unfiltered	S1	
4	1	1118005-4	SMP		200	200	Unfiltered	S1	
5	1	1118005-5	SMP		200	200	Unfiltered	S1	
6	1	1118005-6	SMP		200	200	Unfiltered	S2	
7	1	1118005-7	SMP		200	200	Unfiltered	S2	
8	1	1118005-8	SMP		200	200	Unfiltered	S2	
9	1	1118005-9	SMP		200	200	Unfiltered	S2	
10	1	1118005-10	SMP		200	200	Unfiltered	S2	

GDW
6/20/11

GDW
6/20/11

Comments
 Gross alpha and beta zero mass efficiency. Direct spike onto planchet along with concentrated HNO₃. *(Into desiccator on 6/20/11 @ 13:00 gdw 6/20/11)*

Spiked By: Gabriel D. Wagner *GDW* Date: 6/20/2011
 Witnessed By: Justin D. Anderson Date: 6/20/2011

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009

Reagent Solution IDs:

J12036

Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

244 of 318

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110616-3

Prep Procedure: **GAB**

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 702 Rev: 20 Prep Analyst: Gabriel D. Wagner *GDW* Balance: _____

Prep SOP: NONE Prep Date: 6/16/2011 Balance: _____

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118005-1	SMP		200	200	Unfiltered	S1	
2	1	1118005-2	SMP		200	200	Unfiltered	S1	
3	1	1118005-3	SMP		200	200	Unfiltered	S1	
4	1	1118005-4	SMP		200	200	Unfiltered	S1	
5	1	1118005-5	SMP		200	200	Unfiltered	S1	
6	1	1118005-6	SMP		200	200	Unfiltered	S2	
7	1	1118005-7	SMP		200	200	Unfiltered	S2	
8	1	1118005-8	SMP		200	200	Unfiltered	S2	
9	1	1118005-9	SMP		200	200	Unfiltered	S2	
10	1	1118005-10	SMP		200	200	Unfiltered	S2	

Comments

Gross alpha and beta zero mass efficiency. Direct spike onto planchet along with concentrated HNO₃.

TRAVAS

Designated on 06/20/11 13:00

Spiked By: *GDW* Date: *06/20/11*
 Witnessed By: *JPA* Date: *6/29/11*

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.831	DPM/ml	06/16/11	1	ml	RS-005
S2	Th-230	853.3020.89	1,166.342	DPM/ml	06/16/11	5	ml	RS-009

EXP. 4/1/12
EXP. 11/19/11

Reagent Solution IDs:

J12036

Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

245 of 328

OUTLIER TEST

FILE	DET	SAMPLE ID	Beta CPM	Relative % diff. from mean	Within acceptability range	Outlier?
ABC0621F	C3(11)	1118005-1	3650.0	1.94%	YES	OUTLIER!
ABC0621G	C3(11)	1118005-2	3736	0.37%	YES	NO
ABC0621H	C3(11)	1118005-3	3676.67	1.22%	YES	NO
ABC0621I	C3(11)	1118005-4	3757.67	0.95%	YES	NO
ABC0621J	C3(11)	1118005-5	3790.67	1.84%	YES	NO

Mean of all five plachets:

Average= 3722.20

Std dev= 57.927

2 Std Dev= 115.85

Upper

Lower

Acceptability range

3838.05

3606.35

Relative range

+/- 3.11%

3.11%**Sample 1118005-1 rejected as outlier.**

Criteria: Potential outliers fall outside acceptability range; which is the mean of all five measurements +/- 2 std dev per the Grubbs statistical test.

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Rev.12/01/08 JCP

Data file name: ABC0621F
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 9:59

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b \cdot m^a \cdot (a' \cdot (\text{mass} - x0))$	$y = b \cdot m^a \cdot (a' \cdot (\text{mass} - x0))$
Alpha b= 1.14100	Beta b= 1.0680
m= 0.99380	m= 0.9990
a= 0.9950	a= 0.9920
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk	Beta to Alpha X-talk
$y = b \cdot m^a \cdot \text{mass}$	$y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2779	b -> a xtalk b= -1.05E-05
a -> b xtalk m= 1.0004	b -> a xtalk m= 0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-1	6/21/2011 9:59	3.00	0.0	2.667	0.064	8.391	0.2180	1.141	n/a	n/a	3650.000	1.727	0.7233	0.4712	1.066	n/a	n/a

5
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: Standard
 Rev.12/01/08 JCP

Data file name: ABC0621G
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:03

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b \cdot m^a (a^{(mass-x0)})$		$y = b \cdot m^a (a^{(mass-x0)})$	
Alpha b=	1.14100	Beta b=	1.0680
m=	0.99380	m=	0.9990
a=	0.9950	a=	0.9920
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk		Beta to Alpha X-talk	
$y = b \cdot m^a \cdot mass$		$y = b \cdot mass + m$	
a -> b xtalk b=	0.2779	b -> a xtalk b=	-1.05E-05
a -> b xtalk m=	1.0004	b -> a xtalk m=	0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-2	6/21/2011 10:03	3.00	0.0	4.333	0.064	8.589	0.2180	1.141	n/a	n/a	3736.000	1.727	1.1864	0.4712	1.068	n/a	n/a

8
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC0621H
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:07

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha Attenuation Calibration		Beta Attenuation Calibration	
$y = b * m^{a * (mass - x0)}$		$y = b * m^{a * (mass - x0)}$	
Alpha b=	1.14100	Beta b=	1.0680
m=	0.99380	m=	0.9990
a=	0.9950	a=	0.9920
x0=	0.0000	x0=	0.0000
Alpha to Beta X-talk $y = b * m^{a * mass}$		Beta to Alpha X-talk $y = b * mass + m$	
a -> b xtalk b=	0.2779	b -> a xtalk b=	-1.05E-05
a -> b xtalk m=	1.0004	b -> a xtalk m=	0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-3	6/21/2011 10:07	3.00	0.0	2.667	0.064	8.452	0.2180	1.141	n/a	n/a	3676.667	1.727	0.7233	0.4712	1.068	n/a	n/a

8
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC06211
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:11

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b \cdot m^a (a \cdot (\text{mass} - x_0))$	$y = b \cdot m^a (a \cdot (\text{mass} - x_0))$
Alpha b= 1.14100	Beta b= 1.0680
m= 0.99380	m= 0.9990
a= 0.9950	a= 0.9920
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk	Beta to Alpha X-talk
$y = b \cdot m^a \cdot \text{mass}$	$y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2779	b -> a xtalk b= -1.05E-05
a -> b xtalk m= 1.0004	b -> a xtalk m= 0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
C3	1118005-4	6/21/2011 10:11	3.00	0.0	2.000	0.064	8.639	0.2180	1.141	n/a	n/a	3757.667	1.727	0.5380	0.4712	1.068	n/a	n/a

S
6/27/11

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Application Version: Standard
 Rev.12/01/08 JCP

Data file name: ABC0621J
 Batch ID: SR90 OUTLIER TEST
 Count Preset (m): 3
 Batch Ended: 6/21/2011 10:15

Background logfile: BKGABW
 Date of Bkg. Cal: 6/16/2011
 Alpha efficiency logfile: Am-241R-06/10
 Alpha attenuation calibration: AAM0611/12/14
 Beta efficiency logfile: Sr-89-06/11
 Beta attenuation calibration: ASR0610/0611

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b * m^a (a' (mass - x0))$	$y = b * m^a (a' (mass - x0))$
Alpha b = 1.14100	Beta b = 1.0680
m = 0.99380	m = 0.9990
a = 0.9950	a = 0.9920
x0 = 0.0000	x0 = 0.0000
Alpha to Beta X-talk	Beta to Alpha X-talk
$y = b * m^a - mass$	$y = b * mass + m$
a -> b xtalk b = 0.2779	b -> a xtalk b = -1.05E-05
a -> b xtalk m = 1.0004	b -> a xtalk m = 0.0023

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
C3	1118005-5	6/21/2011 10:15	3.00	0.0	2.667	0.064	8.715	0.2180	1.141	n/a	n/a	3790.667	1.727	0.7233	0.4712	1.068	n/a	n/a		

8
6/27/11

MEL 11/8/11

Prepare a working dilution of 955, Am-241

1. Density of 1M HCl, lot # K22032

Mass of 100mL vol. flask:	<u>66.4295g</u>	Balance #	<u>12</u>
Mass of flask & 100mL acid:	<u>167.9701g</u>	Balance#	<u>12</u>
Net Mass:	<u>101.5406g</u>		
Density:	<u>1.0154g/mL</u>		

2. Mass of 955 transferred:

Mass of empty voa vial:	<u>21.3568g</u>	Balance#	<u>12</u>
Mass of voa vial & standard:	<u>26.4318g</u>	Balance#	<u>12</u>
Net mass of standard transferred:	<u>5.0750g</u>		

MEL 11/8/11

MEL 11/8/11

3. Dilute to final volume:

Mass of vial, standard, & diluent:	<u>42.8085g</u>	Balance#	<u>12</u>
Mass of empty voa vial:	<u>21.3568g</u>	Balance#	<u>12</u>
Net mass of new dilution:	<u>21.4517g</u>		

4. Final activity calculation:

$$(1.965 \times 10^4 \text{ Bq}) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{5.0750 \text{ g}}{5.1341 \text{ g}} \right) \left(\frac{1.0154 \text{ g/mL}}{21.4517 \text{ g}} \right) = 55,161.32 \text{ dpm/mL}$$

MEL 11/8/11
55,161.33 dpm/mL

MEL 11/8/11

Std ID: 955.4095.10

RG 11/29/11

RG 11/29/11

Description: Am-241

Expiration: 11/11/2012

Activity: 55161.33 dpm/mL

2s Uncertainty: 992.90 dpm/mL

Ref. Date: 10/25/2011

Ref Time: N/A

Prep Date: 11/8/2011 Prep by: MEL

Matrix/Comp. 3M HCl

Half Life (y): 4.33E+02

RG 11/29/11

RG 11/29/11

Reverification Log		
Analysis Date	Initials	Expiration Date

Continued on Page

Megan Jones
Signed

11/8/11
Date

Read and Understood By
Rance Holley
Signed

11/29/11
252 of 328



Eckert & Ziegler
Analytics

RS# 955
Rec 10-31-11

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

85983-307

Am-241 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u _A	u _B	U	
Am-241	1.580E+05	1.965E+04	0.1	0.9	1.8	10/25/2011

*Uncertainty: U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %, α -impurities < 0.1 %. 5.13441 g 1M HCl solution, carrier free.

Source Prepared by: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 26 Oct 11

ANA Form005 Rev. 11

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

Prepare a primary dilution of RSO #777 (Analytics #69573-307) in 0.1M HCl to a final volume of approx. 500 mL

1) Prepare 0.1M HCl by diluting 8.3 ml HCl (12M) (Fisher Scientific Lot # 055784) to a final volume of 1L.

2) Determine the density of 0.1M HCl

Weight of empty volumetric flask (100ml) 68.54g
 Mass of flask + 100ml 0.1M HCl 1168.31g
 Mass of 100ml of 0.1M HCl 99.77g
 $\div 100\text{ml} = \text{density} =$ 0.9977

3) Transfer #777 to a 500mL

Mass of bottle 47.9687
 Mass of bottle + std. 52.9160
 Mass of std. 4.9473

4) Dilute to volume w/ 0.1M HCl

Mass of bottle + std. + soln 494.52g
 Mass of bottle (from above) -47.9687g
 Mass of soln 446.55g

5) Final activity (dpm/mL)

$$\frac{(3.812 \times 10^4 \text{ dps}) \left(\frac{60 \text{ sec}}{1 \text{ min}} \right) (4.9473 \text{ g})}{(5.0556 \text{ g}) - (47.9687 \text{ g})} = \frac{5040.94 \text{ dpm}}{5008.25 \text{ g}}$$

$$5040.94 \text{ dpm} \times 0.9977 \text{ g} = 4999.42 \text{ dpm}$$

$$\frac{4999.42 \text{ dpm}}{5008.25 \text{ g}} = 4996.73 \text{ dpm/mL}$$

Reverification Log	Analysis Date	Initials	Expiration Date
	7/7/11	RG	7/7/11
	4/1/12	RG	4/1/12
	7/7/10		11/1/11
	4/1/11		

Std ID: 777.3020.11
 Description: Sr-90
 Expiration: 2/27/07
 Activity: 4996.73

2s Uncertainty: 99.93
 Ref. Date: 12/2/04
 Ref Time: N/A
 Prep Date: 2/8/06
 Matrix/Comp: 0.1 M HCl
 Half Life (y): 2.88E+01

dpm/mL
 dpm/mL
 rep by: HB
 NEW EXP. DATE = 2/8/06
 Read and Understood:

Reverification Log	Analysis Date	Initials	Expiration Date
	11/8/06	RG	11/8/07
	8/3/07	JCS	8/3/08
	2/28/08	MBC	2/25/09
	1/30/09	RG	1/30/2010
	7/17/09	RG	7/17/2010

Christine Barker
 Signed

[Signature]
 Date

2/8/06
 Signed

ANALYTICS

RSO #777
Rec'd 12/9/04
JCB

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 • U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

69573-307

Sr-90 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE: Sr-90
ACTIVITY (dps): 3.812 E4
HALF-LIFE: 28.79 years
CALIBRATION DATE: December 2, 2004 12:00 EST
RELATIVE EXPANDED
UNCERTAINTY (k=2): 2.0%

Impurities: γ -impurities <0.1%

5.05960 grams in 0.1M HCl solution with 30 μ g/g Sr carrier.

This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

P O NUMBER 71069, Item 1

SOURCE PREPARED BY:

M. Dimitrova
M. Dimitrova, Radiochemist

Q A APPROVED:

JM [Signature] 12-6-04

Mass Attenuation Curves

LB4100C Alpha Attenuation Curve -- Am-241

WO #	1223001		
Mass Range	Low	21.0	mg
	High	156.0	mg

Spike Information			
Std. ID	955.4095.10		
Ref. Date	10/25/2011		
Half-life	433		
Activity	55161.33	dpm/mL	yr
Vol.	0.1 mL		
Act. Added	5516.13 dpm		

Attenuation Equation $y=b^m(a^x)(x-x_0)$					
b =	0.8949				
m =	0.9914				
a =	0.9119				
x ₀	21.448				
% Diff Max. = 14.9%					

Cross-Talk Equation $y=b^m \cdot x$			
b =	0.2414		
m =	0.9990		
% Diff Max. = 16.0%			

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Alpha CPM	Beta CPM	Base Alpha Eff.	Decay Corr. Act added dpm/mL	Alpha EFF Actual	Alpha Att. Fitted EFF	Actual/Fit Ratio	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\alpha > \beta$ TIK Actual	$\alpha > \beta$ TIK Fitted	% Diff.
AAM0606	A1	1223001-3	21	6/11/2017 8:18	10011	2845	8.75	1144.0363	323.7069	0.2015	5466.64	0.2093	0.1810	0.8647	1.0386	0.8980	-13.5%	0.2630	0.2463	13.0%
AAM0611	A2	1223001-3	21	6/11/2017 8:48	10012	2643	8.65	1157.3626	304.2131	0.2221	5466.64	0.2117	0.1995	0.9421	0.9532	0.8980	5.8%	0.2629	0.2463	6.3%
AAM0610	A3	1223001-3	21	6/10/2017 10:19	10012	2671	8.61	1162.7379	308.7107	0.2101	5466.66	0.2127	0.1887	0.8871	1.0124	0.8980	11.3%	0.2655	0.2463	7.2%
AAM0610	A4	1223001-3	21	6/10/2017 10:49	10004	2690	8.58	1165.8844	311.9878	0.2068	5466.66	0.2133	0.1857	0.8708	1.0313	0.8980	12.9%	0.2676	0.2463	8.0%
AAM0610	B1	1223001-3	21	6/10/2017 11:17	10016	2665	8.89	1106.5682	298.1620	0.1965	5466.66	0.2024	0.1765	0.8718	1.0301	0.8980	12.8%	0.2694	0.2463	8.6%
AAM0610	B2	1223001-3	21	6/10/2017 11:47	10011	2699	8.87	1128.5189	302.6341	0.2192	5466.66	0.2064	0.1968	0.9535	0.9418	0.8980	4.6%	0.2682	0.2463	8.2%
AAM0610	B3	1223001-3	21	6/10/2017 12:15	10003	2830	8.85	1130.1985	318.2290	0.2040	5466.66	0.2067	0.1832	0.8881	1.0134	0.8980	11.4%	0.2816	0.2463	12.5%
AAM0610	B4	1223001-3	21	6/10/2017 12:47	10009	2817	8.94	1119.4749	313.5097	0.2008	5466.66	0.2048	0.1803	0.8906	1.0198	0.8980	11.0%	0.2801	0.2463	12.1%
AAM0610	C1	1223001-3	21	6/10/2017 13:15	10012	2882	8.83	1133.7518	324.8473	0.2054	5466.66	0.2074	0.1845	0.8894	1.0097	0.8980	11.1%	0.2885	0.2463	14.0%
AAM0610	C2	1223001-3	21	6/10/2017 13:45	10012	2724	8.67	1164.6748	312.5279	0.2232	5466.66	0.2112	0.2004	0.9490	0.9463	0.8980	5.1%	0.2707	0.2463	9.0%
AAM0610	C3	1223001-3	21	6/10/2017 14:14	10007	2821	8.82	1134.4845	318.2013	0.2134	5466.66	0.2075	0.1916	0.9234	0.9725	0.8980	7.7%	0.2805	0.2463	12.2%
AAM0610	C4	1223001-3	21	6/10/2017 14:42	10012	2622	8.62	1121.3439	301.2793	0.2042	5466.66	0.2051	0.1834	0.8940	1.0045	0.8980	10.6%	0.2687	0.2463	8.3%
AAM0610	D1	1223001-3	21	6/10/2017 15:12	10012	2751	9.08	1102.5482	301.3596	0.1946	5466.66	0.2017	0.1748	0.8665	1.0364	0.8980	13.4%	0.2733	0.2463	9.9%
AAM0610	D2	1223001-3	21	6/10/2017 15:40	10006	2724	9.96	1116.6541	302.4109	0.2166	5466.66	0.2043	0.1945	0.9522	0.9431	0.8980	4.8%	0.2708	0.2463	9.1%
AAM0611	D3	1223001-3	21	6/11/2017 7:21	10014	2651	8.89	1126.2632	296.5352	0.2056	5466.64	0.2060	0.1846	0.8962	1.0021	0.8980	10.4%	0.2633	0.2463	6.5%
AAM0611	D4	1223001-3	21	6/11/2017 7:49	10010	2611	8.75	1113.8990	296.7930	0.1996	5466.64	0.2038	0.1792	0.8797	1.0209	0.8980	12.0%	0.2664	0.2463	7.6%
AAM0611	A1	1223001-2	22.1	6/11/17 8:48	10005	2949	9.30	1075.7285	315.6608	0.2015	5466.64	0.1968	0.1794	0.9117	0.9766	0.8903	8.8%	0.2934	0.2465	16.0%
AAM0610	A2	1223001-2	22.1	6/10/2017 10:20	10011	2646	9.4	1064.9060	280.1534	0.2221	5466.66	0.1948	0.1771	0.1051	0.8771	0.8903	-1.5%	0.2631	0.2465	6.3%
AAM0610	A3	1223001-2	22.1	6/10/2017 10:50	10010	2806	9.32	1073.9383	299.5630	0.2101	5466.66	0.1965	0.1871	0.9522	0.9350	0.8903	4.8%	0.2789	0.2465	11.6%
AAM0610	A4	1223001-2	22.1	6/10/2017 11:18	10006	2746	9.25	1081.6467	295.3329	0.2068	5466.66	0.1979	0.1841	0.9305	0.9568	0.8903	6.9%	0.2730	0.2465	9.7%
AAM0610	B1	1223001-2	22.1	6/10/2017 11:47	10010	2636	9.33	1072.7922	280.9165	0.1965	5466.66	0.1962	0.1749	0.8915	0.9987	0.8903	10.9%	0.2619	0.2465	5.8%
AAM0610	B2	1223001-2	22.1	6/10/2017 12:16	10015	2861	9.74	1028.1171	292.0872	0.2192	5466.66	0.1881	0.1952	1.0377	0.8580	0.8903	-3.8%	0.2841	0.2465	13.2%
AAM0610	B3	1223001-2	22.1	6/10/2017 12:48	10015	2791	9.70	1032.3902	286.1700	0.2040	5466.66	0.1889	0.1816	0.9617	0.9257	0.8903	3.8%	0.2772	0.2465	11.1%
AAM0610	B4	1223001-2	22.1	6/10/2017 13:16	10010	2876	9.68	1033.9909	295.5164	0.2008	5466.66	0.1891	0.1788	0.9452	0.9420	0.8903	5.5%	0.2858	0.2465	13.7%
AAM0610	C1	1223001-2	22.1	6/10/2017 13:45	10006	2702	9.18	1089.8682	292.7955	0.2054	5466.66	0.1994	0.1829	0.9173	0.9706	0.8903	8.3%	0.2687	0.2465	8.2%
AAM0610	C2	1223001-2	22.1	6/10/2017 14:14	10006	2799	9.28	1078.1208	299.9574	0.2232	5466.66	0.1972	0.1987	1.0076	0.8836	0.8903	-0.8%	0.2782	0.2465	11.4%
AAM0610	C3	1223001-2	22.1	6/10/2017 14:43	10005	2730	9.30	1075.7105	291.9084	0.2134	5466.66	0.1968	0.1900	0.9655	0.9221	0.8903	3.4%	0.2714	0.2465	9.1%
AAM0610	C4	1223001-2	22.1	6/10/2017 15:12	10003	2871	9.51	1051.6992	298.9957	0.2042	5466.66	0.1924	0.1818	0.9450	0.9421	0.8903	5.5%	0.2843	0.2465	13.3%
AAM0610	D1	1223001-2	22.1	6/10/2017 15:41	10015	2849	9.62	1040.9853	294.5398	0.1946	5466.66	0.1904	0.1733	0.9099	0.9785	0.8903	9.0%	0.2829	0.2465	12.9%
AAM0611	D2	1223001-2	22.1	6/11/2017 7:21	10018	2715	9.57	1046.7260	282.0921	0.2166	5466.64	0.1915	0.1928	1.0071	0.8840	0.8903	-0.7%	0.2695	0.2465	8.5%
AAM0611	D3	1223001-2	22.1	6/11/2017 7:50	10007	2667	9.43	1061.0167	281.1558	0.2056	5466.64	0.1941	0.1830	0.9431	0.9440	0.8903	5.7%	0.2650	0.2465	7.0%
AAM0611	D4	1223001-2	22.1	6/11/2017 8:19	10015	2640	9.44	1060.8100	278.0540	0.1998	5466.64	0.1941	0.1777	0.9158	0.9722	0.8903	8.4%	0.2621	0.2465	5.9%
AAM0610	A1	1223001-1	23.3	6/10/2017 10:21	10002	2654	10.60	943.5069	248.9414	0.2015	5466.66	0.1728	0.1777	1.0297	0.8565	0.8820	-3.0%	0.2638	0.2468	6.4%
AAM0610	A2	1223001-1	23.3	6/10/2017 10:51 AM	10011	2636	10.64	940.78946	246.4084	0.2221	5466.66	0.1721	0.1959	1.1383	0.7749	0.8820	-13.8%	0.2619	0.2468	5.8%
AAM0610	A3	1223001-1	23.3	6/10/2017 11:19	10005	2838	10.81	925.4359	261.0247	0.2101	5466.66	0.1693	0.1853	1.0946	0.8057	0.8820	-9.5%	0.2821	0.2468	12.5%
AAM0610	A4	1223001-1	23.3	6/10/2017 11:48	10011	2832	10.47	956.0775	268.9551	0.2068	5466.66	0.1749	0.1824	1.0429	0.8457	0.8820	-4.3%	0.2813	0.2468	12.3%
AAM0610	B1	1223001-1	23.3	6/10/2017 12:18	10000	2784	10.99	909.8271	251.7082	0.1965	5466.66	0.1664	0.1733	1.0413	0.8470	0.8820	-4.1%	0.2767	0.2468	10.8%
AAM0610	B2	1223001-1	23.3	6/10/2017 12:49	10006	2895	11.14	928.0877	258.2243	0.2192	5466.68	0.1698	0.1933	1.1388	0.7745	0.8820	-13.9%	0.2782	0.2468	11.3%
AAM0610	B3	1223001-1	23.3	6/10/2017 13:17	10010	2836	10.89	919.1079	258.8774	0.2040	5466.68	0.1681	0.1799	1.0702	0.8242	0.8820	-7.0%	0.2817	0.2468	12.4%
AAM0610	B4	1223001-1	23.3	6/10/2017 13:47	10014	2885	10.89	919.4592	263.3309	0.2008	5466.66	0.1682	0.1771	1.0530	0.8376	0.8820	-5.3%	0.2864	0.2468	13.8%
AAM0610	C1	1223001-1	23.3	6/10/2017 14:15	9999	2813	10.41	960.4087	268.6809	0.2054	5466.66	0.1757	0.1812	1.0312	0.8553	0.8820	-3.1%	0.2798	0.2468	11.8%
AAM0610	C2	1223001-1	23.3	6/10/2017 14:44	10004	2876	10.68	936.5921	267.6294	0.2232	5466.66	0.1713	0.1969	1.1490	0.7676	0.8820	-14.9%	0.2857	0.2468	13.6%
AAM0610	C3	1223001-1	23.3	6/10/2017 15:13	10003	2818	10.75	930.4156	260.4995	0.2134	5466.66	0.1702	0.1882	1.1059	0.7976	0.8820	-10.6%	0.2800	0.2468	11.8%
AAM0610	C4	1223001-1	23.3	6/10/2017 15:42	10011	2874	10.93	915.7785	260.0490	0.2042	5466.66	0.1675	0.1801	1.0751	0.8204	0.8820	-7.5%	0.2840	0.2468	13.1%
AAM0611	D1	1223001-1	23.3	6/11/2017 7:23	10003	2691	10.92	915.9306	244.8146	0.1946	5466.64	0.1675	0.1716	1.0244	0.8610	0.8820	-2.4%	0.2673	0.2468	7.7%
AAM0611	D2	1223001-1	23.3	6/11/2017 7:51	10000	2655	10.76	929.2810	245.1402	0.2166	5466.64	0.1700	0.1910	1.1238	0.7848	0.8820	-12.4%	0.2638	0.2468	6.4%
AAM0611	D3	1223001-1	23.3	6/11/2017 8:20	10003	2648	10.68	936.4395	246.2751	0.2056	5466.64	0.1713	0.1813	1.0586	0.8332	0.8820	-5.8%	0.2630	0.2468	6.1%
AAM0611	D4	1223001-1	23.3	6/11/2017 8:50	10020	2739	10.89	920.0092	249.9082	0.1996	5466.64	0.1683	0.1760	1.0480	0.8432	0.8820	-4.6%	0.2716	0.2468	9.1%

LB4100C Alpha Attenuation Curve -- Am-241

WO #	1223001		
Mass Range	Low	21.0 mg	High
		156.0 mg	

Spike Information			
Std. ID	955.4095.10		
Ref. Date	10/25/2011		
Half-life	433		yr
Activity	55161.33	dpm/mL	
Vol.	0.1	mL	
Act. Added	5516.13	dpm	

Attenuation Equation $y=b^m \cdot a^{(x-x_0)}$				
b =	0.8949			
m =	0.9914			
a =	0.9119			
x ₀ =	21.448			
% Diff Max. = 14.9%				

Cross-Talk Equation $y=b^m \cdot x$				
b =	0.2414			
m =	0.9990			
% Diff Max. = 16.0%				

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Alpha CPM	Beta CPM	Base Alpha Eff.	Decay Corr. Act. added dpm/mL	Alpha EFF Actual	Alpha Att. Fitted EFF	Actual/Fit Ratio	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	α > β X Tlk Actual	α > β X Tlk Fitted	% Diff.
AAM0610	A1	1223001-9	46.1	6/10/2017 15:14	10002	2574	11.46	872.6969	223.1713	0.2015	5466.66	0.1596	0.1487	0.9312	0.7923	0.7377	6.9%	0.2557	0.2523	1.3%
AAM0610	A2	1223001-9	46.1	6/10/17 3:43 PM	10007	2535	11.55	866.31293	218.1445	0.2221	5466.66	0.1585	0.1638	1.0339	0.7135	0.7377	-3.4%	0.2518	0.2523	-0.2%
AAM0611	A3	1223001-9	46.1	6/11/2017 7:23	10013	2549	11.38	879.7810	222.4795	0.2101	5466.64	0.1609	0.1550	0.9631	0.7660	0.7377	3.7%	0.2529	0.2523	0.2%
AAM0611	A4	1223001-9	46.1	6/11/2017 7:51	10006	2477	11.03	907.0793	223.0374	0.2068	5466.64	0.1659	0.1526	0.9194	0.8024	0.7377	8.1%	0.2459	0.2523	-2.6%
AAM0611	B1	1223001-9	46.1	6/11/2017 8:21	10002	2626	11.67	856.9784	223.4084	0.1965	5466.64	0.1568	0.1450	0.9247	0.7978	0.7377	7.5%	0.2607	0.2523	3.2%
AAM0611	B2	1223001-9	46.1	6/11/2017 8:50	10016	2483	11.51	870.0828	214.9443	0.2192	5466.64	0.1592	0.1617	1.0160	0.7261	0.7377	-1.6%	0.2470	0.2523	-2.1%
AAM0610	B3	1223001-9	46.1	6/10/2017 10:22	10001	2716	11.70	854.7023	230.5918	0.2040	5466.66	0.1563	0.1505	0.9626	0.7664	0.7377	3.7%	0.2698	0.2523	6.5%
AAM0610	B4	1223001-9	46.1	6/10/2017 10:52	10002	2657	11.82	846.0929	223.1975	0.2008	5466.66	0.1548	0.1481	0.9571	0.7708	0.7377	4.3%	0.2638	0.2523	4.4%
AAM0610	C1	1223001-9	46.1	6/10/2017 11:20	10005	2594	11.43	875.2181	225.4066	0.2054	5466.66	0.1601	0.1515	0.9465	0.7795	0.7377	5.4%	0.2575	0.2523	2.0%
AAM0610	C2	1223001-9	46.1	6/10/2017 11:49	10007	2687	11.53	867.7978	231.3852	0.2232	5466.66	0.1587	0.1647	1.0373	0.7112	0.7377	-3.7%	0.2666	0.2523	5.4%
AAM0610	C3	1223001-9	46.1	6/10/2017 12:18	10011	2478	11.52	868.9144	213.4642	0.2134	5466.66	0.1589	0.1574	0.9905	0.7448	0.7377	1.0%	0.2457	0.2523	-2.7%
AAM0610	C4	1223001-9	46.1	6/10/2017 12:49	10007	2592	11.53	867.7688	221.9079	0.2042	5466.66	0.1587	0.1506	0.9480	0.7774	0.7377	5.1%	0.2557	0.2523	1.3%
AAM0610	D1	1223001-9	46.1	6/10/2017 13:18	10007	2559	11.92	839.4184	213.0672	0.1946	5466.66	0.1536	0.1436	0.9349	0.7891	0.7377	6.5%	0.2538	0.2523	0.6%
AAM0610	D2	1223001-9	46.1	6/10/2017 13:48	10004	2573	11.70	854.9557	218.3075	0.2166	5466.66	0.1564	0.1598	1.0217	0.7220	0.7377	-2.2%	0.2553	0.2523	1.2%
AAM0610	D3	1223001-9	46.1	6/10/2017 14:17	10002	2741	11.74	851.7881	231.8103	0.2056	5466.66	0.1558	0.1517	0.9734	0.7579	0.7377	2.7%	0.2721	0.2523	7.3%
AAM0610	D4	1223001-9	46.1	6/10/2017 14:46	10014	2557	11.79	849.2629	215.2717	0.1996	5466.66	0.1554	0.1473	0.9478	0.7783	0.7377	5.2%	0.2635	0.2523	0.5%
AAM0610	A1	1223001-10	63.5	6/10/2017 14:47	9999	2584	12.92	773.8384	198.5640	0.2015	5466.66	0.1416	0.1297	0.9163	0.7025	0.6437	8.4%	0.2566	0.2565	0.0%
AAM0610	A2	1223001-10	63.5	6/10/17 3:16 PM	10006	2500	13.12	762.55844	189.2128	0.2221	5466.66	0.1395	0.1430	1.0249	0.6281	0.6437	-2.5%	0.2481	0.2565	-3.4%
AAM0610	A3	1223001-10	63.5	6/10/2017 15:44	10009	2685	12.92	774.5944	206.3073	0.2101	5466.66	0.1417	0.1352	0.9545	0.6744	0.6437	4.6%	0.2663	0.2565	3.7%
AAM0611	A4	1223001-10	63.5	6/11/2017 7:24	10011	2570	12.63	792.5536	201.9518	0.2068	5466.64	0.1450	0.1331	0.9182	0.7011	0.6437	8.2%	0.2548	0.2565	-0.7%
AAM0611	B1	1223001-10	63.5	6/11/2017 7:53	10001	2555	13.04	766.8569	194.3226	0.1965	5466.64	0.1403	0.1265	0.9017	0.7139	0.6437	9.8%	0.2534	0.2565	-1.2%
AAM0611	B2	1223001-10	63.5	6/11/2017 8:22	10000	2496	13.15	760.3393	188.1599	0.2192	5466.64	0.1391	0.1411	1.0145	0.6345	0.6437	-1.5%	0.2475	0.2565	-3.7%
AAM0611	B3	1223001-10	63.5	6/11/2017 8:52	10002	2504	12.85	778.2818	193.3188	0.2040	5466.64	0.1424	0.1313	0.9224	0.6979	0.6437	7.8%	0.2484	0.2565	-3.3%
AAM0610	B4	1223001-10	63.5	6/10/2017 10:24	10003	2575	13.13	761.7431	194.5248	0.2008	5466.66	0.1393	0.1293	0.9276	0.6939	0.6437	7.2%	0.2554	0.2565	-0.5%
AAM0610	C1	1223001-10	63.5	6/10/2017 10:53	10005	2676	12.96	771.8807	204.9415	0.2054	5466.66	0.1412	0.1322	0.9364	0.6874	0.6437	6.4%	0.2655	0.2565	3.4%
AAM0610	C2	1223001-10	63.5	6/10/2017 11:21	10005	2579	12.74	785.2098	200.7743	0.2232	5466.66	0.1436	0.1437	1.0003	0.6435	0.6437	0.0%	0.2557	0.2565	-0.3%
AAM0610	C3	1223001-10	63.5	6/10/2017 11:51	10002	2671	13.12	762.2516	201.9423	0.2134	5466.66	0.1394	0.1374	0.9852	0.6534	0.6437	1.5%	0.2649	0.2565	3.2%
AAM0610	C4	1223001-10	63.5	6/10/2017 12:20	10003	2549	13.01	768.7291	193.0292	0.2042	5466.66	0.1406	0.1314	0.9348	0.6886	0.6437	6.5%	0.2511	0.2565	-2.2%
AAM0610	D1	1223001-10	63.5	6/10/2017 12:51	10003	2604	13.26	754.2791	194.7661	0.1946	5466.66	0.1380	0.1253	0.9079	0.7090	0.6437	9.2%	0.2582	0.2565	0.7%
AAM0610	D2	1223001-10	63.5	6/10/2017 13:20	10003	2565	13.36	748.6405	190.3840	0.2166	5466.66	0.1369	0.1394	1.0181	0.6323	0.6437	-1.8%	0.2543	0.2565	-0.9%
AAM0610	D3	1223001-10	63.5	6/10/2017 13:49	10000	2755	13.36	748.3320	204.5476	0.2056	5466.66	0.1369	0.1323	0.9668	0.6658	0.6437	3.3%	0.2733	0.2565	6.1%
AAM0610	D4	1223001-10	63.5	6/10/2017 14:18	9999	2543	13.29	752.2692	189.7399	0.1996	5466.66	0.1376	0.1285	0.9337	0.6894	0.6437	6.6%	0.2522	0.2565	-1.7%
AAM0610	A1	1223001-12	93.6	6/10/2017 13:52	10009	2373	15.97	626.6596	147.1551	0.2015	5466.66	0.1146	0.1025	0.8938	0.5689	0.5085	10.6%	0.2348	0.2640	-12.4%
AAM0610	A2	1223001-12	93.6	6/10/2017 14:21	10003	2318	15.93	627.8407	144.1756	0.2221	5466.66	0.1148	0.1129	0.9834	0.5171	0.5085	1.7%	0.2296	0.2640	-15.0%
AAM0610	A3	1223001-12	93.6	6/10/17 2:50 PM	10008	2500	15.9	629.33796	155.7227	0.2101	5466.66	0.1151	0.1068	0.9280	0.5479	0.5085	7.2%	0.2474	0.2640	-6.7%
AAM0610	A4	1223001-12	93.6	6/10/2017 15:18	10002	2510	15.79	633.3559	157.4294	0.2068	5466.66	0.1159	0.1052	0.9077	0.5602	0.5085	9.2%	0.2486	0.2640	-6.2%
AAM0610	B1	1223001-12	93.6	6/10/2017 15:48	10011	2431	16.31	613.7042	147.4367	0.1965	5466.66	0.1123	0.0999	0.8901	0.5713	0.5085	11.0%	0.2402	0.2640	-9.9%
AAM0611	B2	1223001-12	93.6	6/11/2017 7:28	10003	2473	16.26	615.0737	150.4410	0.2192	5466.64	0.1125	0.1115	0.9907	0.5133	0.5085	0.9%	0.2446	0.2640	-8.0%
AAM0611	B3	1223001-12	93.6	6/11/2017 7:56	10000	2500	16.16	618.7279	153.1580	0.2040	5466.64	0.1132	0.1037	0.9165	0.5548	0.5085	8.3%	0.2475	0.2640	-6.7%
AAM0611	B4	1223001-12	93.6	6/11/2017 8:26	10007	2534	16.47	607.4896	152.2645	0.2008	5466.64	0.1111	0.1021	0.9188	0.5534	0.5085	8.1%	0.2506	0.2640	-5.3%
AAM0611	C1	1223001-12	93.6	6/11/2017 8:55	10001	2603	16.01	624.5621	161.0459	0.2054	5466.64	0.1142	0.1044	0.9142	0.5562	0.5085	8.6%	0.2579	0.2640	-2.4%
AAM0610	C2	1223001-12	93.6	6/10/2017 10:26	10005	2468	15.97	626.3752	152.8808	0.2232	5466.66	0.1146	0.1135	0.9906	0.5134	0.5085	0.8%	0.2441	0.2640	-8.2%
AAM0610	C3	1223001-12	93.6	6/10/2017 10:56	10003	2388	16.08	621.9811	147.4894	0.2134	5466.66	0.1138	0.1085	0.9538	0.5332	0.5085	4.6%	0.2371	0.2640	-11.4%
AAM0610	C4	1223001-12	93.6	6/10/2017 11:24	10001	2469	15.99	625.3124	151.5120	0.2042	5466.66	0.1144	0.1038	0.9078	0.5602	0.5085	9.2%	0.2423	0.2640	-9.0%
AAM0610	D1	1223001-12	93.6	6/10/2017 11:55	10002	2494	16.71	598.4687	147.6379	0.1946	5466.66	0.1095	0.0990	0.9039	0.5626	0.5085	9.6%	0.2467	0.2640	-7.0%
AAM0610	D2	1223001-12	93.6	6/10/2017 12:24	10000	2570	16.97	589.1882	149.8367	0.2166	5466.66	0.1078	0.1101	1.0219	0.4976	0.5085	-2.2%	0.2543	0.2640	-3.8%
AAM0610	D3	1223001-12	93.6	6/10/2017 12:55	10001	2677	16.75	596.9036	158.1559	0.2056	5466.66	0.1092	0.1045	0.9575	0.5311	0.5085	4.2%	0.2650	0.2640	0.3%
AAM0610	D4	1223001-12	93.6	6/10/2017 13:23	10003	2356	16.31	613.2037	142.8443	0.1996</										

LB4100C Alpha Attenuation Curve -- Am-241

WO #	1223001		
Mass Range	21.0 mg	mg	
Low	156.0 mg	mg	
High			

Spike Information			
Std. ID	955.4095.10		
Ref. Date	10/25/2011		
Half-life	433	hrs	
Activity	55161.33	dpm/mL	
Vol.	0.1	mL	
Act. Added	5516.13	dpm	

Attenuation Equation $y=b*m^a(a*(x-x_0))$			
b =	0.8949		
m =	0.9914		
a =	0.9119		
x ₀	21.448		
% Diff Max. = 14.9%			

Cross-Talk Equation $y=b*m^a-x$			
b =	0.2414		
m =	0.9990		
% Diff Max. = 16.0%			

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Alpha CPM	Beta CPM	Base Alpha Eff.	Decay Corr. added dpm/mL	Alpha EFF Actual	Alpha Att. Fitted EFF	Actual/Fit Ratio	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\alpha > \beta$ X Tlk Actual	$\alpha > \beta$ X Tlk Fitted	% Diff.
AAM0610	A1	1223001-13	95.2	6/10/2017 13:23	10008	2609	16.96	590.0163	152.3965	0.2015	5466.66	0.1079	0.1012	0.9375	0.5356	0.5022	6.2%	0.2583	0.2644	-2.4%
AAM0610	A2	1223001-13	95.2	6/10/2017 13:53	10012	2579	17.04	587.4647	150.0138	0.2221	5466.66	0.1075	0.1115	1.0379	0.4839	0.5022	-3.8%	0.2554	0.2644	-3.6%
AAM0610	A3	1223001-13	95.2	6/10/17 2:22 PM	10004	2607	16.8	595.39019	153.6886	0.2101	5466.66	0.1089	0.1055	0.9687	0.5184	0.5022	3.1%	0.2581	0.2644	-2.5%
AAM0610	A4	1223001-13	95.2	6/10/2017 14:51	10000	2655	16.81	594.8010	156.4097	0.2068	5466.66	0.1088	0.1038	0.9545	0.5261	0.5022	4.6%	0.2630	0.2644	-0.6%
AAM0610	B1	1223001-13	95.2	6/10/2017 15:20	10005	2616	17.09	585.3391	151.4590	0.1965	5466.66	0.1071	0.0987	0.9216	0.5449	0.5022	7.8%	0.2588	0.2644	-2.2%
AAM0610	B2	1223001-13	95.2	6/10/2017 15:49	10001	2780	17.76	563.0024	154.8815	0.2192	5466.66	0.1030	0.1101	1.0689	0.4698	0.5022	-6.9%	0.2751	0.2644	3.9%
AAM0611	B3	1223001-13	95.2	6/11/2017 7:29	10001	2696	17.19	581.7077	155.2904	0.2040	5466.64	0.1064	0.1024	0.9627	0.5216	0.5022	3.7%	0.2670	0.2644	0.9%
AAM0611	B4	1223001-13	95.2	6/11/2017 7:58	10007	2700	17.34	577.0050	154.1183	0.2008	5466.64	0.1056	0.1008	0.9553	0.5256	0.5022	4.5%	0.2671	0.2644	1.0%
AAM0611	C1	1223001-13	95.2	6/11/2017 8:26	10002	2721	16.67	599.8900	161.6874	0.2054	5466.64	0.1097	0.1031	0.9399	0.5343	0.5022	6.0%	0.2695	0.2644	1.9%
AAM0611	C2	1223001-13	95.2	6/11/2017 8:56	10003	2635	16.79	595.6593	155.2797	0.2232	5466.64	0.1090	0.1121	1.0287	0.4882	0.5022	-2.9%	0.2607	0.2644	-1.4%
AAM0610	C3	1223001-13	95.2	6/10/2017 10:28	10006	2598	17.32	577.5599	148.3600	0.2134	5466.66	0.1057	0.1072	1.0143	0.4951	0.5022	-1.4%	0.2569	0.2644	-2.9%
AAM0610	C4	1223001-13	95.2	6/10/2017 10:57	10007	2727	17.07	586.0922	156.8570	0.2042	5466.66	0.1072	0.1025	0.9565	0.5250	0.5022	4.4%	0.2676	0.2644	1.2%
AAM0610	D1	1223001-13	95.2	6/10/2017 11:26	10003	2595	17.88	565.6855	145.1620	0.1946	5466.66	0.1035	0.0977	0.9444	0.5318	0.5022	5.6%	0.2566	0.2644	-3.1%
AAM0610	D2	1223001-13	95.2	6/10/2017 11:55	10006	2507	17.33	577.2933	143.0554	0.2166	5466.66	0.1056	0.1088	1.0300	0.4875	0.5022	-3.0%	0.2478	0.2644	-8.7%
AAM0610	D3	1223001-13	95.2	6/10/2017 12:24	10001	2756	17.26	579.2612	158.0106	0.2056	5466.66	0.1060	0.1032	0.9744	0.5154	0.5022	2.6%	0.2728	0.2644	3.1%
AAM0610	D4	1223001-13	95.2	6/10/2017 12:55	10003	2691	17.25	579.7831	154.3930	0.1996	5466.66	0.1061	0.1002	0.9451	0.5314	0.5022	5.5%	0.2663	0.2644	0.7%
AAM0610	A1	1223001-14	116.1	6/10/2017 12:57	10002	2612	18.71	504.5024	138.1685	0.2015	5466.66	0.0923	0.0859	0.9309	0.4580	0.4263	6.9%	0.2739	0.2698	1.5%
AAM0610	A2	1223001-14	116.1	6/10/2017 13:25	10011	2655	18.99	527.0782	138.4744	0.2221	5466.66	0.0964	0.0947	0.9821	0.4341	0.4263	1.8%	0.2627	0.2698	-2.7%
AAM0610	A3	1223001-14	116.1	6/10/17 1:55 PM	10001	2611	18.82	531.30676	137.2254	0.2101	5466.66	0.0972	0.0896	0.9216	0.4626	0.4263	7.8%	0.2583	0.2698	-4.5%
AAM0610	A4	1223001-14	116.1	6/10/2017 14:24	10001	2709	18.61	537.3162	144.0349	0.2068	5466.66	0.0983	0.0882	0.8970	0.4753	0.4263	10.3%	0.2681	0.2698	-0.6%
AAM0610	B1	1223001-14	116.1	6/10/2017 14:53	10002	2676	19.47	503.6224	135.8292	0.1965	5466.66	0.0921	0.0838	0.9094	0.4688	0.4263	9.1%	0.2697	0.2698	0.0%
AAM0610	B2	1223001-14	116.1	6/10/2017 15:22	10004	2675	19.45	514.2275	135.8821	0.2192	5466.66	0.0941	0.0935	0.9935	0.4291	0.4263	0.7%	0.2642	0.2698	-2.1%
AAM0610	B3	1223001-14	116.1	6/10/2017 15:51	10001	2726	19.22	520.2594	140.2864	0.2040	5466.66	0.0952	0.0870	0.9139	0.4665	0.4263	8.6%	0.2696	0.2698	-0.1%
AAM0611	B4	1223001-14	116.1	6/11/2017 7:31	9999	2737	19.13	522.5869	141.4827	0.2008	5466.64	0.0956	0.0856	0.8955	0.4761	0.4263	10.4%	0.2707	0.2698	0.3%
AAM0611	C1	1223001-14	116.1	6/11/17 7:59 AM	10003	2777	18.41	513.23601	149.3019	0.2054	5466.64	0.0939	0.0876	0.9327	0.4571	0.4263	6.7%	0.2909	0.2698	7.3%
AAM0611	C2	1223001-14	116.1	6/11/2017 8:28	10005	2749	18.74	533.7727	145.0326	0.2232	5466.64	0.0976	0.0952	0.9746	0.4375	0.4263	2.5%	0.2717	0.2698	0.7%
AAM0611	C3	1223001-14	116.1	6/11/2017 8:58	10001	2677	16.59	537.8814	142.3622	0.2134	5466.64	0.0984	0.0910	0.9247	0.4611	0.4263	7.5%	0.2647	0.2698	-1.9%
AAM0610	C4	1223001-14	116.1	6/10/2017 10:30	10003	2757	19.00	526.3327	142.2083	0.2042	5466.66	0.0963	0.0871	0.9042	0.4715	0.4263	9.6%	0.2702	0.2698	0.1%
AAM0610	D1	1223001-14	116.1	6/10/2017 11:00	10000	2689	19.81	504.7006	134.1255	0.1948	5466.66	0.0923	0.0830	0.8986	0.4744	0.4263	10.1%	0.2658	0.2698	-1.5%
AAM0610	D2	1223001-14	116.1	6/10/2017 11:28	10002	2665	19.63	509.4392	134.1546	0.2166	5466.66	0.0932	0.0923	0.9909	0.4302	0.4263	0.9%	0.2633	0.2698	-2.5%
AAM0610	D3	1223001-14	116.1	6/10/2017 11:57	10002	2861	19.48	513.8064	145.3545	0.2056	5466.66	0.0940	0.0877	0.9326	0.4571	0.4263	6.7%	0.2829	0.2698	4.6%
AAM0610	D4	1223001-14	116.1	6/10/2017 12:26	10006	2675	19.38	516.2045	136.4219	0.1996	5466.66	0.0944	0.0851	0.9012	0.4731	0.4263	9.9%	0.2643	0.2698	-2.1%
AAM0610	A1	1223001-16	134.2	6/10/2017 12:31	10001	2902	24.23	412.6748	118.3329	0.2015	5466.66	0.0755	0.0746	0.9876	0.3748	0.3700	1.2%	0.2867	0.2745	4.3%
AAM0610	A2	1223001-16	134.2	6/10/2017 13:03	10004	2990	25.18	397.2054	117.4090	0.2221	5466.66	0.0727	0.0822	1.1309	0.3271	0.3700	-13.1%	0.2956	0.2745	7.1%
AAM0610	A3	1223001-16	134.2	6/10/2017 13:31	10005	2997	24.25	412.4813	122.0776	0.2101	5466.66	0.0755	0.0777	1.0302	0.3591	0.3700	-3.0%	0.2960	0.2745	7.2%
AAM0610	A4	1223001-16	134.2	6/10/2017 14:00	10000	2983	23.88	416.6775	123.3842	0.2068	5466.66	0.0766	0.0765	0.9990	0.3703	0.3700	0.1%	0.2947	0.2745	6.8%
AAM0610	B1	1223001-16	134.2	6/10/2017 14:30	10000	2959	24.65	405.5885	118.4276	0.1965	5466.66	0.0742	0.0727	0.9799	0.3776	0.3700	2.0%	0.2920	0.2745	6.0%
AAM0610	B2	1223001-16	134.2	6/10/2017 14:59	10001	3107	25.49	392.2329	120.2409	0.2192	5466.66	0.0718	0.0811	1.1303	0.3273	0.3700	-13.0%	0.3066	0.2745	10.4%
AAM0610	B3	1223001-16	134.2	6/10/2017 15:27	10002	3169	24.85	402.4110	125.9802	0.2040	5466.66	0.0736	0.0755	1.0253	0.3608	0.3700	-2.5%	0.3131	0.2745	12.3%
AAM0610	B4	1223001-16	134.2	6/10/2017 15:57	10003	3144	25.08	398.7437	123.7679	0.2008	5466.66	0.0729	0.0743	1.0185	0.3633	0.3700	-1.9%	0.3104	0.2745	11.6%
AAM0611	C1	1223001-16	134.2	6/11/17 7:36 AM	10004	2990	23.88	418.81797	123.6694	0.2054	5466.64	0.0769	0.0760	0.9919	0.3730	0.3700	0.8%	0.2953	0.2745	7.0%
AAM0611	C2	1223001-16	134.2	6/11/2017 8:04	10005	3103	24.11	414.8610	127.0428	0.2232	5466.64	0.0759	0.0826	1.0881	0.3400	0.3700	-8.8%	0.3062	0.2745	10.4%
AAM0611	C3	1223001-16	134.2	6/11/2017 8:34	9999	3039	24.50	408.0264	122.4008	0.2134	5466.64	0.0746	0.0790	1.0578	0.3498	0.3700	-5.8%	0.3000	0.2745	8.5%
AAM0611	C4	1223001-16	134.2	6/11/2017 9:04	9999	2993	24.55	407.1502	119.0175	0.2042	5466.64	0.0745	0.0755	1.0144	0.3647	0.3700	-1.4%	0.2923	0.2745	6.1%
AAM0610	D1	1223001-16	134.2	6/10/2017 10:36	10002	3047	25.54	391.5260	117.6891	0.1946	5466.66	0.0716	0.0720	1.0053	0.3680	0.3700	-0.5%	0.3006	0.2745	8.7%
AAM0610	D2	1223001-16	134.2	6/10/2017 11:06	10003	2996	25.67	389.5897	115.1051	0.2166	5466.66	0.0713	0.0801	1.1245	0.3290	0.3700	-12.4%	0.2955	0.2745	7.1%
AAM0610	D3	1223001-16	134.2	6/10/2017 11:34	10001	3170	25.32	394.8132	123.5325	0.2056	5466.66	0.0722	0.0761	1.0532	0.3513	0.3700	-5.3%	0.3129	0.2745	12.3%
AAM0610	D4	1223001-16	134.2	6/10/20																

LB4100C Alpha Attenuation Curve -- Am-241

WO #	1223001		
Mass Range			
Low	21.0	mg	
High	156.0	mg	

Spike Information			
Std. ID	955.4095.10		
Ref. Date	10/25/2011		
Half-life	433	ys	
Activity	55161.33	dpm/mL	
Vol.	0.1	mL	
Act. Added	5516.13	dpm	

Attenuation Equation $y=b*m^x(a^{(x-x_0)})$			
b =	0.8949		
m =	0.9914		
a =	0.9119		
x ₀	21.448		
% Diff Max. = 14.9%			

Cross-Talk Equation $y=b*m^x$			
b =	0.2414		
m =	0.9990		
% Diff Max. = 16.0%			

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Alpha CPM	Beta CPM	Base Alpha Eff.	Decay Corr. Act. added dpm/mL	Alpha EFF Actual	Alpha Att Fitted EFF	Actual/Fit Ratio	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\alpha > \beta$ X Tlk Actual	$\alpha > \beta$ X Tlk Fitted	% Diff.
AAM0610	A1	1223001-17	134.3	6/10/2017 12:00	10004	2789	21.71	460.7235	127.0301	0.2015	5466.66	0.0843	0.0745	0.8839	0.4183	0.3697	11.6%	0.2757	0.2746	0.4%
AAM0610	A2	1223001-17	134.3	6/10/2017 12:29	10003	2763	22.11	452.3257	123.6301	0.2221	5466.66	0.0827	0.0821	0.9923	0.3725	0.3697	0.8%	0.2733	0.2746	-0.5%
AAM0610	A3	1223001-17	134.3	6/10/2017 13:00	10005	2764	21.42	466.9908	127.5283	0.2101	5466.66	0.0854	0.0777	0.9092	0.4066	0.3697	9.1%	0.2731	0.2746	-0.5%
AAM0610	A4	1223001-17	134.3	6/10/17 1:28 PM	10001	2850	21.15	472.77752	133.2198	0.2068	5466.66	0.0865	0.0765	0.8840	0.4182	0.3697	11.6%	0.2818	0.2746	2.6%
AAM0610	B1	1223001-17	134.3	6/10/2017 13:59	10005	2958	22.74	439.8826	128.4662	0.1965	5466.66	0.0805	0.0726	0.9028	0.4095	0.3697	9.7%	0.2920	0.2746	6.0%
AAM0610	B2	1223001-17	134.3	6/10/2017 14:28	10002	2953	22.51	444.2189	129.5361	0.2192	5466.66	0.0813	0.0810	0.9972	0.3707	0.3697	0.3%	0.2916	0.2746	5.8%
AAM0610	B3	1223001-17	134.3	6/10/2017 14:56	10002	2909	22.11	452.2905	130.0244	0.2040	5466.66	0.0827	0.0754	0.9115	0.4056	0.3697	8.8%	0.2875	0.2746	4.5%
AAM0610	B4	1223001-17	134.3	6/10/2017 15:25	10003	3002	22.64	441.7286	131.0062	0.2008	5466.66	0.0808	0.0742	0.9187	0.4024	0.3697	8.1%	0.2966	0.2746	7.4%
AAM0610	C1	1223001-17	134.3	6/10/2017 15:53	10001	2871	21.41	467.0082	132.5562	0.2054	5466.66	0.0854	0.0759	0.8889	0.4159	0.3697	11.1%	0.2838	0.2746	3.3%
AAM0611	C2	1223001-17	134.3	6/11/2017 7:33	10003	2870	21.65	461.9203	130.9045	0.2232	5466.66	0.0845	0.0825	0.9765	0.3786	0.3697	2.3%	0.2834	0.2746	3.1%
AAM0611	C3	1223001-17	134.3	6/11/2017 8:02	10002	2812	21.80	458.7113	127.3508	0.2134	5466.66	0.0839	0.0789	0.9402	0.3932	0.3697	6.0%	0.2776	0.2746	1.1%
AAM0611	C4	1223001-17	134.3	6/11/2017 8:31	10000	2918	21.79	458.7851	131.0176	0.2042	5466.66	0.0839	0.0755	0.8995	0.4110	0.3697	10.0%	0.2856	0.2746	3.9%
AAM0611	D1	1223001-17	134.3	6/11/2017 9:02	10003	2832	22.71	440.3718	123.0888	0.1946	5466.66	0.0806	0.0719	0.8931	0.4140	0.3697	10.7%	0.2795	0.2746	1.8%
AAM0610	D2	1223001-17	134.3	6/10/2017 10:33	10001	2720	22.34	447.5853	120.1477	0.2166	5466.66	0.0819	0.0801	0.9780	0.3780	0.3697	2.2%	0.2684	0.2746	-2.3%
AAM0610	D3	1223001-17	134.3	6/10/2017 11:03	9999	3049	22.16	451.0474	135.9253	0.2056	5466.66	0.0825	0.0760	0.9212	0.4013	0.3697	7.9%	0.3014	0.2746	8.9%
AAM0610	D4	1223001-17	134.3	6/10/17 11:31 AM	10003	2828	22.08	452.93342	126.4727	0.1996	5466.66	0.0829	0.0738	0.8906	0.4151	0.3697	10.9%	0.2792	0.2746	1.7%
AAM0610	A1	1223001-19	156	6/10/2017 11:06	10002	2918	25.89	366.2488	111.2716	0.2015	5466.66	0.0670	0.0628	0.9381	0.3325	0.3119	6.2%	0.3038	0.2803	7.7%
AAM0610	A2	1223001-19	156	6/10/2017 11:35	10001	2822	26.16	382.2072	106.5386	0.2221	5466.66	0.0699	0.0693	0.9908	0.3148	0.3119	0.9%	0.2787	0.2803	-0.6%
AAM0610	A3	1223001-19	156	6/10/2017 12:04	9999	2904	26.06	383.5955	109.9251	0.2101	5466.66	0.0702	0.0655	0.9339	0.3340	0.3119	6.6%	0.2866	0.2803	2.2%
AAM0610	A4	1223001-19	156	6/10/17 12:33 PM	10002	3072	26.17	382.11035	115.8543	0.2068	5466.66	0.0699	0.0645	0.9228	0.3380	0.3119	7.7%	0.3032	0.2803	7.5%
AAM0610	B1	1223001-19	156	6/10/2017 13:04	10001	2973	26.27	350.6094	111.5579	0.1965	5466.66	0.0641	0.0613	0.9556	0.3264	0.3119	4.4%	0.3182	0.2803	11.9%
AAM0610	B2	1223001-19	156	6/10/2017 13:33	10000	2972	26.98	370.5279	108.5057	0.2192	5466.66	0.0678	0.0684	1.0087	0.3092	0.3119	-0.9%	0.2928	0.2803	4.3%
AAM0610	B3	1223001-19	156	6/10/2017 14:03	10002	2998	26.78	373.4037	110.4042	0.2040	5466.66	0.0683	0.0636	0.9315	0.3348	0.3119	6.8%	0.2957	0.2803	5.2%
AAM0610	B4	1223001-19	156	6/10/2017 14:32	10001	3006	26.59	376.0188	111.4590	0.2008	5466.66	0.0688	0.0626	0.9105	0.3425	0.3119	8.9%	0.2964	0.2803	5.4%
AAM0610	C1	1223001-19	156	6/10/2017 15:00	10002	3048	25.78	387.8652	116.8912	0.2054	5466.66	0.0710	0.0641	0.9029	0.3454	0.3119	9.7%	0.3009	0.2803	6.8%
AAM0610	C2	1223001-19	156	6/10/2017 15:28	10001	2890	25.85	386.7739	110.1398	0.2232	5466.66	0.0708	0.0696	0.9839	0.3170	0.3119	1.6%	0.2848	0.2803	1.6%
AAM0610	C3	1223001-19	156	6/10/2017 15:58	10000	3007	26.59	375.9852	111.4476	0.2134	5466.66	0.0688	0.0666	0.9677	0.3223	0.3119	3.2%	0.2964	0.2803	5.4%
AAM0611	C4	1223001-19	156	6/11/2017 7:38	10004	3000	26.33	379.8058	111.0415	0.2042	5466.66	0.0695	0.0637	0.9167	0.3402	0.3119	8.3%	0.2924	0.2803	4.1%
AAM0611	D1	1223001-19	156	6/11/2017 8:07	9999	2909	26.77	353.4201	107.0524	0.1946	5466.66	0.0647	0.0607	0.9388	0.3322	0.3119	6.1%	0.3029	0.2803	7.5%
AAM0611	D2	1223001-19	156	6/11/2017 8:36	10001	2987	26.84	372.5285	109.6821	0.2166	5466.66	0.0681	0.0676	0.9914	0.3146	0.3119	0.9%	0.2944	0.2803	4.8%
AAM0611	D3	1223001-19	156	6/11/2017 9:06	10002	3081	27.08	369.1791	112.1090	0.2056	5466.66	0.0675	0.0641	0.9495	0.3285	0.3119	5.0%	0.3037	0.2803	7.7%
AAM0610	D4	1223001-19	156	6/10/17 10:37 AM	10001	2973	26.37	359.15573	111.1348	0.1996	5466.66	0.0657	0.0623	0.9476	0.3292	0.3119	5.2%	0.3094	0.2803	9.4%

LB4100C Alpha Attenuation Curve -- Am-241

WO #	1223001
Mass Range	Low 21.0 ma High 158.0 ma
Spike Information	
Sid ID	865 4086 10
Ref. Date	10/25/2011
Half-life	433 vs
Activity	55161.33 dpm/mL
Vol.	0.1 mL
Act. Added	5516.13 dpm

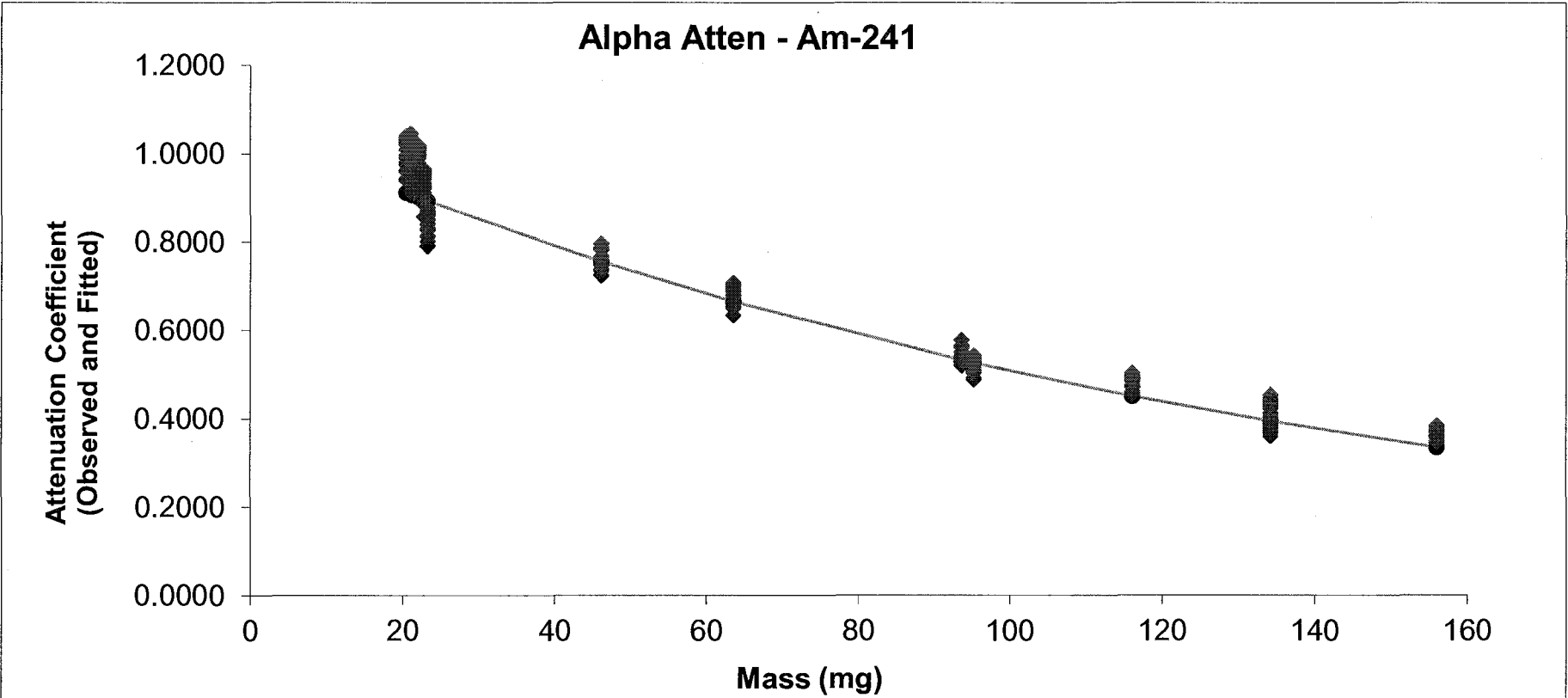
Attenuation Equation $y=b \cdot m^a(x \cdot x_0)$	
b =	0.8649
m =	0.2110
a =	0.9119
xo	21.448
% Diff Max =	14.8%

Cross-Talk Equation $y=b \cdot m^a$	
b =	0.2414
m =	0.9990
% Diff Max =	16.0%

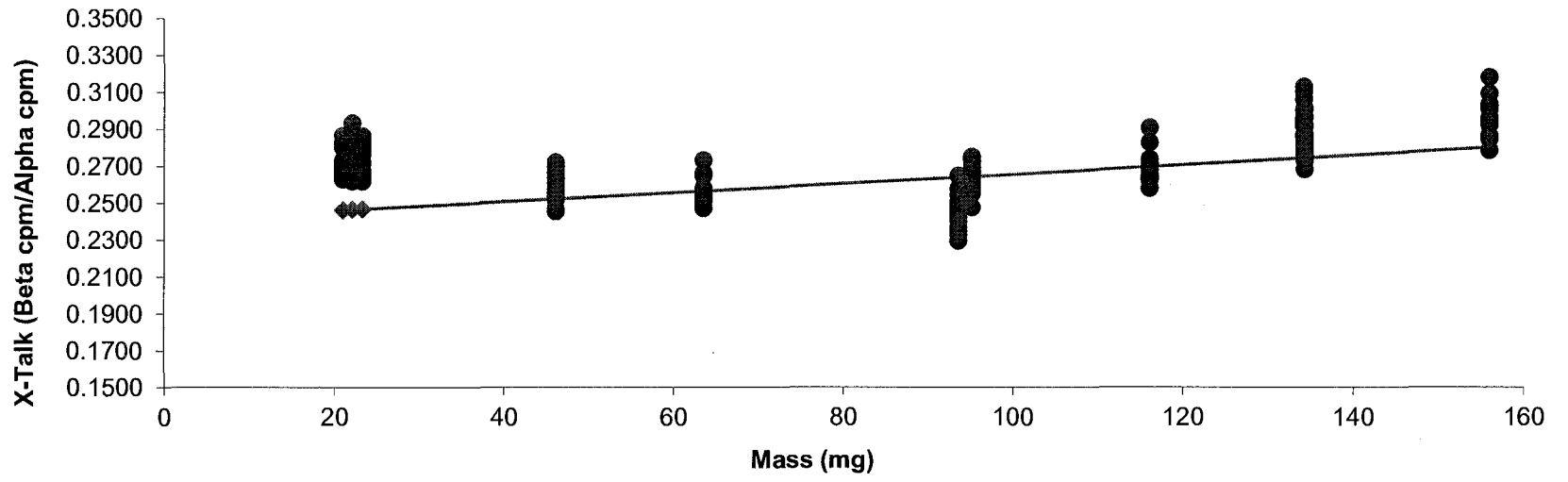
File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Alpha CPM	Beta CPM	Base Alpha Eff.	Decay Corr. Act. added dpm/mL	Alpha EFF Actual	Alpha Att Fitted EFF	Actual/Fitted Ratio	Obs Atten Fact	Fitted Atten Fact	% Diff.	a > B X Tm Actual	a > B X Tm Fitted	% Diff.
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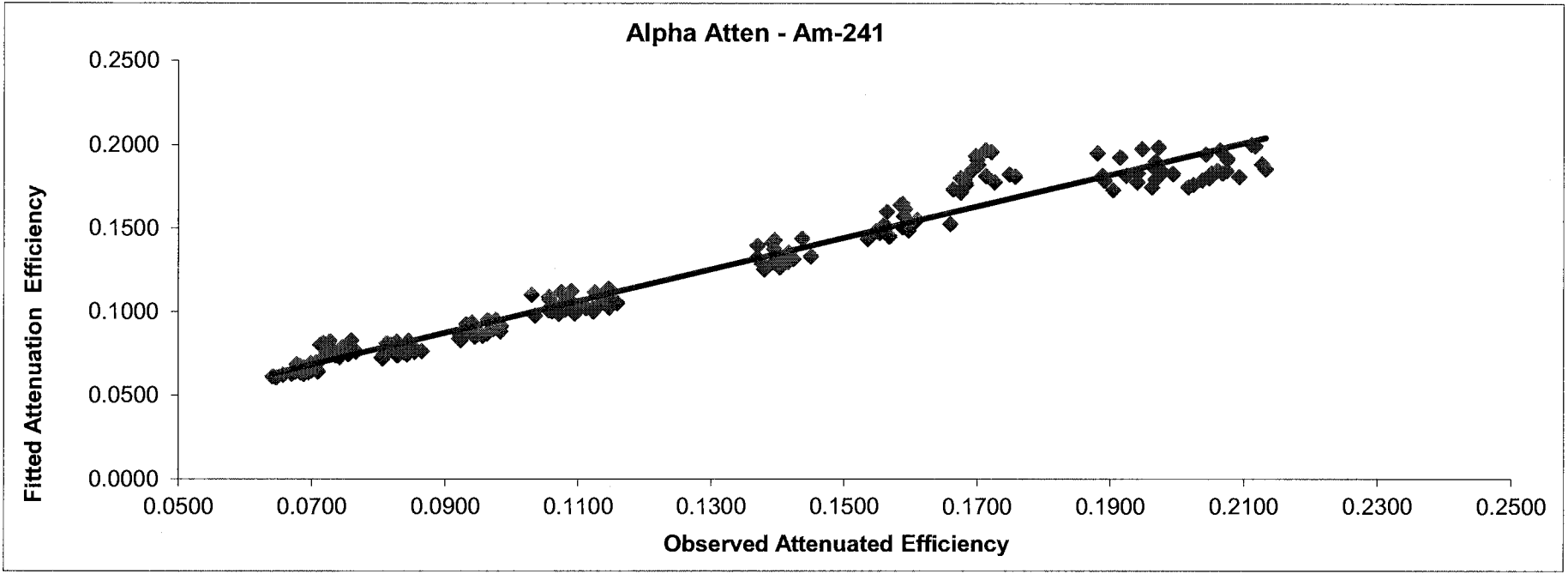
OUTLIERS

AAM0611	A1	1223001-7	47.5	6/11/17 7:30	10002	3074	18.13	551.60429	168.1172	0.2015	5466.64	0.1009	0.1470	1.4571	0.5008	0.7297	-45.7%	0.3048	0.2526	17.1%	
AAM0611	A2	1223001-7	47.5	6/11/2017 7:59	10001	2908	16.38	544.0300	156.8795	0.2211	5466.64	0.0995	0.1621	1.6285	0.4481	0.7297	-62.8%	0.2884	0.2526	12.4%	
AAM0611	A3	1223001-7	47.5	6/11/2017 8:27	10001	3025	18.3	546.4637	163.7905	0.2101	5466.64	0.1000	0.1533	1.5338	0.4757	0.7297	-53.4%	0.2266	0.2526	15.7%	
AAM0611	A4	1223001-7	47.5	6/11/2017 8:57	10002	3027	17.82	558.0643	167.3854	0.2066	5466.64	0.1021	0.1509	1.4782	0.4938	0.7297	-47.9%	0.2999	0.2526	15.8%	
AAM0610	B1	1223001-7	47.5	6/10/2017 10:29	10004	3012	18.80	532.0357	158.5998	0.1965	5466.66	0.0973	0.1434	1.4733	0.4953	0.7297	-47.3%	0.2981	0.2526	15.3%	
AAM0610	B2	1223001-7	47.5	6/10/2017 11:00	10001	2973	19.1	523.4956	154.0045	0.2192	5466.66	0.0958	0.1599	1.6703	0.4369	0.7297	-67.0%	0.2942	0.2526	14.1%	
AAM0610	B3	1223001-7	47.5	6/10/2017 11:27	10003	3141	18.60	537.7117	167.3260	0.2040	5466.66	0.0984	0.1489	1.5133	0.4822	0.7297	-51.3%	0.3112	0.2526	18.8%	
AAM0610	B4	1223001-7	47.5	6/10/2017 11:57	10002	3046	18.69	535.0525	161.3839	0.2058	5466.66	0.0979	0.1465	1.4970	0.4874	0.7297	-48.7%	0.3018	0.2526	18.2%	
AAM0610	C1	1223001-7	47.5	6/10/2017 12:25	10002	3047	18.29	546.7402	166.1473	0.2058	5466.66	0.1000	0.1469	1.4699	0.4869	0.7297	-48.9%	0.3039	0.2526	19.3%	
AAM0610	C2	1223001-7	47.5	6/10/2017 12:56	10004	3014	18.31	546.2561	162.8505	0.2232	5466.66	0.0999	0.1629	1.6299	0.4477	0.7297	-63.0%	0.2963	0.2526	15.3%	
AAM0610	C3	1223001-7	47.5	6/10/2017 13:25	10000	2955	18.44	542.2033	158.8095	0.2134	5466.66	0.0992	0.1557	1.5700	0.4648	0.7297	-57.0%	0.2925	0.2526	13.6%	
AAM0610	C4	1223001-7	47.5	6/10/2017 13:55	10003	3054	18.57	538.5235	161.5618	0.2042	5466.66	0.0985	0.1490	1.5125	0.4824	0.7297	-51.3%	0.3000	0.2526	15.8%	
AAM0610	D1	1223001-7	47.5	6/10/2017 14:24	9999	2970	18.78	532.3331	156.5300	0.1946	5466.66	0.0974	0.1459	1.4582	0.5053	0.7297	-65.9%	0.2941	0.2526	14.1%	
AAM0610	D2	1223001-7	47.5	6/10/2017 14:52	10001	3169	18.58	538.1800	165.5893	0.2188	5466.66	0.0984	0.1580	1.6054	0.4545	0.7297	-60.9%	0.2878	0.2526	17.0%	
AAM0610	D3	1223001-7	47.5	6/10/2017 15:22	10002	3187	18.92	528.4759	166.7811	0.2058	5466.66	0.0987	0.1500	1.5519	0.4702	0.7297	-55.2%	0.3158	0.2526	20.0%	
AAM0610	D4	1223001-7	47.5	6/10/2017 15:51	10001	3111	19.22	520.2424	160.2559	0.1996	5466.66	0.0952	0.1456	1.5304	0.4788	0.7297	-53.0%	0.3080	0.2526	18.0%	
AAM0611	A1	1223001-8	48.5	6/11/17 7:55	10000	2881	14.80	675.59768	191.8748	0.2015	5466.64	0.1296	0.1459	1.1804	0.6133	0.7240	-18.0%	0.2840	0.2529	11.0%	
AAM0611	A2	1223001-8	48.5	6/11/2017 8:24	10004	2885	15.04	665.0958	190.4958	0.2221	5466.64	0.1217	0.1608	1.3217	0.5478	0.7240	-32.2%	0.2964	0.2529	17.0%	
AAM0611	A3	1223001-8	48.5	6/11/2017 8:54	9999	2811	14.68	681.0345	198.2640	0.2114	5466.64	0.1266	0.1510	1.2210	0.5930	0.7240	-22.1%	0.2700	0.2529	9.3%	
AAM0610	A4	1223001-8	48.5	6/10/2017 10:25	10006	2698	14.80	671.4606	192.9646	0.2088	5466.66	0.1228	0.1497	1.2169	0.5939	0.7240	-21.9%	0.2674	0.2529	12.8%	
AAM0610	B1	1223001-8	48.5	6/10/2017 10:55	10007	2818	14.97	668.3793	186.6302	0.1925	5466.66	0.1223	0.1423	1.1635	0.6222	0.7240	-16.4%	0.2762	0.2529	9.4%	
AAM0610	B2	1223001-8	48.5	6/10/2017 11:24	10003	2933	15.48	646.3300	187.8203	0.2195	5466.66	0.1182	0.1587	1.3423	0.5394	0.7240	-34.2%	0.2906	0.2529	13.0%	
AAM0610	B3	1223001-8	48.5	6/10/2017 11:53	10004	3079	15.27	655.0568	200.6922	0.2040	5466.66	0.1198	0.1477	1.2326	0.5574	0.7240	-23.3%	0.3055	0.2529	17.2%	
AAM0610	B4	1223001-8	48.5	6/10/2017 12:22	10005	2812	15.31	693.3844	188.8115	0.2008	5466.66	0.1198	0.1454	1.2183	0.5692	0.7240	-20.9%	0.2884	0.2529	12.4%	
AAM0610	C1	1223001-8	48.5	6/10/2017 12:53	10008	2909	14.73	679.3197	195.9481	0.2054	5466.66	0.1243	0.1487	1.1967	0.6050	0.7240	-19.7%	0.2854	0.2529	12.3%	
AAM0610	C2	1223001-8	48.5	6/10/2017 13:21	10000	2902	14.97	667.8907	192.1954	0.2232	5466.66	0.1222	0.1616	1.3228	0.5474	0.7240	-32.3%	0.2878	0.2529	12.1%	
AAM0610	C3	1223001-8	48.5	6/10/2017 13:51	10003	2926	14.67	698.1071	193.9512	0.2134	5466.66	0.1222	0.1545	1.2542	0.5727	0.7240	-26.4%	0.2903	0.2529	12.9%	
AAM0610	C4	1223001-8	48.5	6/10/2017 14:20	10003	2750	15.05	664.5102	179.8273	0.2042	5466.66	0.1216	0.1478	1.2162	0.5503	0.7240	-21.9%	0.2706	0.2529	6.6%	
AAM0610	D1	1223001-8	48.5	6/10/2017 14:48	10001	2832	15.03	693.0372	196.2061	0.1991	5466.66	0.1180	0.1490	1.2683	0.5249	0.7240	-18.9%	0.2796	0.2529	9.8%	
AAM0610	D2	1223001-8	48.5	6/10/2017 15:18	10002	2680	15.39	649.8155	192.0252	0.2166	5466.66	0.1189	0.1598	1.3192	0.5488	0.7240	-31.9%	0.2955	0.2529	14.4%	
AAM0610	D3	1223001-8	48.5	6/10/2017 15:47	10012	2863	15.21	658.0602	194.4560	0.2056	5466.66	0.1204	0.1489	1.2365	0.5855	0.7240	-23.7%	0.2955	0.2529	14.4%	
AAM0611	D4	1223001-8	48.5	6/11/2017 7:27	10004	2872	15.04	699.0958	176.0526	0.1996	5466.64	0.1217	0.1445	1.1878	0.6095	0.7240	-18.8%	0.2847	0.2529	4.5%	
AAM0610	A1	1223001-11	81.1	6/10/2017 14:16	10020	2487	11.28	868.2199	219.6427	0.2015	5466.66	0.1625	0.1730	0.9955	0.8983	0.9698	30.4%	0.2609	0.2609	-5.9%	
AAM0610	A2	1223001-11	81.1	6/10/2017 14:45	10002	2561	11.08	881.0345	207.5262	0.2214	5466.66	0.1625	0.1546	0.7675	0.9246	0.7307	0.6600	33.3%	0.2330	0.2609	-11.5%
AAM0610	A3	1223001-11	81.1	6/10/2017 15:14	10002	2477	11.02	807.5095	223.2631	0.2101	5466.66	0.1690	0.1778	0.7098	0.7902	0.9609	26.0%	0.2480	0.2609	-6.1%	
AAM0610	A4	1223001-11	81.1	6/10/2017 15:43	10002	2494	11.12	899.3774	222.7486	0.2088	5466.66	0.1645	0.1760	0.7049	0.7956	0.9608	26.5%	0.2477	0.2609	-5.3%	
AAM0611	B1	1223001-11	81.1	6/11/17 7:23 AM	10008	2565	11.50	870.16987	221.4305	0.1965	5466.64	0.1592	0.1710	0.6923	0.8101	0.9608	30.8%	0.2545	0.2609	-2.6%	
AAM0611	B2	1223001-11	81.1	6/11/2017 7:52	10006	2588	11.73	852.9034	217.2758	0.2152	5466.64	0.1580	0.1728	0.7879	0.7718	0.9608	21.2%	0.2547	0.2609	-2.4%	
AAM0611	B3	1223001-11	81.1	6/11/2017 8:21	10000	2512	11.53	881.2167	218.3214	0.2040	5466.64	0.1588	0.1744	0.7212	0.7776	0.9608	27.9%	0.2484	0.2609	-4.0%	
AAM0611	B4	1223001-11	81.1	6/11/2017 8:51	10007	2617	11.68	856.6637	222.4072	0.2008	5466.64	0.1587	0.1728	0.7186	0.7504	0.9608	28.1%	0.2507	0.2609	-0.5%	
AAM0610	C1	1223001-11	81.1	6/10/2017 10:22	10010	2588	11.27	888.0888	228.0602	0.2034	5466.66	0.1625	0.1752	0.7091	0.7909	0.9608	29.1%	0.2588	0.2609	-1.6%	
AAM0610	C2	1223001-11	81.1	6/10/2017 10:51	10007	2533	11.10	901.4195	226.5392	0.2232	5466.66	0.1649	0.1752	0.7591	0.7388	0.9608	24.1%	0.2513	0.2609	-3.8%	
AAM0610	C3	1223001-11	81.1	6/10/2017 11:20	10003	2600	11.47	872.0551	225.8933	0.2134	5466.66	0.1565	0.1787	0.7503	0.7475	0.9608	23.0%	0.2591	0.2609	-1.1%	
AAM0610	C4	1223001-11	81.1	6/10/2017 11:49	10014	2650	11.48	872.1587	219.2384	0.2042	5466.66	0.1595									



Alpha > Beta Cross-Talk - Am-241





LB4100C Beta Attenuation Curve -- Sr-90

WO #: 1118007
 Nuclide: Sr-90
 Std. ID: 777.3020.11
 Ref. Date: 02/08/06
 Half-life: 28.5 yrs
 Activity: 4996.73 dpm/mL
 Vol.: 2 mL

Calibrated Mass Range
 Low 7.7 mg
 High 158.6 mg

Attenuation Equation $y=b*m^a(a^x)$
 b = 0.9681
 m = 0.9996
 a = 0.9174
 % Diff Max. = 5.9%

Cross-Talk Equation $y=b*x+m$
 b = 1.1183E-05
 m = 0.0018
 % Diff Max. = 83.2%

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Base Beta Eff.	Alpha CPM	Beta CPM	Decay Corr. Act. added dpm/mL	Beta Obs. Atten. Eff.	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\beta > \alpha$ XTLK Observed	$\beta > \alpha$ XTLK Fitted	% Diff.
ASR0611	A1	1118007-2	7.7	6/11/2017 11:24	12	10029	3.11	0.4236	3.78	3223.32	7584.92	0.4250	1.0032	0.9654	3.9%	0.0012	0.0019	-37.8%
ASR0611	A2	1118007-2	7.7	6/11/2017 9:13	25	10008	3.13	0.4238	7.89	3196.11	7584.96	0.4214	0.9943	0.9654	3.0%	0.0025	0.0019	30.9%
ASR0611	A3	1118007-2	7.7	6/11/2017 9:19	18	10018	3.13	0.4440	5.65	3199.13	7584.96	0.4218	0.9499	0.9654	-1.6%	0.0018	0.0019	-6.3%
ASR0611	A4	1118007-2	7.7	6/11/2017 9:31	27	10045	3.1	0.4284	8.63	3238.79	7584.96	0.4270	0.9967	0.9654	3.2%	0.0027	0.0019	41.2%
ASR0611	B1	1118007-2	7.7	6/11/2017 9:40	30	10050	3.23	0.4252	9.20	3109.84	7584.96	0.4100	0.9643	0.9654	-0.1%	0.0030	0.0019	56.8%
ASR0611	B2	1118007-2	7.7	6/11/2017 9:48	24	10037	3.18	0.4122	7.43	3154.64	7584.95	0.4159	1.0090	0.9654	4.5%	0.0024	0.0019	24.9%
ASR0611	B3	1118007-2	7.7	6/11/2017 9:53	22	10023	3.23	0.4289	6.73	3101.55	7584.95	0.4089	0.9534	0.9654	-1.2%	0.0022	0.0019	15.0%
ASR0611	B4	1118007-2	7.7	6/11/2017 10:02	18	10029	3.23	0.4195	5.47	3102.12	7584.95	0.4090	0.9749	0.9654	1.0%	0.0018	0.0019	-6.5%
ASR0611	C1	1118007-2	7.7	6/11/2017 10:09	13	10029	3.16	0.4214	4.00	3172.19	7584.94	0.4182	0.9925	0.9654	2.8%	0.0013	0.0019	-33.1%
ASR0611	C2	1118007-2	7.7	6/11/2017 10:19	19	10038	3.18	0.4339	5.86	3154.94	7584.94	0.4159	0.9586	0.9654	-0.7%	0.0019	0.0019	-1.5%
ASR0611	C3	1118007-2	7.7	6/11/2017 10:24	20	10016	3.15	0.4278	6.25	3178.04	7584.94	0.4190	0.9794	0.9654	1.5%	0.0020	0.0019	4.3%
ASR0611	C4	1118007-2	7.7	6/11/2017 10:33	20	10016	3.17	0.4285	6.17	3156.72	7584.94	0.4162	0.9713	0.9654	0.6%	0.0020	0.0019	3.6%
ASR0611	D1	1118007-2	7.7	6/11/2017 10:42	19	10008	3.27	0.4099	5.72	3058.94	7584.93	0.4033	0.9839	0.9654	1.9%	0.0019	0.0019	-0.9%
ASR0611	D2	1118007-2	7.7	6/11/2017 10:54	16	10041	3.22	0.4107	4.88	3116.72	7584.93	0.4109	1.0005	0.9654	3.6%	0.0016	0.0019	-17.0%
ASR0611	D3	1118007-2	7.7	6/11/2017 11:04	10	10039	3.25	0.4196	2.91	3087.26	7584.93	0.4070	0.9700	0.9654	0.5%	0.0009	0.0019	-50.1%
ASR0611	D4	1118007-2	7.7	6/11/2017 11:16	13	10007	3.23	0.4214	3.92	3096.54	7584.92	0.4082	0.9688	0.9654	0.4%	0.0013	0.0019	-32.8%
ASR0611	A1	1118007-1	8.1	6/11/2017 9:13	29	10039	3.13	0.4236	9.19	3205.91	7584.96	0.4227	0.9978	0.9652	3.4%	0.0029	0.0019	51.6%
ASR0611	A2	1118007-1	8.1	6/11/2017 9:19	30	10014	3.11	0.4238	9.55	3218.60	7584.96	0.4243	1.0013	0.9652	3.7%	0.0030	0.0019	57.0%
ASR0611	A3	1118007-1	8.1	6/11/2017 9:31	27	10024	3.11	0.4440	8.59	3221.64	7584.96	0.4247	0.9566	0.9652	-0.9%	0.0027	0.0019	41.0%
ASR0611	A4	1118007-1	8.1	6/11/2017 9:40	28	10041	3.09	0.4284	8.98	3247.98	7584.96	0.4282	0.9996	0.9652	3.6%	0.0028	0.0019	46.2%
ASR0611	B1	1118007-1	8.1	6/11/2017 9:48	27	10021	3.11	0.4252	8.59	3220.57	7584.95	0.4246	0.9986	0.9652	3.5%	0.0027	0.0019	41.1%
ASR0611	B2	1118007-1	8.1	6/11/2017 9:53	23	10039	3.21	0.4122	7.05	3125.76	7584.95	0.4121	0.9998	0.9652	3.6%	0.0023	0.0019	19.3%
ASR0611	B3	1118007-1	8.1	6/11/2017 10:02	19	10041	3.15	0.4289	5.95	3186.07	7584.95	0.4201	0.9794	0.9652	1.5%	0.0019	0.0019	-1.3%
ASR0611	B4	1118007-1	8.1	6/11/2017 10:09	21	10016	3.19	0.4195	6.48	3138.22	7584.94	0.4137	0.9863	0.9652	2.2%	0.0021	0.0019	9.3%
ASR0611	C1	1118007-1	8.1	6/11/2017 10:18	22	10007	3.11	0.4214	6.96	3216.14	7584.94	0.4240	1.0062	0.9652	4.2%	0.0022	0.0019	14.5%
ASR0611	C2	1118007-1	8.1	6/11/2017 10:24	21	10034	3.08	0.4339	6.71	3256.13	7584.94	0.4293	0.9894	0.9652	2.5%	0.0021	0.0019	8.9%
ASR0611	C3	1118007-1	8.1	6/11/2017 10:33	20	10029	3.2	0.4278	6.15	3132.42	7584.94	0.4130	0.9654	0.9652	0.0%	0.0020	0.0019	3.9%
ASR0611	C4	1118007-1	8.1	6/11/2017 10:42	30	10043	3.16	0.4285	9.35	3175.27	7584.93	0.4186	0.9770	0.9652	1.2%	0.0029	0.0019	55.8%
ASR0611	D1	1118007-1	8.1	6/11/2017 10:54	17	10043	3.27	0.4099	5.10	3069.64	7584.93	0.4047	0.9873	0.9652	2.3%	0.0017	0.0019	-12.1%
ASR0611	D2	1118007-1	8.1	6/11/2017 11:04	30	10057	3.2	0.4107	9.29	3141.21	7584.93	0.4141	1.0084	0.9652	4.5%	0.0030	0.0019	56.4%
ASR0611	D3	1118007-1	8.1	6/11/2017 11:16	14	10030	3.17	0.4196	4.25	3162.37	7584.92	0.4169	0.9936	0.9652	2.9%	0.0013	0.0019	-29.0%
ASR0611	D4	1118007-1	8.1	6/11/2017 11:24	15	10033	3.23	0.4214	4.54	3104.58	7584.92	0.4093	0.9713	0.9652	0.6%	0.0015	0.0019	-22.6%
ASR0611	A1	1118007-4	19	6/11/2017 11:04	30	10005	3.14	0.4236	9.48	3184.87	7584.93	0.4199	0.9913	0.9614	3.1%	0.0030	0.0020	47.8%
ASR0611	A2	1118007-4	19	6/11/2017 11:16	28	10076	3.19	0.4238	8.68	3157.28	7584.92	0.4163	0.9822	0.9614	2.2%	0.0028	0.0020	36.7%
ASR0611	A3	1118007-4	19	6/11/2017 11:24	16	10022	3.17	0.4440	4.95	3160.00	7584.92	0.4166	0.9383	0.9614	-2.4%	0.0016	0.0020	-22.1%
ASR0611	A4	1118007-4	19	6/11/2017 9:13	24	10020	3.14	0.4284	7.56	3189.55	7584.96	0.4205	0.9816	0.9614	2.1%	0.0024	0.0020	17.8%
ASR0611	B1	1118007-4	19	6/11/2017 9:19	21	10006	3.2	0.4252	6.47	3125.26	7584.96	0.4120	0.9690	0.9614	0.8%	0.0021	0.0020	2.9%
ASR0611	B2	1118007-4	19	6/11/2017 9:31	30	10004	3.26	0.4122	9.09	3067.06	7584.96	0.4044	0.9810	0.9614	2.0%	0.0030	0.0020	47.2%
ASR0611	B3	1118007-4	19	6/11/2017 9:40	18	10027	3.18	0.4289	5.58	3151.60	7584.96	0.4155	0.9688	0.9614	0.8%	0.0018	0.0020	-12.1%
ASR0611	B4	1118007-4	19	6/11/2017 9:48	23	10032	3.19	0.4195	7.11	3143.24	7584.95	0.4144	0.9879	0.9614	2.8%	0.0023	0.0020	12.4%
ASR0611	C1	1118007-4	19	6/11/2017 9:53	21	10036	3.2	0.4214	6.45	3134.71	7584.95	0.4133	0.9807	0.9614	2.0%	0.0021	0.0020	2.3%
ASR0611	C2	1118007-4	19	6/11/2017 10:02	16	10047	3.17	0.4339	4.94	3167.74	7584.95	0.4176	0.9625	0.9614	0.1%	0.0016	0.0020	-22.6%
ASR0611	C3	1118007-4	19	6/11/2017 10:09	17	10018	3.2	0.4278	5.22	3128.99	7584.94	0.4125	0.9643	0.9614	0.3%	0.0017	0.0020	-17.2%
ASR0611	C4	1118007-4	19	6/11/2017 10:19	20	10066	3.18	0.4285	6.15	3162.51	7584.94	0.4169	0.9730	0.9614	1.2%	0.0019	0.0020	-3.4%
ASR0611	D1	1118007-4	19	6/11/2017 10:24	14	10014	3.21	0.4099	4.27	3118.01	7584.94	0.4111	1.0029	0.9614	4.3%	0.0014	0.0020	-32.0%
ASR0611	D2	1118007-4	19	6/11/2017 10:34	25	10016	3.22	0.4107	7.68	3108.95	7584.94	0.4099	0.9980	0.9614	3.8%	0.0025	0.0020	22.7%
ASR0611	D3	1118007-4	19	6/11/2017 10:42	10	10021	3.22	0.4196	2.93	3110.45	7584.93	0.4101	0.9773	0.9614	1.7%	0.0009	0.0020	-53.1%
ASR0611	D4	1118007-4	19	6/11/2017 10:54	12	10043	3.22	0.4214	3.63	3117.34	7584.93	0.4110	0.9753	0.9614	1.4%	0.0012	0.0020	-42.2%

LB4100C Beta Attenuation Curve -- Sr-90

WO #: 1118007
 Nuclide: Sr-90
 Std. ID: 777.3020.11
 Ref. Date: 02/08/06
 Half-life: 28.5 yrs
 Activity: 4996.73 dpm/mL
 Vol.: 2 mL

Calibrated Mass Range
 Low 7.7 mg
 High 158.6 mg

Attenuation Equation $y=b*m*(a^x)$
 b = 0.9681
 m = 0.9996
 a = 0.9174
 % Diff Max. = 5.9%

Cross-Talk Equation $y=b*x+m$
 b = 1.1183E-05
 m = 0.0018
 % Diff Max. = 83.2%

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Base Beta Eff.	Alpha CPM	Beta CPM	Decay Corr. Act. added dpm/mL	Beta Obs. Atten. Eff.	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\beta > \alpha$ XTLK Observed	$\beta > \alpha$ XTLK Fitted	% Diff.
ASR0611	A1	1118007-3	19.8	6/11/2017 11:16	25	10034	3.26	0.4236	7.59	3076.48	7584.92	0.4056	0.9575	0.9611	-0.4%	0.0025	0.0020	22.1%
ASR0611	A2	1118007-3	19.8	6/11/2017 11:24	30	10031	3.22	0.4238	9.22	3113.88	7584.92	0.4105	0.9687	0.9611	0.8%	0.0030	0.0020	46.5%
ASR0611	A3	1118007-3	19.8	6/11/2017 9:13	23	10014	3.19	0.4440	7.11	3137.67	7584.96	0.4137	0.9317	0.9611	-3.1%	0.0023	0.0020	12.2%
ASR0611	A4	1118007-3	19.8	6/11/2017 9:19	37	10016	3.18	0.4284	11.55	3148.15	7584.96	0.4151	0.9688	0.9611	0.8%	0.0037	0.0020	81.5%
ASR0611	B1	1118007-3	19.8	6/11/2017 9:31	19	10041	3.31	0.4252	5.65	3031.92	7584.96	0.3997	0.9401	0.9611	-2.2%	0.0019	0.0020	-7.8%
ASR0611	B2	1118007-3	19.8	6/11/2017 9:40	23	10026	3.33	0.4122	6.79	3009.16	7584.96	0.3967	0.9625	0.9611	0.1%	0.0023	0.0020	11.6%
ASR0611	B3	1118007-3	19.8	6/11/2017 9:48	22	10014	3.29	0.4289	6.60	3042.22	7584.95	0.4011	0.9352	0.9611	-2.7%	0.0022	0.0020	7.4%
ASR0611	B4	1118007-3	19.8	6/11/2017 9:54	26	10027	3.39	0.4195	7.57	2956.23	7584.95	0.3897	0.9291	0.9611	-3.3%	0.0026	0.0020	26.7%
ASR0611	C1	1118007-3	19.8	6/11/2017 10:02	12	10028	3.17	0.4214	3.68	3161.87	7584.95	0.4169	0.9892	0.9611	2.9%	0.0012	0.0020	-42.5%
ASR0611	C2	1118007-3	19.8	6/11/2017 10:09	18	10018	3.18	0.4339	5.55	3148.66	7584.94	0.4151	0.9567	0.9611	-0.5%	0.0018	0.0020	-12.8%
ASR0611	C3	1118007-3	19.8	6/11/2017 10:19	21	10016	3.25	0.4278	6.37	3080.21	7584.94	0.4061	0.9493	0.9611	-1.2%	0.0021	0.0020	2.2%
ASR0611	C4	1118007-3	19.8	6/11/2017 10:24	22	10031	3.26	0.4285	6.61	3074.10	7584.94	0.4053	0.9458	0.9611	-1.6%	0.0021	0.0020	6.3%
ASR0611	D1	1118007-3	19.8	6/11/2017 10:34	25	10022	3.32	0.4099	7.44	3017.06	7584.94	0.3978	0.9704	0.9611	1.0%	0.0025	0.0020	21.9%
ASR0611	D2	1118007-3	19.8	6/11/2017 10:42	29	10029	3.29	0.4107	8.73	3046.72	7584.93	0.4017	0.9780	0.9611	1.8%	0.0029	0.0020	41.7%
ASR0611	D3	1118007-3	19.8	6/11/2017 10:54	16	10015	3.32	0.4196	4.65	3014.90	7584.93	0.3975	0.9473	0.9611	-1.4%	0.0015	0.0020	-23.7%
ASR0611	D4	1118007-3	19.8	6/11/2017 11:04	25	10042	3.28	0.4214	7.52	3059.98	7584.93	0.4034	0.9574	0.9611	-0.4%	0.0025	0.0020	21.6%
ASR0611	A1	1118007-5	39.9	6/11/2017 10:54	20	10036	3.32	0.4236	5.95	3021.46	7584.93	0.3983	0.9404	0.9540	-1.4%	0.0020	0.0022	-12.4%
ASR0611	A2	1118007-5	39.9	6/11/2017 11:04	22	10009	3.25	0.4238	6.68	3078.36	7584.93	0.4059	0.9576	0.9540	0.4%	0.0022	0.0022	-3.5%
ASR0611	A3	1118007-5	39.9	6/11/2017 11:16	18	10020	3.28	0.4440	5.39	3053.37	7584.92	0.4026	0.9067	0.9540	-5.0%	0.0018	0.0022	-21.4%
ASR0611	A4	1118007-5	39.9	6/11/2017 11:24	31	10015	3.27	0.4284	9.40	3061.16	7584.92	0.4036	0.9421	0.9540	-1.3%	0.0031	0.0022	36.7%
ASR0611	B1	1118007-5	39.9	6/11/2017 9:14	22	10021	3.41	0.4252	6.36	2937.10	7584.96	0.3872	0.9107	0.9540	-4.5%	0.0022	0.0022	-3.6%
ASR0611	B2	1118007-5	39.9	6/11/2017 9:19	25	10034	3.39	0.4122	7.26	2958.23	7584.96	0.3900	0.9462	0.9540	-0.8%	0.0025	0.0022	9.2%
ASR0611	B3	1118007-5	39.9	6/11/2017 9:31	21	10013	3.26	0.4289	6.36	3069.93	7584.96	0.4047	0.9437	0.9540	-1.1%	0.0021	0.0022	-7.8%
ASR0611	B4	1118007-5	39.9	6/11/2017 9:40	19	10012	3.35	0.4195	5.57	2987.07	7584.96	0.3938	0.9388	0.9540	-1.6%	0.0019	0.0022	-17.0%
ASR0611	C1	1118007-5	39.9	6/11/2017 9:48	20	10036	3.34	0.4214	5.88	3003.25	7584.95	0.3959	0.9396	0.9540	-1.5%	0.0020	0.0022	-12.9%
ASR0611	C2	1118007-5	39.9	6/11/2017 9:53	17	10013	3.24	0.4339	5.13	3088.77	7584.95	0.4072	0.9385	0.9540	-1.6%	0.0017	0.0022	-26.0%
ASR0611	C3	1118007-5	39.9	6/11/2017 10:02	13	10025	3.33	0.4278	3.81	3008.87	7584.95	0.3967	0.9273	0.9540	-2.8%	0.0013	0.0022	-43.7%
ASR0611	C4	1118007-5	39.9	6/11/2017 10:09	25	10032	3.31	0.4285	7.41	3027.92	7584.94	0.3992	0.9316	0.9540	-2.3%	0.0024	0.0022	9.0%
ASR0611	D1	1118007-5	39.9	6/11/2017 10:19	18	10010	3.37	0.4099	5.25	2968.71	7584.94	0.3914	0.9549	0.9540	0.1%	0.0018	0.0022	-21.3%
ASR0611	D2	1118007-5	39.9	6/11/2017 10:25	14	10011	3.37	0.4107	4.07	2969.02	7584.94	0.3914	0.9531	0.9540	-0.1%	0.0014	0.0022	-39.0%
ASR0611	D3	1118007-5	39.9	6/11/2017 10:34	9	10022	3.44	0.4196	2.45	2911.71	7584.94	0.3839	0.9149	0.9540	-4.1%	0.0008	0.0022	-62.6%
ASR0611	D4	1118007-5	39.9	6/11/2017 10:42	18	10026	3.31	0.4214	5.34	3027.40	7584.93	0.3991	0.9472	0.9540	-0.7%	0.0018	0.0022	-21.5%
ASR0611	A1	1118007-6	40.4	6/11/2017 10:42	18	10026	3.29	0.4236	5.39	3045.98	7584.93	0.4016	0.9480	0.9539	-0.6%	0.0018	0.0023	-21.4%
ASR0611	A2	1118007-6	40.4	6/11/2017 10:54	21	10027	3.31	0.4238	6.25	3027.97	7584.93	0.3992	0.9420	0.9539	-1.2%	0.0021	0.0023	-8.3%
ASR0611	A3	1118007-6	40.4	6/11/2017 11:04	12	10010	3.28	0.4440	3.56	3050.32	7584.93	0.4022	0.9058	0.9539	-5.0%	0.0012	0.0023	-48.1%
ASR0611	A4	1118007-6	40.4	6/11/2017 11:16	24	10017	3.27	0.4284	7.26	3061.77	7584.92	0.4037	0.9423	0.9539	-1.2%	0.0024	0.0023	5.3%
ASR0611	B1	1118007-6	40.4	6/11/2017 11:24	25	10041	3.34	0.4252	7.39	3004.67	7584.92	0.3961	0.9317	0.9539	-2.3%	0.0025	0.0023	9.3%
ASR0611	B2	1118007-6	40.4	6/11/2017 9:14	19	10025	3.37	0.4122	5.52	2973.13	7584.96	0.3920	0.9509	0.9539	-0.3%	0.0019	0.0023	-17.5%
ASR0611	B3	1118007-6	40.4	6/11/2017 9:19	20	10014	3.39	0.4289	5.82	2952.44	7584.96	0.3892	0.9076	0.9539	-4.9%	0.0020	0.0023	-12.5%
ASR0611	B4	1118007-6	40.4	6/11/2017 9:31	24	10050	3.34	0.4195	7.09	3007.39	7584.96	0.3965	0.9452	0.9539	-0.9%	0.0024	0.0023	4.6%
ASR0611	C1	1118007-6	40.4	6/11/2017 9:40	25	10029	3.3	0.4214	7.47	3037.55	7584.96	0.4005	0.9503	0.9539	-0.4%	0.0025	0.0023	9.1%
ASR0611	C2	1118007-6	40.4	6/11/2017 9:48	16	10019	3.32	0.4339	4.71	3016.11	7584.95	0.3976	0.9164	0.9539	-3.9%	0.0016	0.0023	-30.7%
ASR0611	C3	1118007-6	40.4	6/11/2017 9:54	15	10022	3.33	0.4278	4.41	3007.97	7584.95	0.3966	0.9270	0.9539	-2.8%	0.0015	0.0023	-34.9%
ASR0611	C4	1118007-6	40.4	6/11/2017 10:02	27	10030	3.4	0.4285	7.80	2947.10	7584.95	0.3885	0.9068	0.9539	-4.9%	0.0026	0.0023	17.5%
ASR0611	D1	1118007-6	40.4	6/11/2017 10:09	20	10023	3.42	0.4099	5.75	2929.09	7584.94	0.3862	0.9421	0.9539	-1.2%	0.0020	0.0023	-12.8%
ASR0611	D2	1118007-6	40.4	6/11/2017 10:19	28	10021	3.43	0.4107	8.08	2919.97	7584.94	0.3850	0.9373	0.9539	-1.7%	0.0028	0.0023	22.8%
ASR0611	D3	1118007-6	40.4	6/11/2017 10:25	10	10027	3.42	0.4196	2.75	2930.21	7584.94	0.3863	0.9207	0.9539	-3.5%	0.0009	0.0023	-58.3%
ASR0611	D4	1118007-6	40.4	6/11/2017 10:34	15	10020	3.37	0.4214	4.35	2971.69	7584.94	0.3918	0.9297	0.9539	-2.5%	0.0015	0.0023	-35.0%

LB4100C Beta Attenuation Curve -- Sr-90

WO #: 1118007
 Nuclide: Sr-90
 Std. ID: 777.3020.11
 Ref. Date: 02/08/06
 Half-life: 28.5 yrs
 Activity: 4996.73 dpm/mL
 Vol.: 2 mL

Calibrated Mass Range
 Low 7.7 mg
 High 158.6 mg

Attenuation Equation $y=b*m^{(a*x)}$
 b = 0.9681
 m = 0.9996
 a = 0.9174
 % Diff Max. = 5.9%

Cross-Talk Equation $y=b*x+m$
 b = 1.1183E-05
 m = 0.0018
 % Diff Max. = 83.2%

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Base Beta Eff.	Alpha CPM	Beta CPM	Decay Corr. Act. added dpm/mL	Beta Obs. Atten. Eff.	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\beta > \alpha$ XTLM Observed	$\beta > \alpha$ XTLK Fitted	% Diff.
ASR0611	A1	1118007-7	61.5	6/11/2017 10:34	26	10040	3.27	0.4236	7.87	3068.90	7584.94	0.4046	0.9552	0.9465	0.9%	0.0026	0.0025	3.1%
ASR0611	A2	1118007-7	61.5	6/11/2017 10:42	27	10010	3.31	0.4238	8.06	3022.83	7584.93	0.3985	0.9404	0.9465	-0.6%	0.0027	0.0025	7.2%
ASR0611	A3	1118007-7	61.5	6/11/2017 10:54	17	10052	3.27	0.4440	5.10	3072.50	7584.93	0.4051	0.9123	0.9465	-3.6%	0.0017	0.0025	-33.2%
ASR0611	A4	1118007-7	61.5	6/11/2017 11:04	14	10014	3.26	0.4284	4.21	3070.25	7584.93	0.4048	0.9449	0.9465	-0.2%	0.0014	0.0025	-44.9%
ASR0611	B1	1118007-7	61.5	6/11/2017 11:16	24	10006	3.31	0.4252	7.16	3021.35	7584.92	0.3983	0.9368	0.9465	-1.0%	0.0024	0.0025	-4.7%
ASR0611	B2	1118007-7	61.5	6/11/2017 11:24	23	10023	3.38	0.4122	6.69	2963.73	7584.92	0.3907	0.9479	0.9465	0.2%	0.0023	0.0025	-9.3%
ASR0611	B3	1118007-7	61.5	6/11/2017 9:13	18	10005	3.24	0.4289	5.47	3086.42	7584.96	0.4069	0.9487	0.9465	0.2%	0.0018	0.0025	-28.7%
ASR0611	B4	1118007-7	61.5	6/11/2017 9:19	18	10035	3.34	0.4195	5.29	3002.90	7584.96	0.3959	0.9437	0.9465	-0.3%	0.0018	0.0025	-29.2%
ASR0611	C1	1118007-7	61.5	6/11/2017 9:31	17	10024	3.31	0.4214	5.03	3026.86	7584.96	0.3991	0.9470	0.9465	0.1%	0.0017	0.0025	-33.3%
ASR0611	C2	1118007-7	61.5	6/11/2017 9:40	17	10019	3.25	0.4339	5.12	3081.11	7584.96	0.4062	0.9362	0.9465	-1.1%	0.0017	0.0025	-33.2%
ASR0611	C3	1118007-7	61.5	6/11/2017 9:48	15	10036	3.35	0.4278	4.38	2994.18	7584.95	0.3948	0.9228	0.9465	-2.5%	0.0015	0.0025	-41.2%
ASR0611	C4	1118007-7	61.5	6/11/2017 9:53	27	10026	3.26	0.4285	8.14	3072.56	7584.95	0.4051	0.9454	0.9465	-0.1%	0.0026	0.0025	6.5%
ASR0611	D1	1118007-7	61.5	6/11/2017 10:02	17	10023	3.39	0.4099	4.92	2955.02	7584.95	0.3896	0.9505	0.9465	0.4%	0.0017	0.0025	-33.1%
ASR0611	D2	1118007-7	61.5	6/11/2017 10:09	16	10028	3.4	0.4107	4.62	2947.80	7584.94	0.3886	0.9463	0.9465	0.0%	0.0016	0.0025	-37.0%
ASR0611	D3	1118007-7	61.5	6/11/2017 10:19	10	10037	3.32	0.4196	2.84	3021.53	7584.94	0.3984	0.9494	0.9465	0.3%	0.0009	0.0025	-62.2%
ASR0611	D4	1118007-7	61.5	6/11/2017 10:25	13	10000	3.32	0.4214	3.81	3010.44	7584.94	0.3969	0.9419	0.9465	-0.5%	0.0013	0.0025	-49.1%
ASR0611	A1	1118007-8	61.6	6/11/2017 10:24	18	10040	3.27	0.4236	5.43	3068.90	7584.94	0.4046	0.9552	0.9465	0.9%	0.0018	0.0025	-29.0%
ASR0611	A2	1118007-8	61.6	6/11/2017 10:34	17	10037	3.34	0.4238	5.00	3003.75	7584.94	0.3960	0.9344	0.9465	-1.3%	0.0017	0.0025	-33.2%
ASR0611	A3	1118007-8	61.6	6/11/2017 10:42	23	10009	3.3	0.4440	6.87	3031.52	7584.93	0.3997	0.9002	0.9465	-4.9%	0.0023	0.0025	-8.9%
ASR0611	A4	1118007-8	61.6	6/11/2017 10:54	24	10012	3.27	0.4284	7.26	3060.24	7584.93	0.4035	0.9418	0.9465	-0.5%	0.0024	0.0025	-4.7%
ASR0611	B1	1118007-8	61.6	6/11/2017 11:04	20	10024	3.38	0.4252	5.83	2964.07	7584.93	0.3908	0.9191	0.9465	-2.9%	0.0020	0.0025	-21.0%
ASR0611	B2	1118007-8	61.6	6/11/2017 11:17	27	10031	3.38	0.4122	7.87	2966.10	7584.92	0.3911	0.9487	0.9465	0.2%	0.0027	0.0025	6.6%
ASR0611	B3	1118007-8	61.6	6/11/2017 11:24	23	10030	3.36	0.4289	6.76	2983.57	7584.92	0.3934	0.9171	0.9465	-3.1%	0.0023	0.0025	-8.9%
ASR0611	B4	1118007-8	61.6	6/11/2017 9:14	27	10000	3.39	0.4195	7.86	2948.26	7584.96	0.3887	0.9266	0.9465	-2.1%	0.0027	0.0025	7.2%
ASR0611	C1	1118007-8	61.6	6/11/2017 9:19	15	10036	3.34	0.4214	4.38	3003.25	7584.96	0.3959	0.9396	0.9465	-0.7%	0.0015	0.0025	-41.4%
ASR0611	C2	1118007-8	61.6	6/11/2017 9:31	13	10012	3.31	0.4339	3.82	3023.11	7584.96	0.3986	0.9186	0.9465	-2.9%	0.0013	0.0025	-49.3%
ASR0611	C3	1118007-8	61.6	6/11/2017 9:40	17	10014	3.34	0.4278	4.99	2996.56	7584.96	0.3951	0.9235	0.9465	-2.4%	0.0017	0.0025	-33.0%
ASR0611	C4	1118007-8	61.6	6/11/2017 9:48	26	10040	3.34	0.4285	7.64	3003.09	7584.95	0.3959	0.9240	0.9465	-2.4%	0.0025	0.0025	2.3%
ASR0611	D1	1118007-8	61.6	6/11/2017 9:54	15	10021	3.4	0.4099	4.32	2945.74	7584.95	0.3884	0.9475	0.9465	0.1%	0.0015	0.0025	-41.1%
ASR0611	D2	1118007-8	61.6	6/11/2017 10:02	19	10024	3.36	0.4107	5.57	2981.73	7584.95	0.3931	0.9572	0.9465	1.1%	0.0019	0.0025	-25.0%
ASR0611	D3	1118007-8	61.6	6/11/2017 10:09	9	10027	3.32	0.4196	2.54	3018.52	7584.94	0.3980	0.9484	0.9465	0.2%	0.0008	0.0025	-66.2%
ASR0611	D4	1118007-8	61.6	6/11/2017 10:19	18	10021	3.38	0.4214	5.22	2963.19	7584.94	0.3907	0.9271	0.9465	-2.0%	0.0018	0.0025	-29.2%
ASR0611	A1	1118007-9	83.7	6/11/2017 10:19	17	10037	3.28	0.4236	5.10	3058.62	7584.94	0.4032	0.9520	0.9388	1.4%	0.0017	0.0027	-39.0%
ASR0611	A2	1118007-9	83.7	6/11/2017 10:24	12	10013	3.25	0.4238	3.60	3079.59	7584.94	0.4060	0.9580	0.9388	2.0%	0.0012	0.0027	-57.3%
ASR0611	A3	1118007-9	83.7	6/11/2017 10:34	22	10029	3.29	0.4440	6.59	3046.82	7584.94	0.4017	0.9047	0.9388	-3.6%	0.0022	0.0027	-20.9%
ASR0611	A4	1118007-9	83.7	6/11/2017 10:42	25	10033	3.26	0.4284	7.59	3076.08	7584.93	0.4056	0.9467	0.9388	0.8%	0.0025	0.0027	-9.9%
ASR0611	B1	1118007-9	83.7	6/11/2017 10:54	24	10007	3.37	0.4252	7.03	2967.82	7584.93	0.3913	0.9202	0.9388	-2.0%	0.0024	0.0027	-13.4%
ASR0611	B2	1118007-9	83.7	6/11/2017 11:04	16	10021	3.32	0.4122	4.70	3016.72	7584.93	0.3977	0.9649	0.9388	2.8%	0.0016	0.0027	-43.0%
ASR0611	B3	1118007-9	83.7	6/11/2017 11:16	19	10013	3.28	0.4289	5.71	3051.20	7584.92	0.4023	0.9379	0.9388	-0.1%	0.0019	0.0027	-31.6%
ASR0611	B4	1118007-9	83.7	6/11/2017 11:24	20	10007	3.39	0.4195	5.80	2950.33	7584.92	0.3890	0.9272	0.9388	-1.2%	0.0020	0.0027	-28.2%
ASR0611	C1	1118007-9	83.7	6/11/2017 9:13	12	10038	3.27	0.4214	3.56	3068.18	7584.96	0.4045	0.9599	0.9388	2.2%	0.0012	0.0027	-57.6%
ASR0611	C2	1118007-9	83.7	6/11/2017 9:19	14	10031	3.25	0.4339	4.20	3084.80	7584.96	0.4067	0.9373	0.9388	-0.2%	0.0014	0.0027	-50.3%
ASR0611	C3	1118007-9	83.7	6/11/2017 9:31	15	10015	3.35	0.4278	4.38	2987.91	7584.96	0.3939	0.9208	0.9388	-1.9%	0.0015	0.0027	-46.4%
ASR0611	C4	1118007-9	83.7	6/11/2017 9:40	31	10049	3.28	0.4285	9.31	3060.82	7584.96	0.4035	0.9417	0.9388	0.3%	0.0030	0.0027	11.2%
ASR0611	D1	1118007-9	83.7	6/11/2017 9:48	15	10020	3.41	0.4099	4.30	2936.80	7584.95	0.3872	0.9446	0.9388	0.6%	0.0015	0.0027	-46.4%
ASR0611	D2	1118007-9	83.7	6/11/2017 9:54	16	10041	3.35	0.4107	4.69	2995.71	7584.95	0.3950	0.9617	0.9388	2.4%	0.0016	0.0027	-42.8%
ASR0611	D3	1118007-9	83.7	6/11/2017 10:02	10	10027	3.29	0.4196	2.87	3046.06	7584.95	0.4016	0.9571	0.9388	1.9%	0.0009	0.0027	-65.6%
ASR0611	D4	1118007-9	83.7	6/11/2017 10:09	11	10030	3.35	0.4214	3.18	2992.42	7584.94	0.3945	0.9362	0.9388	-0.3%	0.0011	0.0027	-61.1%

LB4100C Beta Attenuation Curve -- Sr-90

WO #: 1118007
 Nuclide: Sr-90
 Std. ID: 777.3020.11
 Ref. Date: 02/08/06
 Half-life: 28.5 yrs
 Activity: 4996.73 dpm/mL
 Vol.: 2 mL

Calibrated Mass Range
 Low 7.7 mg
 High 158.6 mg

Attenuation Equation $y=b*m^m*(a^x)$
 b = 0.9681
 m = 0.9996
 a = 0.9174
 % Diff Max. = 5.9%

Cross-Talk Equation $y=b*x+m$
 b = 1.1183E-05
 m = 0.0018
 % Diff Max. = 83.2%

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Base Beta Eff.	Alpha CPM	Beta CPM	Decay Corr. Act. added dpm/mL	Beta Obs. Atten. Eff.	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\beta > \alpha$ XTLK Observed	$\beta > \alpha$ XTLK Fitted	% Diff.
ASR0611	A1	1118007-10	84.3	6/11/2017 10:09	25	10021	3.3	0.4236	7.50	3035.23	7584.94	0.4002	0.9447	0.9386	0.6%	0.0025	0.0027	-9.9%
ASR0611	A2	1118007-10	84.3	6/11/2017 10:19	25	10013	3.36	0.4238	7.35	2978.72	7584.94	0.3927	0.9267	0.9386	-1.3%	0.0025	0.0027	-10.1%
ASR0611	A3	1118007-10	84.3	6/11/2017 10:25	13	10044	3.36	0.4440	3.77	2987.78	7584.94	0.3939	0.8872	0.9386	-5.5%	0.0013	0.0027	-54.0%
ASR0611	A4	1118007-10	84.3	6/11/2017 10:34	29	10055	3.34	0.4284	8.60	3008.95	7584.94	0.3967	0.9260	0.9386	-1.3%	0.0029	0.0027	4.2%
ASR0611	B1	1118007-10	84.3	6/11/2017 10:42	22	10023	3.39	0.4252	6.40	2955.02	7584.93	0.3896	0.9163	0.9386	-2.4%	0.0022	0.0027	-21.1%
ASR0611	B2	1118007-10	84.3	6/11/2017 10:54	19	10015	3.39	0.4122	5.49	2952.63	7584.93	0.3893	0.9444	0.9386	0.6%	0.0019	0.0027	-32.2%
ASR0611	B3	1118007-10	84.3	6/11/2017 11:04	15	10008	3.32	0.4289	4.43	3012.91	7584.93	0.3972	0.9261	0.9386	-1.3%	0.0015	0.0027	-46.3%
ASR0611	B4	1118007-10	84.3	6/11/2017 11:17	10	10003	3.41	0.4195	2.83	2931.84	7584.92	0.3865	0.9214	0.9386	-1.8%	0.0010	0.0027	-64.8%
ASR0611	C1	1118007-10	84.3	6/11/2017 11:24	20	10025	3.34	0.4214	5.88	2999.96	7584.92	0.3955	0.9386	0.9386	0.0%	0.0020	0.0027	-28.6%
ASR0611	C2	1118007-10	84.3	6/11/2017 9:13	21	10038	3.32	0.4339	6.21	3021.83	7584.96	0.3984	0.9182	0.9386	-2.2%	0.0021	0.0027	-25.0%
ASR0611	C3	1118007-10	84.3	6/11/2017 9:19	18	10021	3.36	0.4278	5.26	2980.80	7584.96	0.3930	0.9186	0.9386	-2.1%	0.0018	0.0027	-35.6%
ASR0611	C4	1118007-10	84.3	6/11/2017 9:31	21	10033	3.32	0.4285	6.18	3019.09	7584.96	0.3980	0.9289	0.9386	-1.0%	0.0020	0.0027	-25.3%
ASR0611	D1	1118007-10	84.3	6/11/2017 9:40	14	10022	3.38	0.4099	4.05	2963.47	7584.96	0.3907	0.9532	0.9386	1.6%	0.0014	0.0027	-50.2%
ASR0611	D2	1118007-10	84.3	6/11/2017 9:48	20	10032	3.43	0.4107	5.74	2923.17	7584.95	0.3854	0.9384	0.9386	0.0%	0.0020	0.0027	-28.4%
ASR0611	D3	1118007-10	84.3	6/11/2017 9:54	11	10027	3.33	0.4196	3.13	3009.45	7584.95	0.3968	0.9456	0.9386	0.7%	0.0010	0.0027	-62.1%
ASR0611	D4	1118007-10	84.3	6/11/2017 10:02	15	10035	3.36	0.4214	4.36	2985.00	7584.95	0.3935	0.9339	0.9386	-0.5%	0.0015	0.0027	-46.7%
ASR0611	A1	1118007-11	106.2	6/11/2017 10:02	14	10038	3.29	0.4236	4.18	3049.63	7584.95	0.4021	0.9492	0.9311	1.9%	0.0014	0.0030	-54.2%
ASR0611	A2	1118007-11	106.2	6/11/2017 10:09	24	10032	3.36	0.4238	7.05	2984.38	7584.94	0.3935	0.9284	0.9311	-0.3%	0.0024	0.0030	-20.9%
ASR0611	A3	1118007-11	106.2	6/11/2017 10:19	12	10031	3.3	0.4440	3.54	3038.19	7584.94	0.4006	0.9022	0.9311	-3.1%	0.0012	0.0030	-61.0%
ASR0611	A4	1118007-11	106.2	6/11/2017 10:24	17	10032	3.33	0.4284	5.02	3011.08	7584.94	0.3970	0.9267	0.9311	-0.5%	0.0017	0.0030	-44.2%
ASR0611	B1	1118007-11	106.2	6/11/2017 10:34	24	10009	3.37	0.4252	7.03	2968.42	7584.94	0.3914	0.9204	0.9311	-1.1%	0.0024	0.0030	-20.7%
ASR0611	B2	1118007-11	106.2	6/11/2017 10:42	25	10026	3.46	0.4122	7.11	2896.04	7584.93	0.3818	0.9263	0.9311	-0.5%	0.0025	0.0030	-17.8%
ASR0611	B3	1118007-11	106.2	6/11/2017 10:54	14	10028	3.39	0.4289	4.05	2956.57	7584.93	0.3898	0.9088	0.9311	-2.4%	0.0014	0.0030	-54.2%
ASR0611	B4	1118007-11	106.2	6/11/2017 11:04	17	10026	3.35	0.4195	4.97	2991.24	7584.93	0.3944	0.9401	0.9311	1.0%	0.0017	0.0030	-44.3%
ASR0611	C1	1118007-11	106.2	6/11/2017 11:17	15	10037	3.36	0.4214	4.35	2985.66	7584.92	0.3936	0.9341	0.9311	0.3%	0.0015	0.0030	-51.2%
ASR0611	C2	1118007-11	106.2	6/11/2017 11:24	13	10032	3.3	0.4339	3.83	3038.34	7584.92	0.4006	0.9232	0.9311	-0.8%	0.0013	0.0030	-57.8%
ASR0611	C3	1118007-11	106.2	6/11/2017 9:13	15	10030	3.33	0.4278	4.41	3010.37	7584.96	0.3969	0.9277	0.9311	-0.4%	0.0015	0.0030	-51.0%
ASR0611	C4	1118007-11	106.2	6/11/2017 9:19	21	10020	3.28	0.4285	6.26	3051.98	7584.96	0.4024	0.9390	0.9311	0.9%	0.0021	0.0030	-31.3%
ASR0611	D1	1118007-11	106.2	6/11/2017 9:31	15	10006	3.4	0.4099	4.32	2941.33	7584.96	0.3878	0.9460	0.9311	1.6%	0.0015	0.0030	-50.9%
ASR0611	D2	1118007-11	106.2	6/11/2017 9:40	24	10023	3.36	0.4107	7.06	2981.43	7584.96	0.3931	0.9571	0.9311	2.8%	0.0024	0.0030	-20.8%
ASR0611	D3	1118007-11	106.2	6/11/2017 9:48	8	10018	3.41	0.4196	2.18	2936.16	7584.95	0.3871	0.9226	0.9311	-0.9%	0.0007	0.0030	-75.2%
ASR0611	D4	1118007-11	106.2	6/11/2017 9:54	15	10010	3.35	0.4214	4.38	2986.45	7584.95	0.3937	0.9343	0.9311	0.3%	0.0015	0.0030	-50.9%
ASR0611	A1	1118007-12	106.8	6/11/2017 9:54	18	10045	3.36	0.4236	5.28	2988.15	7584.95	0.3940	0.9300	0.9309	-0.1%	0.0018	0.0030	-41.0%
ASR0611	A2	1118007-12	106.8	6/11/2017 10:02	18	10031	3.33	0.4238	5.31	3010.98	7584.95	0.3970	0.9367	0.9309	0.6%	0.0018	0.0030	-41.1%
ASR0611	A3	1118007-12	106.8	6/11/2017 10:09	21	10039	3.32	0.4440	6.23	3022.29	7584.94	0.3985	0.8974	0.9309	-3.6%	0.0021	0.0030	-31.2%
ASR0611	A4	1118007-12	106.8	6/11/2017 10:19	19	10025	3.32	0.4284	5.64	3018.05	7584.94	0.3979	0.9288	0.9309	-0.2%	0.0019	0.0030	-37.6%
ASR0611	B1	1118007-12	106.8	6/11/2017 10:25	20	10028	3.4	0.4252	5.79	2947.80	7584.94	0.3886	0.9140	0.9309	-1.8%	0.0020	0.0030	-34.4%
ASR0611	B2	1118007-12	106.8	6/11/2017 10:34	22	10004	3.38	0.4122	6.39	2958.11	7584.94	0.3900	0.9461	0.9309	1.6%	0.0022	0.0030	-27.8%
ASR0611	B3	1118007-12	106.8	6/11/2017 10:42	12	10048	3.38	0.4289	3.47	2971.24	7584.93	0.3917	0.9133	0.9309	-1.9%	0.0012	0.0030	-61.0%
ASR0611	B4	1118007-12	106.8	6/11/2017 10:54	15	10003	3.42	0.4195	4.29	2923.26	7584.93	0.3854	0.9187	0.9309	-1.3%	0.0015	0.0030	-51.0%
ASR0611	C1	1118007-12	106.8	6/11/2017 11:04	16	10009	3.33	0.4214	4.69	3004.17	7584.93	0.3961	0.9399	0.9309	1.0%	0.0016	0.0030	-47.8%
ASR0611	C2	1118007-12	106.8	6/11/2017 11:17	14	10055	3.38	0.4339	4.03	2973.19	7584.92	0.3920	0.9034	0.9309	-3.0%	0.0014	0.0030	-54.7%
ASR0611	C3	1118007-12	106.8	6/11/2017 11:24	17	10051	3.33	0.4278	5.01	3016.68	7584.92	0.3977	0.9297	0.9309	-0.1%	0.0017	0.0030	-44.5%
ASR0611	C4	1118007-12	106.8	6/11/2017 9:14	23	10051	3.42	0.4285	6.58	2935.99	7584.96	0.3871	0.9033	0.9309	-3.0%	0.0022	0.0030	-25.1%
ASR0611	D1	1118007-12	106.8	6/11/2017 9:19	16	10021	3.36	0.4099	4.67	2980.83	7584.96	0.3930	0.9587	0.9309	3.0%	0.0016	0.0030	-47.7%
ASR0611	D2	1118007-12	106.8	6/11/2017 9:31	19	10026	3.43	0.4107	5.45	2921.43	7584.96	0.3852	0.9378	0.9309	0.7%	0.0019	0.0030	-37.7%
ASR0611	D3	1118007-12	106.8	6/11/2017 9:40	17	10010	3.42	0.4196	4.80	2925.24	7584.96	0.3857	0.9191	0.9309	-1.3%	0.0016	0.0030	-45.2%
ASR0611	D4	1118007-12	106.8	6/11/2017 9:48	12	10029	3.39	0.4214	3.44	2956.80	7584.95	0.3898	0.9251	0.9309	-0.6%	0.0012	0.0030	-61.2%

LB4100C Beta Attenuation Curve -- Sr-90

WO #: 1118007

Nuclide: Sr-90
 Std. ID: 777.3020.11
 Ref. Date: 02/08/06
 Half-life: 28.5 yrs
 Activity: 4996.73 dpm/mL
 Vol.: 2 mL

Calibrated Mass Range
 Low 7.7 mg
 High 158.6 mg

Attenuation Equation $y=b*m^{(a*x)}$

b = 0.9681
 m = 0.9996
 a = 0.9174

% Diff Max. = 5.9%

Cross-Talk Equation $y=b*x+m$

b = 1.1183E-05
 m = 0.0018

% Diff Max. = 83.2%

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Base Beta Eff.	Alpha CPM	Beta CPM	Decay Corr. Act. added dpm/mL	Beta Obs. Atten. Eff.	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\beta > \alpha$ XTLK Observed	$\beta > \alpha$ XTLK Fitted	% Diff.
ASR0611	A1	1118007-13	126.6	6/11/2017 9:48	16	10034	3.34	0.4236	4.71	3002.76	7584.95	0.3959	0.9346	0.9241	1.1%	0.0016	0.0032	-51.2%
ASR0611	A2	1118007-13	126.6	6/11/2017 9:54	20	10028	3.43	0.4238	5.74	2922.28	7584.95	0.3853	0.9091	0.9241	-1.6%	0.0020	0.0032	-39.0%
ASR0611	A3	1118007-13	126.6	6/11/2017 10:02	16	10012	3.37	0.4440	4.65	2969.41	7584.95	0.3915	0.8817	0.9241	-4.6%	0.0016	0.0032	-51.3%
ASR0611	A4	1118007-13	126.6	6/11/2017 10:09	23	10026	3.33	0.4284	6.82	3009.28	7584.94	0.3967	0.9261	0.9241	0.2%	0.0023	0.0032	-29.5%
ASR0611	B1	1118007-13	126.6	6/11/2017 10:19	26	10030	3.43	0.4252	7.49	2922.59	7584.94	0.3853	0.9062	0.9241	-1.9%	0.0026	0.0032	-20.3%
ASR0611	B2	1118007-13	126.6	6/11/2017 10:25	17	10023	3.49	0.4122	4.75	2870.27	7584.94	0.3784	0.9180	0.9241	-0.7%	0.0017	0.0032	-48.5%
ASR0611	B3	1118007-13	126.6	6/11/2017 10:34	13	10036	3.43	0.4289	3.71	2924.40	7584.94	0.3856	0.8989	0.9241	-2.7%	0.0013	0.0032	-60.6%
ASR0611	B4	1118007-13	126.6	6/11/2017 10:42	16	10020	3.34	0.4195	4.69	2998.41	7584.93	0.3953	0.9423	0.9241	2.0%	0.0016	0.0032	-51.4%
ASR0611	C1	1118007-13	126.6	6/11/2017 10:54	26	10028	3.34	0.4214	7.67	3000.86	7584.93	0.3956	0.9389	0.9241	1.6%	0.0026	0.0032	-20.5%
ASR0611	C2	1118007-13	126.6	6/11/2017 11:04	18	10017	3.36	0.4339	5.25	2979.59	7584.93	0.3928	0.9053	0.9241	-2.0%	0.0018	0.0032	-45.3%
ASR0611	C3	1118007-13	126.6	6/11/2017 11:17	12	10025	3.37	0.4278	3.46	2973.14	7584.92	0.3920	0.9163	0.9241	-0.9%	0.0012	0.0032	-63.8%
ASR0611	C4	1118007-13	126.6	6/11/2017 11:24	21	10040	3.31	0.4285	6.20	3030.34	7584.92	0.3995	0.9324	0.9241	0.9%	0.0020	0.0032	-36.3%
ASR0611	D1	1118007-13	126.6	6/11/2017 9:14	9	10037	3.4	0.4099	2.55	2950.44	7584.96	0.3890	0.9490	0.9241	2.7%	0.0009	0.0032	-73.1%
ASR0611	D2	1118007-13	126.6	6/11/2017 9:19	12	10022	3.38	0.4107	3.46	2963.48	7584.96	0.3907	0.9513	0.9241	2.9%	0.0012	0.0032	-63.7%
ASR0611	D3	1118007-13	126.6	6/11/2017 9:31	6	10011	3.4	0.4196	1.59	2942.75	7584.96	0.3880	0.9246	0.9241	0.1%	0.0005	0.0032	-83.2%
ASR0611	D4	1118007-13	126.6	6/11/2017 9:40	14	10018	3.38	0.4214	4.04	2962.30	7584.96	0.3905	0.9268	0.9241	0.3%	0.0014	0.0032	-57.6%
ASR0611	A1	1118007-14	127.4	6/11/2017 9:40	13	10025	3.29	0.4236	3.87	3045.68	7584.96	0.4015	0.9479	0.9239	2.6%	0.0013	0.0032	-60.6%
ASR0611	A2	1118007-14	127.4	6/11/2017 9:48	18	10029	3.35	0.4238	5.28	2992.40	7584.95	0.3945	0.9309	0.9239	0.8%	0.0018	0.0032	-45.3%
ASR0611	A3	1118007-14	127.4	6/11/2017 9:53	13	10014	3.31	0.4440	3.83	3023.87	7584.95	0.3987	0.8979	0.9239	-2.8%	0.0013	0.0032	-60.7%
ASR0611	A4	1118007-14	127.4	6/11/2017 10:02	20	10027	3.31	0.4284	5.96	3027.77	7584.95	0.3992	0.9318	0.9239	0.9%	0.0020	0.0032	-39.0%
ASR0611	B1	1118007-14	127.4	6/11/2017 10:09	18	10022	3.38	0.4252	5.23	2963.48	7584.94	0.3907	0.9189	0.9239	-0.5%	0.0018	0.0032	-45.2%
ASR0611	B2	1118007-14	127.4	6/11/2017 10:19	28	10018	3.45	0.4122	8.00	2902.12	7584.94	0.3826	0.9282	0.9239	0.5%	0.0028	0.0032	-14.5%
ASR0611	B3	1118007-14	127.4	6/11/2017 10:25	17	10024	3.44	0.4289	4.86	2912.41	7584.94	0.3840	0.8952	0.9239	-3.1%	0.0017	0.0032	-48.3%
ASR0611	B4	1118007-14	127.4	6/11/2017 10:34	20	10047	3.33	0.4195	5.91	3015.53	7584.94	0.3976	0.9477	0.9239	2.6%	0.0020	0.0032	-39.3%
ASR0611	C1	1118007-14	127.4	6/11/2017 10:42	17	10023	3.34	0.4214	4.98	2999.36	7584.93	0.3954	0.9384	0.9239	1.6%	0.0017	0.0032	-48.5%
ASR0611	C2	1118007-14	127.4	6/11/2017 10:54	18	10024	3.35	0.4339	5.26	2990.58	7584.93	0.3943	0.9087	0.9239	-1.6%	0.0018	0.0032	-45.4%
ASR0611	C3	1118007-14	127.4	6/11/2017 11:04	11	10036	3.36	0.4278	3.18	2985.26	7584.93	0.3936	0.9200	0.9239	-0.4%	0.0011	0.0032	-67.0%
ASR0611	C4	1118007-14	127.4	6/11/2017 11:16	20	10018	3.32	0.4285	5.88	3014.57	7584.92	0.3974	0.9275	0.9239	0.4%	0.0020	0.0032	-39.5%
ASR0611	D1	1118007-14	127.4	6/11/2017 11:24	17	10021	3.34	0.4099	4.99	2998.69	7584.92	0.3953	0.9645	0.9239	4.4%	0.0017	0.0032	-48.3%
ASR0611	D2	1118007-14	127.4	6/11/2017 9:14	13	10019	3.44	0.4107	3.69	2910.89	7584.96	0.3838	0.9344	0.9239	1.1%	0.0013	0.0032	-60.7%
ASR0611	D3	1118007-14	127.4	6/11/2017 9:19	7	10027	3.36	0.4196	1.91	2982.56	7584.96	0.3932	0.9371	0.9239	1.4%	0.0006	0.0032	-80.1%
ASR0611	D4	1118007-14	127.4	6/11/2017 9:31	16	10035	3.38	0.4214	4.63	2967.33	7584.96	0.3912	0.9284	0.9239	0.5%	0.0016	0.0032	-51.6%
ASR0611	A1	1118007-16	148	6/11/2017 9:19	21	10029	3.41	0.4236	6.08	2939.62	7584.96	0.3876	0.9149	0.9169	-0.2%	0.0021	0.0035	-40.1%
ASR0611	A2	1118007-16	148	6/11/2017 9:31	14	10036	3.46	0.4238	3.95	2899.24	7584.96	0.3822	0.9019	0.9169	-1.6%	0.0014	0.0035	-60.5%
ASR0611	A3	1118007-16	148	6/11/2017 9:40	16	10003	3.44	0.4440	4.56	2906.34	7584.96	0.3832	0.8630	0.9169	-5.9%	0.0016	0.0035	-54.6%
ASR0611	A4	1118007-16	148	6/11/2017 9:48	19	10039	3.42	0.4284	5.47	2933.85	7584.95	0.3868	0.9029	0.9169	-1.5%	0.0019	0.0035	-46.0%
ASR0611	B1	1118007-16	148	6/11/2017 9:54	24	10017	3.57	0.4252	6.63	2804.27	7584.95	0.3697	0.8695	0.9169	-5.2%	0.0024	0.0035	-31.6%
ASR0611	B2	1118007-16	148	6/11/2017 10:02	19	10007	3.51	0.4122	5.30	2849.35	7584.95	0.3757	0.9113	0.9169	-0.6%	0.0019	0.0035	-46.2%
ASR0611	B3	1118007-16	148	6/11/2017 10:09	14	10024	3.46	0.4289	3.96	2895.56	7584.94	0.3818	0.8901	0.9169	-2.9%	0.0014	0.0035	-60.4%
ASR0611	B4	1118007-16	148	6/11/2017 10:19	24	10034	3.42	0.4195	6.92	2932.33	7584.94	0.3866	0.9216	0.9169	0.5%	0.0024	0.0035	-31.7%
ASR0611	C1	1118007-16	148	6/11/2017 10:25	20	10001	3.51	0.4214	5.59	2847.75	7584.94	0.3754	0.8910	0.9169	-2.8%	0.0020	0.0035	-43.2%
ASR0611	C2	1118007-16	148	6/11/2017 10:34	19	10027	3.4	0.4339	5.48	2947.46	7584.94	0.3886	0.8956	0.9169	-2.3%	0.0019	0.0035	-46.2%
ASR0611	C3	1118007-16	148	6/11/2017 10:42	11	10018	3.44	0.4278	3.10	2910.57	7584.93	0.3837	0.8970	0.9169	-2.2%	0.0011	0.0035	-69.2%
ASR0611	C4	1118007-16	148	6/11/2017 10:55	20	10017	3.49	0.4285	5.59	2867.30	7584.93	0.3780	0.8822	0.9169	-3.8%	0.0019	0.0035	-43.6%
ASR0611	D1	1118007-16	148	6/11/2017 11:04	15	10027	3.54	0.4099	4.14	2830.87	7584.93	0.3732	0.9105	0.9169	-0.7%	0.0015	0.0035	-57.6%
ASR0611	D2	1118007-16	148	6/11/2017 11:17	29	10013	3.57	0.4107	8.04	2803.15	7584.92	0.3696	0.8999	0.9169	-1.9%	0.0029	0.0035	-17.0%
ASR0611	D3	1118007-16	148	6/11/2017 11:24	15	10039	3.57	0.4196	4.03	2810.38	7584.92	0.3705	0.8830	0.9169	-3.7%	0.0014	0.0035	-58.5%
ASR0611	D4	1118007-16	148	6/11/2017 9:14	8	10039	3.53	0.4214	2.17	2842.30	7584.96	0.3747	0.8892	0.9169	-3.0%	0.0008	0.0035	-78.0%

LB4100C Beta Attenuation Curve -- Sr-90

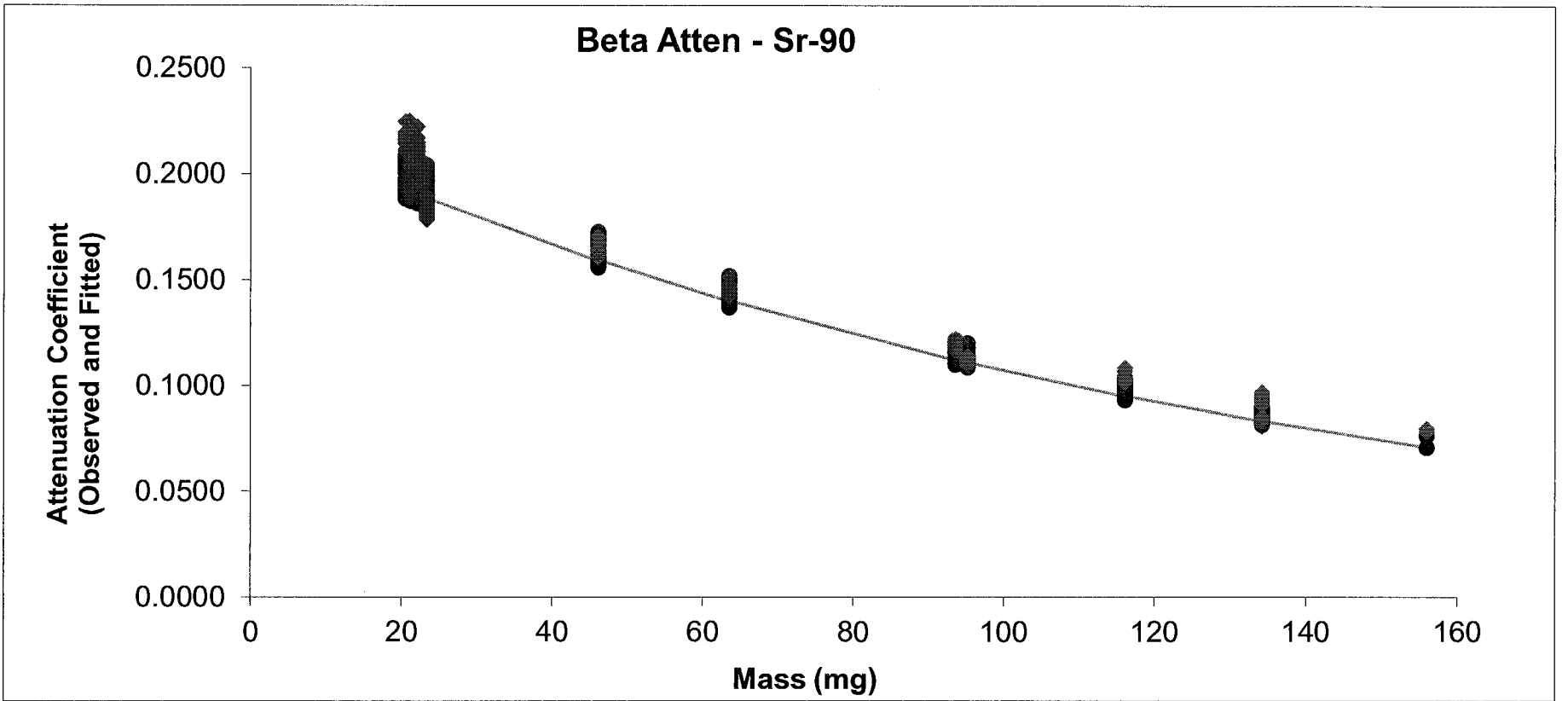
WO #: 1118007
 Nuclide: Sr-90
 Std. ID: 777.3020.11
 Ref. Date: 02/08/06
 Half-life: 28.5 yrs
 Activity: 4996.73 dpm/mL
 Vol.: 2 mL

Calibrated Mass Range
 Low 7.7 mg
 High 158.6 mg

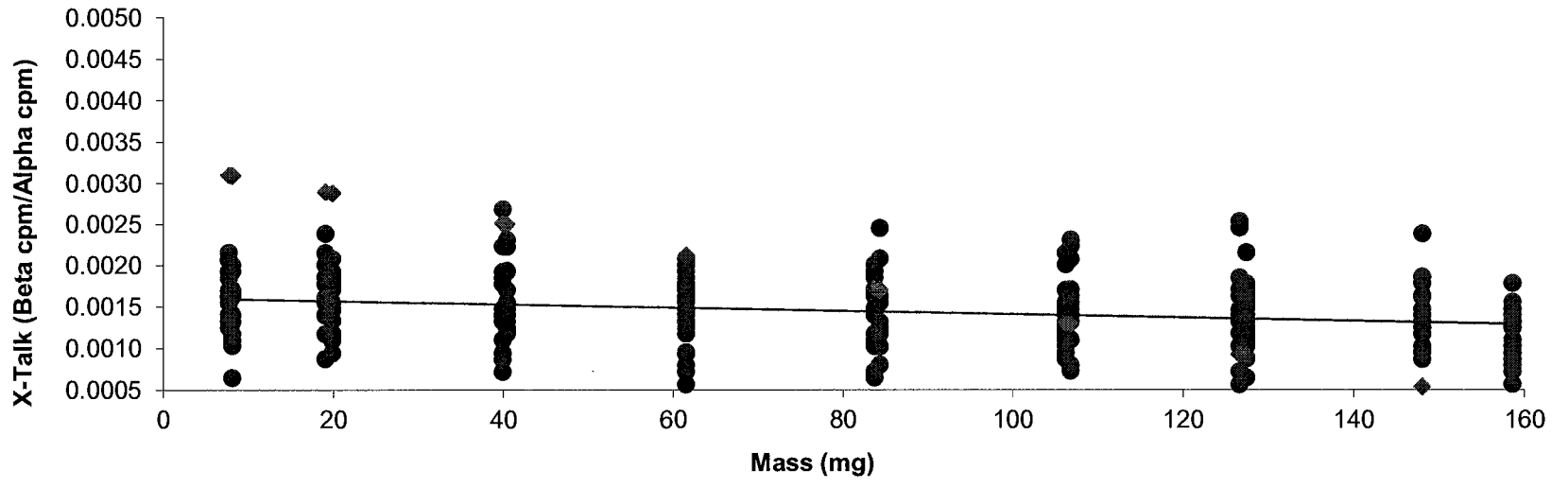
Attenuation Equation $y=b*m^a(a*x)$
 b = 0.9681
 m = 0.9996
 a = 0.9174
 % Diff Max. = 5.9%

Cross-Talk Equation $y=b*x+m$
 b = 1.1183E-05
 m = 0.0018
 % Diff Max. = 83.2%

File ID	Detector ID	Sample ID	Mass (mg)	Count Date	Alpha Counts	Beta Counts	Count Time	Base Beta Eff.	Alpha CPM	Beta CPM	Decay Corr. Act. added dpm/mL	Beta Obs. Atten. Eff.	Obs Atten Fact.	Fitted Atten Fact.	% Diff.	$\beta > \alpha$ XTL Observed	$\beta > \alpha$ XTL Fitted	% Diff.
ASR0611	A1	1118007-15	158.6	6/11/2017 9:31	21	10010	3.38	0.4236	6.14	2960.10	7584.96	0.3903	0.9213	0.9134	0.9%	0.0021	0.0036	-42.0%
ASR0611	A2	1118007-15	158.6	6/11/2017 9:40	24	10036	3.39	0.4238	6.99	2959.14	7584.96	0.3901	0.9206	0.9134	0.8%	0.0024	0.0036	-33.9%
ASR0611	A3	1118007-15	158.6	6/11/2017 9:48	14	10014	3.38	0.4440	4.05	2961.21	7584.95	0.3904	0.8793	0.9134	-3.7%	0.0014	0.0036	-61.8%
ASR0611	A4	1118007-15	158.6	6/11/2017 9:54	18	10027	3.44	0.4284	5.15	2913.29	7584.95	0.3841	0.8966	0.9134	-1.8%	0.0018	0.0036	-50.5%
ASR0611	B1	1118007-15	158.6	6/11/2017 10:02	17	10021	3.44	0.4252	4.85	2911.47	7584.95	0.3838	0.9027	0.9134	-1.2%	0.0017	0.0036	-53.4%
ASR0611	B2	1118007-15	158.6	6/11/2017 10:09	19	10034	3.49	0.4122	5.33	2873.42	7584.94	0.3788	0.9190	0.9134	0.6%	0.0019	0.0036	-48.1%
ASR0611	B3	1118007-15	158.6	6/11/2017 10:19	17	10027	3.43	0.4289	4.87	2921.78	7584.94	0.3852	0.8981	0.9134	-1.7%	0.0017	0.0036	-53.3%
ASR0611	B4	1118007-15	158.6	6/11/2017 10:25	11	10004	3.47	0.4195	3.07	2881.41	7584.94	0.3799	0.9056	0.9134	-0.9%	0.0011	0.0036	-70.2%
ASR0611	C1	1118007-15	158.6	6/11/2017 10:34	15	10029	3.39	0.4214	4.31	2956.87	7584.94	0.3898	0.9251	0.9134	1.3%	0.0015	0.0036	-59.2%
ASR0611	C2	1118007-15	158.6	6/11/2017 10:42	15	10011	3.42	0.4339	4.27	2925.53	7584.93	0.3857	0.8889	0.9134	-2.7%	0.0015	0.0036	-59.1%
ASR0611	C3	1118007-15	158.6	6/11/2017 10:54	20	10029	3.41	0.4278	5.77	2939.42	7584.93	0.3875	0.9059	0.9134	-0.8%	0.0020	0.0036	-45.1%
ASR0611	C4	1118007-15	158.6	6/11/2017 11:04	27	10036	3.38	0.4285	7.85	2966.33	7584.93	0.3911	0.9127	0.9134	-0.1%	0.0026	0.0036	-26.0%
ASR0611	D1	1118007-15	158.6	6/11/2017 11:17	16	10018	3.48	0.4099	4.50	2877.12	7584.92	0.3793	0.9254	0.9134	1.3%	0.0016	0.0036	-56.2%
ASR0611	D2	1118007-15	158.6	6/11/2017 11:24	14	10006	3.44	0.4107	3.98	2907.11	7584.92	0.3833	0.9332	0.9134	2.2%	0.0014	0.0036	-61.7%
ASR0611	D3	1118007-15	158.6	6/11/2017 9:14	9	10035	3.45	0.4196	2.44	2907.03	7584.96	0.3833	0.9134	0.9134	0.0%	0.0008	0.0036	-76.5%
ASR0611	D4	1118007-15	158.6	6/11/2017 9:19	7	10011	3.47	0.4214	1.92	2883.41	7584.96	0.3801	0.9021	0.9134	-1.2%	0.0007	0.0036	-81.4%



Beta > Alpha Cross-Talk - Sr-90



Detector	Sample				Count		ALPHA	BETA
ID	ID	Alpha	Beta	Guard	Time	TOD	CPM	CPM
A1	23.3	10002	2654	7406	10.6	6/10/2017 10:21	943.5069	248.9414
A1	43.7	10000	2613	8885	12.97	6/10/2017 15:44	770.932	200.0289
A1	46.1	10002	2574	7898	11.46	6/10/2017 15:14	872.6969	223.1713
A1	63.5	9999	2584	9151	12.92	6/10/2017 14:47	773.8384	198.564
A1	81.1	10020	2487	7790	11.28	6/10/2017 14:16	888.2199	219.0427
A1	93.6	10009	2373	11094	15.97	6/10/2017 13:52	626.6596	147.1551
A1	95.2	10008	2609	11819	16.96	6/10/2017 13:23	590.0163	152.3965
A1	116.1	10002	2612	13186	18.71	6/10/2017 12:57	534.5024	138.1685
A1	134.2	10001	2902	17075	24.23	6/10/2017 12:31	412.6748	118.3329
A1	134.3	10004	2789	15271	21.71	6/10/2017 12:00	460.7235	127.0301
A1	151.6	9999	2851	16367	23.11	6/10/2017 11:32	432.5918	121.9305
A1	156	10002	2918	18142	25.89	6/10/2017 11:06	386.2488	111.2716
A2	22.1	10011	2646	6595	9.4	6/10/2017 10:20	1064.906	280.1534
A2	23.3	10011	2636	7609	10.64	6/10/2017 10:51	940.7895	246.4084
A2	46.1	10007	2535	7934	11.55	6/10/2017 15:43	866.3129	218.1445
A2	63.5	10006	2500	9094	13.12	6/10/2017 15:16	762.5584	189.2128
A2	81.1	10009	2356	7986	11.28	6/10/2017 14:45	887.2287	207.5292
A2	93.6	10003	2318	11007	15.93	6/10/2017 14:21	627.8407	144.1756
A2	95.2	10012	2579	11870	17.04	6/10/2017 13:53	587.4647	150.0138
A2	116.1	10011	2655	13262	18.99	6/10/2017 13:25	527.0782	138.4744
A2	134.2	10004	2990	17715	25.18	6/10/2017 13:03	397.2054	117.409
A2	134.3	10003	2763	15595	22.11	6/10/2017 12:29	452.3257	123.6301
A2	151.6	10003	2818	16361	23.28	6/10/2017 12:01	429.5881	119.7121
A2	156	10001	2822	18457	26.16	6/10/2017 11:35	382.2072	106.5386
A3	21	10012	2671	6066	8.61	6/10/2017 10:19	1162.738	308.7107
A3	22.1	10010	2806	6703	9.32	6/10/2017 10:50	1073.938	299.563
A3	23.3	10005	2838	7514	10.81	6/10/2017 11:19	925.4359	261.0247
A3	63.5	10009	2685	8856	12.92	6/10/2017 15:44	774.5944	206.3073
A3	81.1	10002	2477	7603	11.02	6/10/2017 15:14	907.5265	223.2631
A3	93.6	10008	2500	11269	15.9	6/10/2017 14:50	629.338	155.7227
A3	95.2	10004	2607	11650	16.8	6/10/2017 14:22	595.3802	153.6686
A3	116.1	10001	2611	13179	18.82	6/10/2017 13:55	531.3068	137.2254
A3	134.2	10005	2997	16878	24.25	6/10/2017 13:31	412.4813	122.0776
A3	134.3	10005	2764	15102	21.42	6/10/2017 13:00	466.9908	127.5283
A3	151.6	10004	2844	16176	22.95	6/10/2017 12:30	435.8081	122.4116
A3	156	9999	2904	18286	26.06	6/10/2017 12:04	383.5955	109.9251
A4	21	10004	2690	6173	8.58	6/10/2017 10:49	1165.884	311.9878
A4	22.1	10006	2746	6454	9.25	6/10/2017 11:18	1081.647	295.3329
A4	23.3	10011	2832	7457	10.47	6/10/2017 11:48	956.0775	268.9551
A4	48.5	10006	2898	10358	14.9	6/10/2017 10:25	671.4606	192.9646
A4	81.1	10002	2494	7658	11.12	6/10/2017 15:43	899.3774	222.7486
A4	93.6	10002	2510	11033	15.79	6/10/2017 15:18	633.3559	157.4294
A4	95.2	10000	2655	11909	16.81	6/10/2017 14:51	594.801	156.4097
A4	116.1	10001	2709	12944	18.61	6/10/2017 14:24	537.3162	144.0349
A4	134.2	10000	2983	16717	23.88	6/10/2017 14:00	418.6775	123.3842
A4	134.3	10001	2850	14745	21.15	6/10/2017 13:28	472.7775	133.2198
A4	151.6	10003	2813	15978	22.69	6/10/2017 13:01	440.772	122.4433
A4	156	10002	3072	18458	26.17	6/10/2017 12:33	382.1104	115.8543
B1	21	10016	2665	6317	8.89	6/10/2017 11:17	1126.568	298.162
B1	22.1	10010	2636	6772	9.33	6/10/2017 11:47	1072.792	280.9165

B1	23.3	10000	2784	8006	10.99	6/10/2017 12:18	909.8271	251.7082
B1	47.5	10004	3012	13364	18.8	6/10/2017 10:29	532.0367	158.5998
B1	48.5	10007	2818	10722	14.97	6/10/2017 10:55	668.3793	186.6302
B1	93.6	10011	2431	11611	16.31	6/10/2017 15:48	613.7042	147.4367
B1	95.2	10005	2616	12000	17.09	6/10/2017 15:20	585.3391	151.459
B1	116.1	10002	2676	13864	19.47	6/10/2017 14:53	513.6224	135.8292
B1	134.2	10000	2959	17625	24.65	6/10/2017 14:30	405.5885	118.4276
B1	134.3	10005	2958	16108	22.74	6/10/2017 13:59	439.8826	128.4662
B1	151.6	10006	2732	16525	23.35	6/10/2017 13:30	428.4315	115.3891
B1	156	10001	2973	18646	26.27	6/10/2017 13:04	380.6094	111.5579
B2	21	10011	2699	6451	8.87	6/10/2017 11:47	1128.519	302.6341
B2	22.1	10015	2861	7137	9.74	6/10/2017 12:16	1028.117	292.0872
B2	23.3	10006	2895	7900	11.14	6/10/2017 12:49	898.0877	258.2243
B2	43.7	10006	2699	9551	13.5	6/10/2017 10:24	741.0682	198.2759
B2	47.5	10001	2973	13557	19.1	6/10/2017 11:00	523.4956	154.0045
B2	48.5	10007	2933	11045	15.48	6/10/2017 11:24	646.33	187.8203
B2	95.2	10001	2780	12620	17.76	6/10/2017 15:49	563.0024	154.8815
B2	116.1	10004	2675	13717	19.45	6/10/2017 15:22	514.2275	135.8821
B2	134.2	10001	3107	18077	25.49	6/10/2017 14:59	392.2329	120.2409
B2	134.3	10002	2953	16192	22.51	6/10/2017 14:28	444.2189	129.5361
B2	151.6	10002	2963	17070	24.07	6/10/2017 14:00	415.421	121.4493
B2	156	10000	2972	19055	26.98	6/10/2017 13:33	370.5279	108.5057
B3	21	10003	2830	6473	8.85	6/10/2017 12:15	1130.198	318.229
B3	22.1	10015	2791	6866	9.7	6/10/2017 12:48	1032.39	286.187
B3	23.3	10010	2836	7679	10.89	6/10/2017 13:17	919.1079	258.8774
B3	43.7	10006	2811	9628	13.43	6/10/2017 10:54	744.9644	207.7625
B3	46.1	10001	2716	8244	11.7	6/10/2017 10:22	854.7023	230.5918
B3	47.5	10003	3141	13327	18.6	6/10/2017 11:27	537.7117	167.326
B3	48.5	10004	3079	11025	15.27	6/10/2017 11:53	655.0568	200.0922
B3	116.1	10001	2726	13670	19.22	6/10/2017 15:51	520.2594	140.2864
B3	134.2	10002	3169	17537	24.85	6/10/2017 15:27	402.411	125.9802
B3	134.3	10002	2909	15708	22.11	6/10/2017 14:56	452.2905	130.0244
B3	151.6	10000	2918	16758	23.34	6/10/2017 14:28	428.365	123.4764
B3	156	10002	2998	19002	26.78	6/10/2017 14:03	373.4037	110.4042
B4	21	10009	2817	6320	8.94	6/10/2017 12:47	1119.475	313.5097
B4	22.1	10010	2876	6834	9.68	6/10/2017 13:16	1033.991	295.5164
B4	23.3	10014	2885	7650	10.89	6/10/2017 13:47	919.4592	263.3309
B4	43.7	10005	2765	9398	13.13	6/10/2017 11:22	761.8954	208.9954
B4	46.1	10002	2657	8495	11.82	6/10/2017 10:52	846.0929	223.1975
B4	47.5	10002	3046	13505	18.69	6/10/2017 11:57	535.0525	161.3839
B4	48.5	10005	2912	11066	15.31	6/10/2017 12:22	653.3944	188.6115
B4	63.5	10003	2575	9268	13.13	6/10/2017 10:24	761.7431	194.5248
B4	134.2	10003	3144	17876	25.08	6/10/2017 15:57	398.7437	123.7679
B4	134.3	10003	3002	15951	22.64	6/10/2017 15:25	441.7286	131.0062
B4	151.6	10003	2945	16489	23.23	6/10/2017 14:57	430.507	125.1847
B4	156	10001	3006	18966	26.59	6/10/2017 14:32	376.0188	111.459
C1	21	10012	2882	6401	8.83	6/10/2017 13:15	1133.752	324.8473
C1	22.1	10006	2702	6527	9.18	6/10/2017 13:45	1089.868	292.7955
C1	23.3	9999	2813	7534	10.41	6/10/2017 14:15	960.4087	268.6809
C1	43.7	10010	2653	9354	12.72	6/10/2017 11:51	786.8397	207.0292
C1	46.1	10005	2594	8270	11.43	6/10/2017 11:20	875.2181	225.4066
C1	47.5	10002	3067	13299	18.29	6/10/2017 12:25	546.7462	166.1473

C1	48.5	10008	2909	10618	14.73	6/10/2017 12:53	679.3197	195.9481
C1	63.5	10005	2676	9493	12.96	6/10/2017 10:53	771.8807	204.9415
C1	81.1	10010	2588	8050	11.27	6/10/2017 10:22	888.0888	228.0962
C1	134.3	10001	2871	15485	21.41	6/10/2017 15:53	467.0082	132.5562
C1	151.6	10001	2874	16729	23.24	6/10/2017 15:26	430.2256	122.1261
C1	156	10002	3048	18560	25.78	6/10/2017 15:00	387.8652	116.6912
C2	21	10012	2724	6160	8.67	6/10/2017 13:45	1154.675	312.5279
C2	22.1	10006	2799	6749	9.28	6/10/2017 14:14	1078.121	299.9574
C2	23.3	10004	2876	7687	10.68	6/10/2017 14:44	936.5921	267.6294
C2	43.7	10009	2671	9453	12.93	6/10/2017 12:20	773.9793	204.9149
C2	46.1	10007	2687	8469	11.53	6/10/2017 11:49	867.7978	231.3852
C2	47.5	10004	3014	13231	18.31	6/10/2017 12:56	546.2561	162.9505
C2	48.5	10000	2902	10881	14.97	6/10/2017 13:21	667.8907	192.1954
C2	63.5	10005	2579	9239	12.74	6/10/2017 11:21	785.2098	200.7743
C2	81.1	10007	2533	8182	11.1	6/10/2017 10:51	901.4195	226.5392
C2	93.6	10005	2468	11486	15.97	6/10/2017 10:26	626.3752	152.8808
C2	151.6	10001	2934	16860	23.35	6/10/2017 15:55	428.1964	123.9941
C2	156	10001	2890	18630	25.85	6/10/2017 15:28	386.7739	110.1398
C3	21	10007	2821	6408	8.82	6/10/2017 14:14	1134.484	318.2013
C3	22.1	10005	2730	6665	9.3	6/10/2017 14:43	1075.71	291.9084
C3	23.3	10003	2818	7655	10.75	6/10/2017 15:13	930.4156	260.4995
C3	43.7	10002	2622	9451	13.02	6/10/2017 12:51	768.1068	199.7425
C3	46.1	10011	2478	8413	11.52	6/10/2017 12:18	868.9144	213.4642
C3	47.5	10000	2955	13463	18.44	6/10/2017 13:25	542.2033	158.6095
C3	48.5	10003	2928	10764	14.97	6/10/2017 13:51	668.1071	193.9512
C3	63.6	10002	2671	9648	13.12	6/10/2017 11:51	762.2516	201.9423
C3	81.1	10003	2600	8299	11.47	6/10/2017 11:20	872.0051	225.0383
C3	93.6	10003	2398	11706	16.08	6/10/2017 10:56	621.9811	147.4894
C3	95.2	10005	2598	12450	17.32	6/10/2017 10:28	577.5599	148.36
C3	156	10000	3007	19206	26.59	6/10/2017 15:58	375.9852	111.4476
C4	21	10012	2622	6177	8.62	6/10/2017 14:42	1161.344	301.2793
C4	22.1	10003	2871	6734	9.51	6/10/2017 15:12	1051.699	298.9957
C4	23.3	10011	2874	7988	10.93	6/10/2017 15:42	915.7785	260.049
C4	43.7	10004	2568	9238	12.75	6/10/2017 13:19	784.4865	198.5148
C4	46.1	10007	2592	8385	11.53	6/10/2017 12:49	867.7688	221.9079
C4	47.5	10003	3054	13427	18.57	6/10/2017 13:55	538.5235	161.5618
C4	48.5	10003	2750	10934	15.05	6/10/2017 14:20	664.5102	179.8273
C4	63.5	10003	2549	9517	13.01	6/10/2017 12:20	768.7291	193.0292
C4	81.1	10014	2550	8438	11.48	6/10/2017 11:49	872.1587	219.2284
C4	93.6	10001	2469	11614	15.99	6/10/2017 11:24	625.3124	151.512
C4	95.2	10007	2727	12414	17.07	6/10/2017 10:57	586.0922	156.857
C4	116.1	10003	2757	13734	19	6/10/2017 10:30	526.3327	142.2083
D1	21	10012	2751	6589	9.08	6/10/2017 15:12	1102.548	301.3596
D1	22.1	10015	2849	6949	9.62	6/10/2017 15:41	1040.965	294.5398
D1	43.7	10001	2595	9657	13.29	6/10/2017 13:49	752.4257	193.6456
D1	46.1	10007	2559	8836	11.92	6/10/2017 13:18	839.4184	213.0672
D1	47.5	9999	2970	13852	18.78	6/10/2017 14:24	532.3331	156.533
D1	48.5	10006	2822	11263	15.51	6/10/2017 14:49	645.0372	180.3331
D1	63.5	10003	2604	9724	13.26	6/10/2017 12:51	754.2791	194.7661
D1	81.1	10002	2645	8550	11.77	6/10/2017 12:18	849.6926	223.1099
D1	93.6	10002	2494	12447	16.71	6/10/2017 11:55	598.4687	147.6379
D1	95.2	10003	2595	13050	17.68	6/10/2017 11:26	565.6855	145.162

D1	116.1	10000	2689	14417	19.81	6/10/2017 11:00	504.7006	134.1255
D1	134.2	10002	3047	18644	25.54	6/10/2017 10:36	391.526	117.6891
D2	21	10006	2724	6467	8.96	6/10/2017 15:40	1116.654	302.4109
D2	43.7	10004	2689	9847	13.38	6/10/2017 14:18	747.5961	199.3646
D2	46.1	10004	2573	8469	11.7	6/10/2017 13:48	854.9557	218.3075
D2	47.5	10001	3108	13588	18.58	6/10/2017 14:52	538.18	165.6696
D2	48.5	10002	2980	11159	15.39	6/10/2017 15:18	649.8155	192.0252
D2	63.5	10003	2565	9872	13.36	6/10/2017 13:20	748.6405	190.384
D2	81.1	10010	2622	8634	11.76	6/10/2017 12:50	851.1035	221.3522
D2	93.6	10000	2570	12441	16.97	6/10/2017 12:24	589.1882	149.8367
D2	95.2	10006	2507	12877	17.33	6/10/2017 11:55	577.2933	143.0554
D2	116.1	10002	2665	14461	19.63	6/10/2017 11:28	509.4392	134.1546
D2	134.2	10003	2996	18625	25.67	6/10/2017 11:06	389.5897	115.1051
D2	134.3	10001	2720	16375	22.34	6/10/2017 10:33	447.5853	120.1477
D3	43.7	10019	2784	9676	13.35	6/10/2017 14:47	750.3159	206.8743
D3	46.1	10002	2741	8685	11.74	6/10/2017 14:17	851.7881	231.8103
D3	47.5	10002	3187	13821	18.92	6/10/2017 15:22	528.4759	166.7811
D3	48.5	10012	2983	10970	15.21	6/10/2017 15:47	658.0802	194.456
D3	63.5	10000	2755	9715	13.36	6/10/2017 13:49	748.332	204.5476
D3	81.1	10002	2669	8584	11.58	6/10/2017 13:18	863.5596	228.8186
D3	93.6	10001	2677	12205	16.75	6/10/2017 12:55	596.9036	158.1559
D3	95.2	10001	2756	12624	17.26	6/10/2017 12:24	579.2612	158.0106
D3	116.1	10002	2861	14462	19.46	6/10/2017 11:57	513.8064	145.3545
D3	134.2	10001	3170	18459	25.32	6/10/2017 11:34	394.8132	123.5325
D3	134.3	9999	3049	16122	22.16	6/10/2017 11:03	451.0474	135.9253
D3	151.6	10002	3092	17649	24.1	6/10/2017 10:35	414.8497	126.6338
D4	43.7	10002	2828	9550	13.17	6/10/2017 15:16	759.3523	213.1234
D4	46.1	10014	2557	8553	11.79	6/10/2017 14:46	849.2629	215.2717
D4	47.5	10001	3111	13892	19.22	6/10/2017 15:51	520.2424	160.2556
D4	63.5	9999	2543	9776	13.29	6/10/2017 14:18	752.2692	189.7399
D4	81.1	10004	2590	8436	11.65	6/10/2017 13:48	858.6114	220.7106
D4	93.6	10003	2356	12057	16.31	6/10/2017 13:23	613.2037	142.8443
D4	95.2	10003	2691	12576	17.25	6/10/2017 12:55	579.7831	154.393
D4	116.1	10006	2675	14206	19.38	6/10/2017 12:26	516.2045	136.4219
D4	134.2	10005	2988	18358	24.88	6/10/2017 12:03	402.0292	118.4895
D4	134.3	10003	2828	16148	22.08	6/10/2017 11:31	452.9334	126.4727
D4	151.6	10006	3006	17360	23.9	6/10/2017 11:04	418.5601	124.1671
D4	156	10001	2973	19249	26.37	6/10/2017 10:37	379.1557	111.1348
A1	21	10011	2845	5988	8.75	6/11/2017 8:18	1144.036	323.7069
A1	22.1	10005	2949	6557	9.3	6/11/2017 8:48	1075.728	315.6608
A1	47.5	10002	3074	12634	18.13	6/11/2017 7:30	551.6043	168.1172
A1	48.5	10000	2861	10320	14.8	6/11/2017 7:55	675.5977	191.8748
A2	21	10012	2643	6087	8.65	6/11/2017 8:48	1157.363	304.2131
A2	43.7	10006	2617	8923	12.73	6/11/2017 7:24	785.9233	204.2414
A2	47.5	10001	2908	12772	18.38	6/11/2017 7:59	544.03	156.8795
A2	48.5	10004	2885	10355	15.04	6/11/2017 8:24	665.0656	190.4858
A3	43.7	10011	2634	8907	12.81	6/11/2017 7:53	781.4028	204.1106
A3	46.1	10013	2549	8024	11.38	6/11/2017 7:23	879.781	222.4795
A3	47.5	10001	3025	12651	18.3	6/11/2017 8:27	546.4067	163.7905
A3	48.5	9999	2811	10307	14.68	6/11/2017 8:54	681.0348	189.975
A4	43.7	10004	2717	8691	12.66	6/11/2017 8:22	790.1224	213.081
A4	46.1	10006	2477	7653	11.03	6/11/2017 7:51	907.0793	223.0374

A4	47.5	10002	3027	12548	17.92	6/11/2017 8:57	558.0643	167.3854
A4	63.5	10011	2570	8856	12.63	6/11/2017 7:24	792.5536	201.9518
B1	43.7	10006	2576	9018	12.65	6/11/2017 8:52	790.8971	202.0234
B1	46.1	10002	2626	8203	11.67	6/11/2017 8:21	856.9784	223.4084
B1	63.5	10001	2555	9221	13.04	6/11/2017 7:53	766.8569	194.3226
B1	81.1	10008	2565	8288	11.5	6/11/2017 7:23	870.1699	221.4305
B2	46.1	10016	2493	8221	11.51	6/11/2017 8:50	870.0828	214.9443
B2	63.5	10000	2496	9253	13.15	6/11/2017 8:22	760.3393	188.1599
B2	81.1	10006	2568	8316	11.73	6/11/2017 7:52	852.9094	217.2758
B2	93.6	10003	2473	11549	16.26	6/11/2017 7:28	615.0737	150.441
B3	63.5	10002	2504	9148	12.85	6/11/2017 8:52	778.2818	193.3188
B3	81.1	10000	2512	8113	11.53	6/11/2017 8:21	867.2187	216.3214
B3	93.6	10000	2500	11422	16.16	6/11/2017 7:56	618.7279	153.158
B3	95.2	10001	2696	12261	17.19	6/11/2017 7:29	581.7077	155.2904
B4	81.1	10007	2617	8361	11.68	6/11/2017 8:51	856.6637	222.4672
B4	93.6	10007	2534	11619	16.47	6/11/2017 8:26	607.4896	152.2645
B4	95.2	10007	2700	12247	17.34	6/11/2017 7:58	577.005	154.1183
B4	116.1	9999	2737	13670	19.13	6/11/2017 7:31	522.5869	141.4827
C1	93.6	10001	2603	11548	16.01	6/11/2017 8:55	624.5621	161.0459
C1	95.2	10002	2721	12144	16.67	6/11/2017 8:26	599.89	161.6874
C1	116.1	10003	2777	13365	18.41	6/11/2017 7:59	543.236	149.3019
C1	134.2	10004	2990	17392	23.88	6/11/2017 7:36	418.818	123.6694
C2	95.2	10003	2635	12086	16.79	6/11/2017 8:56	595.6593	155.2797
C2	116.1	10005	2749	13669	18.74	6/11/2017 8:28	533.7727	145.0326
C2	134.2	10005	3103	17609	24.11	6/11/2017 8:04	414.861	127.0428
C2	134.3	10003	2870	15827	21.65	6/11/2017 7:33	461.9203	130.9045
C3	116.1	10001	2677	13423	18.59	6/11/2017 8:58	537.8814	142.3622
C3	134.2	9999	3039	17878	24.5	6/11/2017 8:34	408.0264	122.4008
C3	134.3	10002	2812	15879	21.8	6/11/2017 8:02	458.7113	127.3508
C3	151.6	10000	2846	16948	23.22	6/11/2017 7:35	430.5672	120.9268
C4	134.2	9999	2993	17794	24.55	6/11/2017 9:04	407.1502	119.0175
C4	134.3	10000	2918	15870	21.79	6/11/2017 8:31	458.7851	131.0176
C4	151.6	10001	2902	17326	23.68	6/11/2017 8:04	422.1985	119.6537
C4	156	10004	3000	19186	26.33	6/11/2017 7:38	379.8058	111.0415
D1	23.3	10003	2691	8136	10.92	6/11/2017 7:23	915.9306	244.8146
D1	134.3	10003	2832	16505	22.71	6/11/2017 9:02	440.3718	123.0888
D1	151.6	10000	2724	17413	23.65	6/11/2017 8:33	422.738	113.5657
D1	156	9999	2909	19704	26.77	6/11/2017 8:07	373.4201	107.0524
D2	22.1	10018	2715	7144	9.57	6/11/2017 7:21	1046.726	282.0921
D2	23.3	10000	2655	7864	10.76	6/11/2017 7:51	929.281	245.1402
D2	151.6	10007	2805	17385	23.91	6/11/2017 9:03	418.4408	115.7079
D2	156	10001	2987	19810	26.84	6/11/2017 8:36	372.5285	109.6821
D3	21	10014	2651	6666	8.89	6/11/2017 7:21	1126.263	296.5352
D3	22.1	10007	2667	6829	9.43	6/11/2017 7:50	1061.017	281.1558
D3	23.3	10003	2648	7847	10.68	6/11/2017 8:20	936.4395	246.2751
D3	156	10002	3081	19624	27.08	6/11/2017 9:06	369.1791	112.109
D4	21	10010	2611	6340	8.75	6/11/2017 7:49	1143.899	296.793
D4	22.1	10015	2640	6896	9.44	6/11/2017 8:19	1060.81	278.054
D4	23.3	10020	2739	7831	10.89	6/11/2017 8:50	920.0092	249.9082
D4	48.5	10004	2672	11077	15.04	6/11/2017 7:27	665.0586	176.0526

Detector	Sample				Count		ALPHA	BETA
ID	ID	Alpha	Beta	Guard	Time	TOD	CPM	CPM
A1	7.7	12	10029	2111	3.11	6/11/2017 11:24	3.780521	3223.323
A1	8.1	29	10039	2184	3.13	6/11/2017 9:13	9.187176	3205.912
A1	19	30	10005	2183	3.14	6/11/2017 11:04	9.47614	3184.87
A1	19.8	25	10034	2262	3.26	6/11/2017 11:16	7.590712	3076.478
A1	39.9	20	10036	2242	3.32	6/11/2017 10:54	5.946096	3021.456
A1	40.4	18	10026	2319	3.29	6/11/2017 10:42	5.393125	3045.98
A1	61.5	26	10040	2342	3.27	6/11/2017 10:34	7.87307	3068.9
A1	61.6	18	10040	2331	3.27	6/11/2017 10:24	5.426587	3068.9
A1	83.7	17	10037	2331	3.28	6/11/2017 10:19	5.104927	3058.625
A1	84.3	25	10021	2319	3.3	6/11/2017 10:09	7.497758	3035.231
A1	106.2	14	10038	2326	3.29	6/11/2017 10:02	4.177319	3049.628
A1	106.8	18	10045	2326	3.36	6/11/2017 9:54	5.279143	2988.147
A1	126.6	16	10034	2283	3.34	6/11/2017 9:48	4.712419	3002.756
A1	127.4	13	10025	2285	3.29	6/11/2017 9:40	3.873368	3045.676
A1	148	21	10029	2471	3.41	6/11/2017 9:19	6.080358	2939.62
A1	158.6	21	10010	2353	3.38	6/11/2017 9:31	6.135018	2960.102
A2	7.7	25	10008	2186	3.13	6/11/2017 9:13	7.89322	3196.108
A2	8.1	30	10014	2241	3.11	6/11/2017 9:19	9.552302	3218.6
A2	19	28	10076	2216	3.19	6/11/2017 11:16	8.683429	3157.285
A2	19.8	30	10031	2198	3.22	6/11/2017 11:24	9.22277	3113.881
A2	39.9	22	10009	2272	3.25	6/11/2017 11:04	6.675231	3078.356
A2	40.4	21	10027	2239	3.31	6/11/2017 10:54	6.250411	3027.969
A2	61.5	27	10010	2338	3.31	6/11/2017 10:42	8.0631	3022.833
A2	61.6	17	10037	2378	3.34	6/11/2017 10:34	4.99582	3003.754
A2	83.7	12	10013	2320	3.25	6/11/2017 10:24	3.598308	3079.587
A2	84.3	25	10013	2392	3.36	6/11/2017 10:19	7.346476	2978.724
A2	106.2	24	10032	2340	3.36	6/11/2017 10:09	7.048857	2984.378
A2	106.8	18	10031	2364	3.33	6/11/2017 10:02	5.311405	3010.976
A2	126.6	20	10028	2379	3.43	6/11/2017 9:54	5.736904	2922.279
A2	127.4	18	10029	2289	3.35	6/11/2017 9:48	5.279134	2992.395
A2	148	14	10036	2422	3.46	6/11/2017 9:31	3.952243	2899.242
A2	158.6	24	10036	2352	3.39	6/11/2017 9:40	6.985646	2959.136
A3	7.7	18	10018	2255	3.13	6/11/2017 9:19	5.654799	3199.129
A3	8.1	27	10024	2168	3.11	6/11/2017 9:31	8.585672	3221.641
A3	19	16	10022	2158	3.17	6/11/2017 11:24	4.951319	3160.004
A3	19.8	23	10014	2229	3.19	6/11/2017 9:13	7.114031	3137.675
A3	39.9	18	10020	2276	3.28	6/11/2017 11:16	5.391805	3053.368
A3	40.4	12	10010	2296	3.28	6/11/2017 11:04	3.562537	3050.319
A3	61.5	17	10052	2213	3.27	6/11/2017 10:54	5.102777	3072.496
A3	61.6	23	10009	2332	3.3	6/11/2017 10:42	6.873697	3031.52
A3	83.7	22	10029	2347	3.29	6/11/2017 10:34	6.59093	3046.818
A3	84.3	13	10044	2383	3.36	6/11/2017 10:25	3.773048	2987.776
A3	106.2	12	10031	2349	3.3	6/11/2017 10:19	3.540364	3038.187
A3	106.8	21	10039	2322	3.32	6/11/2017 10:09	6.229301	3022.285
A3	126.6	16	10012	2385	3.37	6/11/2017 10:02	4.651774	2969.41
A3	127.4	13	10014	2301	3.31	6/11/2017 9:53	3.831492	3023.868
A3	148	16	10003	2385	3.44	6/11/2017 9:40	4.555163	2906.339
A3	158.6	14	10014	2307	3.38	6/11/2017 9:48	4.046012	2961.212
A4	7.7	27	10045	2163	3.1	6/11/2017 9:31	8.626677	3238.791
A4	8.1	28	10041	2161	3.09	6/11/2017 9:40	8.978489	3247.983

A4	19	24	10020	2199	3.14	6/11/2017 9:13	7.560312	3189.551
A4	19.8	37	10016	2298	3.18	6/11/2017 9:19	11.55222	3148.154
A4	39.9	31	10015	2235	3.27	6/11/2017 11:24	9.397122	3061.159
A4	40.4	24	10017	2271	3.27	6/11/2017 11:16	7.25645	3061.771
A4	61.5	14	10014	2287	3.26	6/11/2017 11:04	4.211479	3070.247
A4	61.6	24	10012	2213	3.27	6/11/2017 10:54	7.25645	3060.242
A4	83.7	25	10033	2302	3.26	6/11/2017 10:42	7.585712	3076.075
A4	84.3	29	10055	2373	3.34	6/11/2017 10:34	8.599635	3008.947
A4	106.2	17	10032	2362	3.33	6/11/2017 10:24	5.022105	3011.081
A4	106.8	19	10025	2372	3.32	6/11/2017 10:19	5.639892	3018.046
A4	126.6	23	10026	2325	3.33	6/11/2017 10:09	6.823907	3009.279
A4	127.4	20	10027	2351	3.31	6/11/2017 10:02	5.959296	3027.773
A4	148	19	10039	2333	3.42	6/11/2017 9:48	5.472556	2933.848
A4	158.6	18	10027	2387	3.44	6/11/2017 9:54	5.149558	2913.294
B1	7.7	30	10050	2283	3.23	6/11/2017 9:40	9.196926	3109.842
B1	8.1	27	10021	2233	3.11	6/11/2017 9:48	8.590672	3220.573
B1	19	21	10006	2290	3.2	6/11/2017 9:19	6.4715	3125.262
B1	19.8	19	10041	2363	3.31	6/11/2017 9:31	5.649181	3031.922
B1	39.9	22	10021	2488	3.41	6/11/2017 9:14	6.360613	2937.097
B1	40.4	25	10041	2289	3.34	6/11/2017 11:24	7.39403	3004.674
B1	61.5	24	10006	2355	3.31	6/11/2017 11:16	7.159755	3021.348
B1	61.6	20	10024	2394	3.38	6/11/2017 11:04	5.82616	2964.067
B1	83.7	24	10007	2300	3.37	6/11/2017 10:54	7.030662	2967.823
B1	84.3	22	10023	2410	3.39	6/11/2017 10:42	6.398676	2955.024
B1	106.2	24	10009	2354	3.37	6/11/2017 10:34	7.030662	2968.417
B1	106.8	20	10028	2382	3.4	6/11/2017 10:25	5.791353	2947.799
B1	126.6	26	10030	2399	3.43	6/11/2017 10:19	7.489175	2922.585
B1	127.4	18	10022	2400	3.38	6/11/2017 10:09	5.234444	2963.476
B1	148	24	10017	2430	3.57	6/11/2017 9:54	6.631689	2804.269
B1	158.6	17	10021	2479	3.44	6/11/2017 10:02	4.85086	2911.468
B2	7.7	24	10037	2274	3.18	6/11/2017 9:48	7.43017	3154.639
B2	8.1	23	10039	2185	3.21	6/11/2017 9:53	7.048109	3125.764
B2	19	30	10004	2326	3.26	6/11/2017 9:31	9.085454	3067.062
B2	19.8	23	10026	2351	3.33	6/11/2017 9:40	6.789907	3009.161
B2	39.9	25	10034	2441	3.39	6/11/2017 9:19	7.257631	2958.232
B2	40.4	19	10025	2452	3.37	6/11/2017 9:14	5.520982	2973.127
B2	61.5	23	10023	2316	3.38	6/11/2017 11:24	6.687734	2963.735
B2	61.6	27	10031	2414	3.38	6/11/2017 11:17	7.871166	2966.101
B2	83.7	16	10021	2356	3.32	6/11/2017 11:04	4.702277	3016.723
B2	84.3	19	10015	2313	3.39	6/11/2017 10:54	5.48772	2952.627
B2	106.2	25	10026	2455	3.46	6/11/2017 10:42	7.108434	2896.038
B2	106.8	22	10004	2359	3.38	6/11/2017 10:34	6.391876	2958.113
B2	126.6	17	10023	2443	3.49	6/11/2017 10:25	4.75406	2870.27
B2	127.4	28	10018	2409	3.45	6/11/2017 10:19	7.998942	2902.118
B2	148	19	10007	2538	3.51	6/11/2017 10:02	5.296105	2849.347
B2	158.6	19	10034	2476	3.49	6/11/2017 10:09	5.327126	2873.422
B3	7.7	22	10023	2205	3.23	6/11/2017 9:53	6.727146	3101.551
B3	8.1	19	10041	2280	3.15	6/11/2017 10:02	5.947746	3186.074
B3	19	18	10027	2252	3.18	6/11/2017 9:40	5.576377	3151.6
B3	19.8	22	10014	2345	3.29	6/11/2017 9:48	6.60293	3042.224
B3	39.9	21	10013	2326	3.26	6/11/2017 9:31	6.357718	3069.927
B3	40.4	20	10014	2441	3.39	6/11/2017 9:19	5.815705	2952.437

B3	61.5	18	10005	2354	3.24	6/11/2017 9:13	5.471556	3086.418
B3	61.6	23	10030	2301	3.36	6/11/2017 11:24	6.761238	2983.574
B3	83.7	19	10013	2326	3.28	6/11/2017 11:16	5.708683	3051.199
B3	84.3	15	10008	2356	3.32	6/11/2017 11:04	4.434072	3012.913
B3	106.2	14	10028	2314	3.39	6/11/2017 10:54	4.045794	2956.567
B3	106.8	12	10048	2407	3.38	6/11/2017 10:42	3.466296	2971.236
B3	126.6	13	10036	2390	3.43	6/11/2017 10:34	3.706087	2924.403
B3	127.4	17	10024	2407	3.44	6/11/2017 10:25	4.85786	2912.408
B3	148	14	10024	2448	3.46	6/11/2017 10:09	3.962243	2895.565
B3	158.6	17	10027	2399	3.43	6/11/2017 10:19	4.872268	2921.779
B4	7.7	18	10025	2329	3.23	6/11/2017 10:02	5.472755	3102.124
B4	8.1	21	10016	2269	3.19	6/11/2017 10:09	6.483072	3138.221
B4	19	23	10032	2270	3.19	6/11/2017 9:48	7.110031	3143.237
B4	19.8	26	10027	2295	3.39	6/11/2017 9:54	7.569617	2956.226
B4	39.9	19	10012	2363	3.35	6/11/2017 9:40	5.571642	2987.066
B4	40.4	24	10050	2381	3.34	6/11/2017 9:31	7.085629	3007.391
B4	61.5	18	10035	2404	3.34	6/11/2017 9:19	5.289222	3002.9
B4	61.6	27	10000	2471	3.39	6/11/2017 9:14	7.864602	2948.262
B4	83.7	20	10007	2328	3.39	6/11/2017 11:24	5.799705	2950.326
B4	84.3	10	10003	2440	3.41	6/11/2017 11:17	2.832551	2931.84
B4	106.2	17	10026	2384	3.35	6/11/2017 11:04	4.974627	2991.245
B4	106.8	15	10003	2345	3.42	6/11/2017 10:54	4.285965	2923.263
B4	126.6	16	10020	2387	3.34	6/11/2017 10:42	4.690419	2998.409
B4	127.4	20	10047	2325	3.33	6/11/2017 10:34	5.906006	3015.526
B4	148	24	10034	2388	3.42	6/11/2017 10:19	6.917544	2932.327
B4	158.6	11	10004	2427	3.47	6/11/2017 10:25	3.070029	2881.406
C1	7.7	13	10029	2277	3.16	6/11/2017 10:09	4.003924	3172.194
C1	8.1	22	10007	2212	3.11	6/11/2017 10:18	6.963955	3216.145
C1	19	21	10036	2293	3.2	6/11/2017 9:53	6.4525	3134.71
C1	19.8	12	10028	2290	3.17	6/11/2017 10:02	3.675489	3161.867
C1	39.9	20	10036	2426	3.34	6/11/2017 9:48	5.878024	3003.25
C1	40.4	25	10029	2448	3.3	6/11/2017 9:40	7.465758	3037.551
C1	61.5	17	10024	2432	3.31	6/11/2017 9:31	5.025952	3026.859
C1	61.6	15	10036	2367	3.34	6/11/2017 9:19	4.381018	3003.25
C1	83.7	12	10038	2416	3.27	6/11/2017 9:13	3.559725	3068.185
C1	84.3	20	10025	2227	3.34	6/11/2017 11:24	5.878024	2999.957
C1	106.2	15	10037	2405	3.36	6/11/2017 11:17	4.354286	2985.662
C1	106.8	16	10009	2425	3.33	6/11/2017 11:04	4.694805	3004.166
C1	126.6	26	10028	2339	3.34	6/11/2017 10:54	7.674431	3000.855
C1	127.4	17	10023	2419	3.34	6/11/2017 10:42	4.97982	2999.358
C1	148	20	10001	2484	3.51	6/11/2017 10:25	5.588006	2847.748
C1	158.6	15	10029	2445	3.39	6/11/2017 10:34	4.314779	2956.867
C2	7.7	19	10038	2252	3.18	6/11/2017 10:19	5.862843	3154.945
C2	8.1	21	10034	2172	3.08	6/11/2017 10:24	6.706182	3256.133
C2	19	16	10047	2288	3.17	6/11/2017 10:02	4.935319	3167.742
C2	19.8	18	10018	2287	3.18	6/11/2017 10:09	5.548377	3148.655
C2	39.9	17	10013	2329	3.24	6/11/2017 9:53	5.134914	3088.773
C2	40.4	16	10019	2405	3.32	6/11/2017 9:48	4.707277	3016.112
C2	61.5	17	10019	2402	3.25	6/11/2017 9:40	5.118769	3081.11
C2	61.6	13	10012	2430	3.31	6/11/2017 9:31	3.815492	3023.114
C2	83.7	14	10031	2294	3.25	6/11/2017 9:19	4.195692	3084.803
C2	84.3	21	10038	2458	3.32	6/11/2017 9:13	6.213301	3021.835

C2	106.2	13	10032	2209	3.3	6/11/2017 11:24	3.827394	3038.341
C2	106.8	14	10055	2423	3.38	6/11/2017 11:17	4.030012	2973.193
C2	126.6	18	10017	2459	3.36	6/11/2017 11:04	5.245143	2979.591
C2	127.4	18	10024	2345	3.35	6/11/2017 10:54	5.261134	2990.58
C2	148	19	10027	2456	3.4	6/11/2017 10:34	5.476235	2947.459
C2	158.6	15	10011	2468	3.42	6/11/2017 10:42	4.273965	2925.534
C3	7.7	20	10016	2239	3.15	6/11/2017 10:24	6.253206	3178.043
C3	8.1	20	10029	2302	3.2	6/11/2017 10:33	6.154	3132.423
C3	19	17	10018	2295	3.2	6/11/2017 10:09	5.2165	3128.985
C3	19.8	21	10016	2301	3.25	6/11/2017 10:19	6.365538	3080.206
C3	39.9	13	10025	2404	3.33	6/11/2017 10:02	3.807904	3008.871
C3	40.4	15	10022	2395	3.33	6/11/2017 9:54	4.408505	3007.97
C3	61.5	15	10036	2436	3.35	6/11/2017 9:48	4.381612	2994.181
C3	61.6	17	10014	2463	3.34	6/11/2017 9:40	4.99382	2996.564
C3	83.7	15	10015	2462	3.35	6/11/2017 9:31	4.381612	2987.912
C3	84.3	18	10021	2384	3.36	6/11/2017 9:19	5.261143	2980.8
C3	106.2	15	10030	2464	3.33	6/11/2017 9:13	4.408505	3010.372
C3	106.8	17	10051	2219	3.33	6/11/2017 11:24	5.009105	3016.678
C3	126.6	12	10025	2422	3.37	6/11/2017 11:17	3.464831	2973.137
C3	127.4	11	10036	2458	3.36	6/11/2017 11:04	3.17781	2985.265
C3	148	11	10018	2480	3.44	6/11/2017 10:42	3.101674	2910.569
C3	158.6	20	10029	2386	3.41	6/11/2017 10:54	5.769103	2939.416
C4	7.7	20	10016	2286	3.17	6/11/2017 10:33	6.168148	3156.724
C4	8.1	30	10043	2276	3.16	6/11/2017 10:42	9.352671	3175.268
C4	19	20	10066	2251	3.18	6/11/2017 10:19	6.148308	3162.512
C4	19.8	22	10031	2325	3.26	6/11/2017 10:24	6.607466	3074.097
C4	39.9	25	10032	2359	3.31	6/11/2017 10:09	7.41187	3027.919
C4	40.4	27	10030	2445	3.4	6/11/2017 10:02	7.800176	2947.103
C4	61.5	27	10026	2347	3.26	6/11/2017 9:53	8.141209	3072.563
C4	61.6	26	10040	2430	3.34	6/11/2017 9:48	7.643431	3003.091
C4	83.7	31	10049	2432	3.28	6/11/2017 9:40	9.31022	3060.823
C4	84.3	21	10033	2439	3.32	6/11/2017 9:31	6.184301	3019.091
C4	106.2	21	10020	2318	3.28	6/11/2017 9:19	6.261439	3051.981
C4	106.8	23	10051	2532	3.42	6/11/2017 9:14	6.584146	2935.992
C4	126.6	21	10040	2204	3.31	6/11/2017 11:24	6.203411	3030.336
C4	127.4	20	10018	2378	3.32	6/11/2017 11:16	5.883096	3014.573
C4	148	20	10017	2461	3.49	6/11/2017 10:55	5.589659	2867.304
C4	158.6	27	10036	2467	3.38	6/11/2017 11:04	7.847166	2966.334
D1	7.7	19	10008	2257	3.27	6/11/2017 10:42	5.715398	3058.936
D1	8.1	17	10043	2277	3.27	6/11/2017 10:54	5.103777	3069.64
D1	19	14	10014	2377	3.21	6/11/2017 10:24	4.266371	3118.012
D1	19.8	25	10022	2440	3.32	6/11/2017 10:34	7.43512	3017.061
D1	39.9	18	10010	2404	3.37	6/11/2017 10:19	5.246246	2968.712
D1	40.4	20	10023	2539	3.42	6/11/2017 10:09	5.752953	2929.088
D1	61.5	17	10023	2451	3.39	6/11/2017 10:02	4.919749	2955.023
D1	61.6	15	10021	2516	3.4	6/11/2017 9:54	4.316765	2945.739
D1	83.7	15	10020	2524	3.41	6/11/2017 9:48	4.303827	2936.802
D1	84.3	14	10022	2583	3.38	6/11/2017 9:40	4.047012	2963.475
D1	106.2	15	10006	2514	3.4	6/11/2017 9:31	4.316765	2941.327
D1	106.8	16	10021	2397	3.36	6/11/2017 9:19	4.666905	2980.826
D1	126.6	9	10037	2584	3.4	6/11/2017 9:14	2.552059	2950.445
D1	127.4	17	10021	2292	3.34	6/11/2017 11:24	4.99482	2998.685

D1	148	15	10027	2637	3.54	6/11/2017 11:04	4.142288	2830.872
D1	158.6	16	10018	2532	3.48	6/11/2017 11:17	4.502701	2877.122
D2	7.7	16	10041	2241	3.22	6/11/2017 10:54	4.881944	3116.716
D2	8.1	30	10057	2383	3.2	6/11/2017 11:04	9.288	3141.206
D2	19	25	10016	2360	3.22	6/11/2017 10:34	7.676975	3108.952
D2	19.8	29	10029	2277	3.29	6/11/2017 10:42	8.72759	3046.721
D2	39.9	14	10011	2479	3.37	6/11/2017 10:25	4.067303	2969.016
D2	40.4	28	10021	2449	3.43	6/11/2017 10:19	8.076265	2919.967
D2	61.5	16	10028	2529	3.4	6/11/2017 10:09	4.618882	2947.805
D2	61.6	19	10024	2435	3.36	6/11/2017 10:02	5.567762	2981.726
D2	83.7	16	10041	2477	3.35	6/11/2017 9:54	4.689119	2995.706
D2	84.3	20	10032	2533	3.43	6/11/2017 9:48	5.743904	2923.174
D2	106.2	24	10023	2565	3.36	6/11/2017 9:40	7.055857	2981.429
D2	106.8	19	10026	2537	3.43	6/11/2017 9:31	5.452359	2921.425
D2	126.6	12	10022	2414	3.38	6/11/2017 9:19	3.463296	2963.482
D2	127.4	13	10019	2623	3.44	6/11/2017 9:14	3.69207	2910.893
D2	148	29	10013	2608	3.57	6/11/2017 11:17	8.036249	2803.155
D2	158.6	14	10006	2357	3.44	6/11/2017 11:24	3.982767	2907.114
D3	7.7	10	10039	2425	3.25	6/11/2017 11:04	2.905923	3087.258
D3	8.1	14	10030	2295	3.17	6/11/2017 11:16	4.245404	3162.373
D3	19	10	10021	2225	3.22	6/11/2017 10:42	2.93459	3110.447
D3	19.8	16	10015	2307	3.32	6/11/2017 10:54	4.648277	3014.901
D3	39.9	9	10022	2527	3.44	6/11/2017 10:34	2.445279	2911.707
D3	40.4	10	10027	2507	3.42	6/11/2017 10:25	2.752977	2930.206
D3	61.5	10	10037	2369	3.32	6/11/2017 10:19	2.841048	3021.528
D3	61.6	9	10027	2469	3.32	6/11/2017 10:09	2.539843	3018.516
D3	83.7	10	10027	2387	3.29	6/11/2017 10:02	2.868514	3046.055
D3	84.3	11	10027	2460	3.33	6/11/2017 9:54	3.132303	3009.446
D3	106.2	8	10018	2519	3.41	6/11/2017 9:48	2.175041	2936.165
D3	106.8	17	10010	2602	3.42	6/11/2017 9:40	4.79976	2925.236
D3	126.6	6	10011	2518	3.4	6/11/2017 9:31	1.593706	2942.747
D3	127.4	7	10027	2403	3.36	6/11/2017 9:19	1.912333	2982.561
D3	148	15	10039	2456	3.57	6/11/2017 11:24	4.030681	2810.38
D3	158.6	9	10035	2635	3.45	6/11/2017 9:14	2.437696	2907.031
D4	7.7	13	10007	2335	3.23	6/11/2017 11:16	3.923768	3096.535
D4	8.1	15	10033	2215	3.23	6/11/2017 11:24	4.542963	3104.585
D4	19	12	10043	2243	3.22	6/11/2017 10:54	3.625708	3117.337
D4	19.8	25	10042	2449	3.28	6/11/2017 11:04	7.520951	3059.978
D4	39.9	18	10026	2292	3.31	6/11/2017 10:42	5.337066	3027.396
D4	40.4	15	10020	2478	3.37	6/11/2017 10:34	4.350039	2971.687
D4	61.5	13	10000	2440	3.32	6/11/2017 10:25	3.814663	3010.441
D4	61.6	18	10021	2416	3.38	6/11/2017 10:19	5.224444	2963.186
D4	83.7	11	10030	2497	3.35	6/11/2017 10:09	3.182582	2992.423
D4	84.3	15	10035	2434	3.36	6/11/2017 10:02	4.363286	2985
D4	106.2	15	10010	2477	3.35	6/11/2017 9:54	4.376612	2986.453
D4	106.8	12	10029	2503	3.39	6/11/2017 9:48	3.438823	2956.8
D4	126.6	14	10018	2579	3.38	6/11/2017 9:40	4.041012	2962.298
D4	127.4	16	10035	2502	3.38	6/11/2017 9:31	4.632728	2967.328
D4	148	8	10039	2703	3.53	6/11/2017 9:14	2.165289	2842.302
D4	158.6	7	10011	2480	3.47	6/11/2017 9:19	1.916291	2883.407

6/10/2017 Gross Alpha Mass Attenuation Curve

Benchsheet: AB121109-1 Sources: 1223001 1-3, 6-14, 16-19

Calibration Range: 21mg -> 18mg

File names: AAM0610
AAM0611

Det	10:10	10:40	11:08	11:37	12:06	12:38	13:06	13:36	14:08	14:33	15:02	15:31	7:11	7:40	8:09	8:39
A1	1	19	18	17	16	14	13	12	11	10	9	8	7	6	3	2
A2	2	1	19	18	17	16	14	13	12	11	10	9	8	7	6	3
A3	3	2	1	19	18	17	16	14	13	12	11	10	9	8	7	6
A4	6	3	2	1	19	18	17	16	14	13	12	11	10	9	8	7
B1	7	6	3	2	1	19	18	17	16	14	13	12	11	10	9	8
B2	8	7	6	3	2	1	19	18	17	16	14	13	12	11	10	9
B3	9	8	7	6	3	2	1	19	18	17	16	14	13	12	11	10
B4	10	9	8	7	6	3	2	1	19	18	17	16	14	13	12	11
C1	11	10	9	8	7	6	3	2	1	19	18	17	16	14	13	12
C2	12	11	10	9	8	7	6	3	2	1	19	18	17	16	14	13
C3	13	12	11	10	9	8	7	6	3	2	1	19	18	17	16	14
C4	14	13	12	11	10	9	8	7	6	3	2	1	19	18	17	16
D1	16	14	13	12	11	10	9	8	7	6	3	2	1	19	18	17
D2	17	16	14	13	12	11	10	9	8	7	6	3	2	1	19	18
D3	18	17	16	14	13	12	11	10	9	8	7	6	3	2	1	19
D4	19	18	17	16	14	13	12	11	10	9	8	7	6	3	2	1

6/10/17

6/11/17

JP 6/11/17

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6/11/17

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Read and Understood By

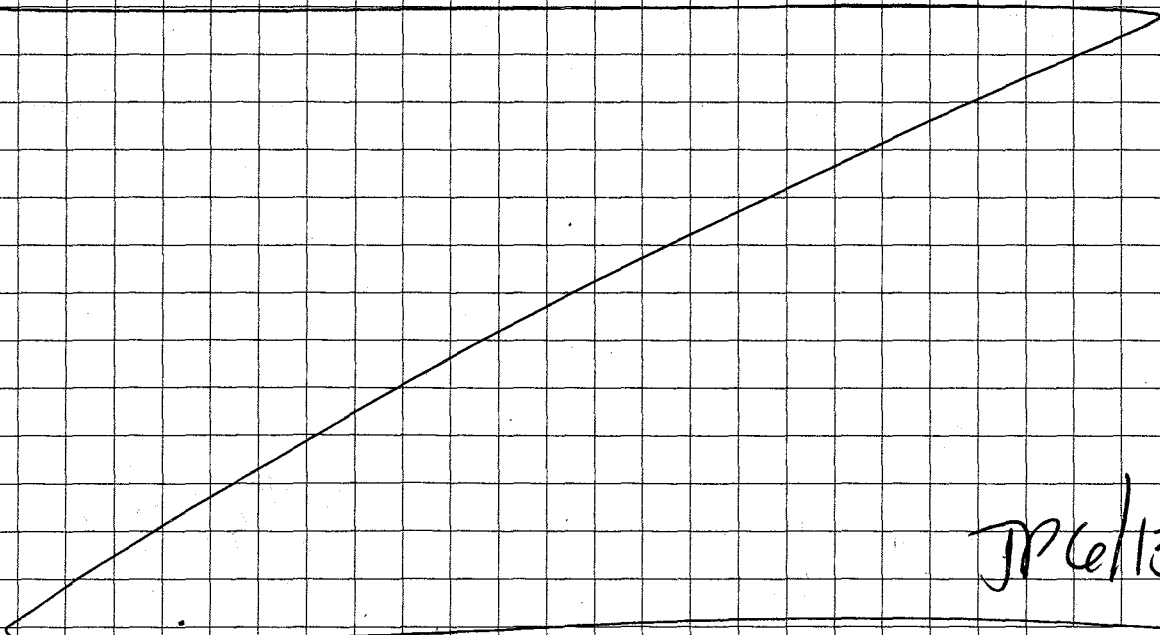
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6/15/17

6/11/2017 Gross Beta Mass Attenuation
 Benchsheet: AB110619-4 Sources: 1118007-1 → 16
 Calibration Range: 7.7 - 158.6mg Filename: ASRO611

Det	9:10	9:16	9:27	9:36	9:44	9:50	9:58	10:06	10:15	10:21	10:30	10:38	10:51	11:00	11:13	11:20
A1	1	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
A2	2	1	16	15	14	13	12	11	10	9	8	7	6	5	4	3
A3	3	2	1	16	15	14	13	12	11	10	9	8	7	6	5	4
A4	4	3	2	1	16	15	14	13	12	11	10	9	8	7	6	5
B1	5	4	3	2	1	16	15	14	13	12	11	10	9	8	7	6
B2	6	5	4	3	2	1	16	15	14	13	12	11	10	9	8	7
B3	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9	8
B4	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
C1	9	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10
C2	10	9	8	7	6	5	4	3	2	1	16	15	14	13	12	11
C3	11	10	9	8	7	6	5	4	3	2	1	16	15	14	13	12
C4	12	11	10	9	8	7	6	5	4	3	2	1	16	15	14	13
D1	13	12	11	10	9	8	7	6	5	4	3	2	1	16	15	14
D2	14	13	12	11	10	9	8	7	6	5	4	3	2	1	16	15
D3	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	16
D4	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1



JPC6/13/17

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6/12/17 JPC6/13/17

6/13/17

Signed

Date

Signed

Date

Date 6/10/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			JP	P			P
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16						(HB)			(HB)

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK0607W			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

P-10 Supply		P-10 Flow	
Tank 1	0	Dr A	10
		Dr B	
Tank 2	2000	Dr C	1
		Dr D	

Comments:

Date 6/10/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Daily EFP	—	—	30	9:18	JP	EFC0610	JP
1-16	Daily Bks	—	—	30 30	9:25	JP	BKCO610	JP
1-16	1223001-1-36-14	AB121109-1	A-241	30	10:10	JP	AAM0610	JP
	1223001-16-19		Attn					
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JP 6/10/17

Comments:

Page No.: 471493 **B**
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Form 780r8.doc (6/23/06)

Reviewed By / Date JP 6/10/17

Date 6/11/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	JP	P			VP	P			P
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16						(HB)			(HB)

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK00407W			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow
Tank 1	2700	Dr A	10
		Dr B	
Tank 2	1800	Dr C	
		Dr D	

Comments:

Date 6/11/17

SOP 724r 12

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Daily EIP	---	---	30	6:20	JP	EFC0611	JP
1-16	Daily Bks	---	---	30	6:28	JP	BKCO611	JP
1-16	1223001-1-3,6-14	AB121109-1	Am241	30	7:11	JP	AAM0611	JP
	→ 16-19		Athn					
1-16	1118007-1-16	AB110619-4	Sr90 Ath	30	9:10	JP	ASR0611	JP
2	1224001-1	AB121206-3	21B	360	11:48	JP	ABC0611	JP
7	-2		ICVs/ICBs	360				
9	-3			360				
14	-4							
4	AB121206-3AMB							
6	BMB							
11	CMB							
15	EMB							

JP 6/11/17
 JP 6/11/17

JP 6/12/17

Comments:

Date 6/12/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	✓	P			✓	P			P
2	↓	↓			↓	↓			↓
3	↓	↓			↓	↓			↓
4	↓	↓			↓	↓			↓
5	↓	↓			↓	↓			↓
6	↓	↓			↓	↓			↓
7	↓	↓			↓	Hα	JCB	P	↓
8	↓	↓			↓	P			↓
9	↓	↓			↓	Hβ	JCB	P	↓
10	↓	↓			↓	PI			↓
11	↓	↓			↓	↓			↓
12	↓	↓			↓	↓			↓
13	↓	↓			↓	↓			↓
14	↓	↓			↓	↓			↓
15	↓	↓			↓	Hα	JCB	P	↓
16	↓	↓			↓	Hβ	JCB	Hβ	Hβ

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BUC0607W			
Dr B	↓			
Dr C	↓			
Dr D	↓			

Dr = Drawer

Gas Supply

	P-10 Supply		P-10 Flow
Tank 1	1900	Dr A	10
	↓	Dr B	↓
Tank 2	1900	Dr C	↓
	↓	Dr D	↓

Comments:

Gross Alpha!!

Prep Procedure: GAB

Eff. & ATTN calibration.

Mass Attenuation

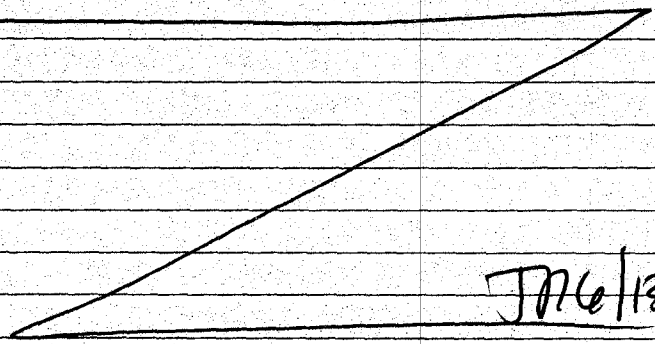
Analytical QASS / NCR? Y N WK

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Ins/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Ins/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Ins/Det	Cnt 3 Pos Chk By	Notes
1	1223001-1	SMP	200	200	ml	PCI/L	23.3										
1	1223001-2	SMP	200	200	ml	PCI/L	22.1										
1	1223001-3	SMP	200	200	ml	PCI/L	21										
1	1223001-4	SMP	200	200	ml	PCI/L	22.8										
1	1223001-5	SMP	200	200	ml	PCI/L	22.7										don't use outlier - don't use
1	1223001-6	SMP	200	200	ml	PCI/L	48.5										
1	1223001-7	SMP	200	200	ml	PCI/L	47.5										
1	1223001-8	SMP	200	200	ml	PCI/L	43.7										
1	1223001-9	SMP	200	200	ml	PCI/L	46.1										
1	1223001-10	SMP	200	200	ml	PCI/L	63.5										
1	1223001-11	SMP	200	200	ml	PCI/L	81.1										
1	1223001-12	SMP	200	200	ml	PCI/L	93.6										
1	1223001-13	SMP	200	200	ml	PCI/L	95.2										
1	1223001-14	SMP	200	200	ml	PCI/L	116.1										
1	1223001-15	SMP	200	200	ml	PCI/L	90.7										don't use
1	1223001-16	SMP	200	200	ml	PCI/L	134.2										
1	1223001-17	SMP	200	200	ml	PCI/L	134.2										
1	1223001-18	SMP	200	200	ml	PCI/L	151.6										
1	1223001-19	SMP	200	200	ml	PCI/L	156										
1	1223001-20	SMP	200	200	ml	PCI/L	21.3										
1	1223001-21	SMP	200	200	ml	PCI/L	21.8										AB1110 WK ↓ A ↓ OUTLIER don't use
1	1223001-22	SMP	200	200	ml	PCI/L	19.7										↓ B ↓
1	1223001-23	SMP	200	200	ml	PCI/L	20.5										↓ C JP
1	1223001-24	SMP	200	200	ml	PCI/L	21.2										AB1119 WK
1	1223001-25	SMP	200	200	ml	PCI/L	21.1										↓ A ↓
1	1223001-26	SMP	200	200	ml	PCI/L	21.5										↓ B ↓
1	1223001-27	SMP	200	200	ml	PCI/L	20.7										↓ C ↓

See Maintenance Log 3710 pg 85

see for Eff. Calibration

290 of 328



JTG 6/13/17

NA

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: **GAB**

Analytical QASS / NCR? Y **N** *WA*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes
----------	-------	---------	----------	---------	-------	--------------	--------------------	------------	----------------	------------------	------------	----------------	------------------	------------	----------------	------------------	-------

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1	ml	RS-008

Sample Barcodes

1223001-1 AB121109-1PS1		1223001-2 AB121109-1PS2		1223001-3 AB121109-1PS3	
1223001-4 AB121109-1PS4		1223001-5 AB121109-1PS5		1223001-6 AB121109-1PS6	
1223001-7 AB121109-1PS7		1223001-8 AB121109-1PS8		1223001-9 AB121109-1PS9	
1223001-10 AB121109-1PS10		1223001-11 AB121109-1PS11		1223001-12 AB121109-1PS12	
1223001-13 AB121109-1PS13		1223001-14 AB121109-1PS14		1223001-15 AB121109-1PS15	
1223001-16 AB121109-1PS16		1223001-17 AB121109-1PS17		1223001-18 AB121109-1PS18	
1223001-19 AB121109-1PS19		1223001-20 AB121109-1PS20		1223001-21 AB121109-1PS21	
1223001-22 AB121109-1PS22		1223001-23 AB121109-1PS23		1223001-24 AB121109-1PS24	
1223001-25 AB121109-1PS25		1223001-26 AB121109-1PS26		1223001-27 AB121109-1PS27	

291 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Reporting Units

LabID:	TstGrpName:	RptUnits:
1223001-1	GrossAlpha/Beta	PCI/L
1223001-2	GrossAlpha/Beta	PCI/L
1223001-3	GrossAlpha/Beta	PCI/L
1223001-4	GrossAlpha/Beta	PCI/L
1223001-5	GrossAlpha/Beta	PCI/L
1223001-6	GrossAlpha/Beta	PCI/L
1223001-7	GrossAlpha/Beta	PCI/L
1223001-8	GrossAlpha/Beta	PCI/L
1223001-9	GrossAlpha/Beta	PCI/L
1223001-10	GrossAlpha/Beta	PCI/L
1223001-11	GrossAlpha/Beta	PCI/L
1223001-12	GrossAlpha/Beta	PCI/L
1223001-13	GrossAlpha/Beta	PCI/L
1223001-14	GrossAlpha/Beta	PCI/L
1223001-15	GrossAlpha/Beta	PCI/L
1223001-16	GrossAlpha/Beta	PCI/L
1223001-17	GrossAlpha/Beta	PCI/L
1223001-18	GrossAlpha/Beta	PCI/L
1223001-19	GrossAlpha/Beta	PCI/L
1223001-20	GrossAlpha/Beta	PCI/L
1223001-21	GrossAlpha/Beta	PCI/L
1223001-22	GrossAlpha/Beta	PCI/L
1223001-23	GrossAlpha/Beta	PCI/L
1223001-24	GrossAlpha/Beta	PCI/L
1223001-25	GrossAlpha/Beta	PCI/L
1223001-26	GrossAlpha/Beta	PCI/L
1223001-27	GrossAlpha/Beta	PCI/L

292 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: GAB

Reviewed By: jll *JK*

Review Date: 11/15/2012

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 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10
 Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1223001-1	SMP		200	200	Unfiltered	S1	
2	1	1223001-2	SMP		200	200	Unfiltered	S1	
3	1	1223001-3	SMP		200	200	Unfiltered	S1	
4	1	1223001-4	SMP		200	200	Unfiltered	S1	
5	1	1223001-5	SMP		200	200	Unfiltered	S1	
6	1	1223001-6	SMP		200	200	Unfiltered	S1	
7	1	1223001-7	SMP		200	200	Unfiltered	S1	
8	1	1223001-8	SMP		200	200	Unfiltered	S1	
9	1	1223001-9	SMP		200	200	Unfiltered	S1	
10	1	1223001-10	SMP		200	200	Unfiltered	S1	
11	1	1223001-11	SMP		200	200	Unfiltered	S1	
12	1	1223001-12	SMP		200	200	Unfiltered	S1	
13	1	1223001-13	SMP		200	200	Unfiltered	S1	
14	1	1223001-14	SMP		200	200	Unfiltered	S1	
15	1	1223001-15	SMP		200	200	Unfiltered	S1	
16	1	1223001-16	SMP		200	200	Unfiltered	S1	
17	1	1223001-17	SMP		200	200	Unfiltered	S1	
18	1	1223001-18	SMP		200	200	Unfiltered	S1	
19	1	1223001-19	SMP		200	200	Unfiltered	S1	
20	1	1223001-20	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
21	1	1223001-21	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
22	1	1223001-22	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
23	1	1223001-23	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
24	1	1223001-24	SMP		200	200	Unfiltered	S1	Spiked on 11/14 by SW
25	1	1223001-25	SMP		200	200	Unfiltered		0.05 mL of 10 mg/mL natural Uranium
26	1	1223001-26	SMP		200	200	Unfiltered		0.05 mL of 10 mg/mL natural Uranium
27	1	1223001-27	SMP		200	200	Unfiltered		0.05 mL of 10 mg/mL natural Uranium

JK

JK

NA

293 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB121109-1

Prep Procedure: **GAB**

Reviewed By: jtl

Review Date: 11/15/2012

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Steve Workman Balance: 10

Prep SOP: NONE Prep Date: 11/8/2012 Balance: 13

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes

Comments

Calibration planchets and mass attenuation curve.

Spiked By: Steve Workman Date: 11/8/2012

Witnessed By: N/A Date: N/A

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Am-241	955.4095.10	55,069.251	DPM/ml	11/08/12	0.1	ml	RS-008

Reagent Solution IDs*

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

294 of 328

Radiochemistry Gravimetric Worksheet

ALS Environmental -- FC

Prep Batch: **AB121109-1**

Prep Procedure: **GAB**

Reviewed By: *JL*

Review Date: 11/15/2012

Prep Num	Planc. Num	LabID	QC Type	Test Alq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Alq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1223001-1	SMP	10	9.1050	0.0000	0	200	200	200	9.1283	23.3	0.5	
1	2	1223001-2	SMP	10	9.0995	0.0000	0	200	200	200	9.1216	22.1	0.5	
1	3	1223001-3	SMP	10	9.0872	0.0000	0	200	200	200	9.1082	21	0.5	
1	4	1223001-4	SMP	10	9.1198	0.0000	0	200	200	200	9.1426	22.8	0.5	
1	5	1223001-5	SMP	10	9.1442	0.0000	0	200	200	200	9.1669	22.7	0.5	
1	6	1223001-6	SMP	10	9.1142	0.0000	0	200	200	200	9.1627	48.5	1	
1	7	1223001-7	SMP	10	9.1346	0.0000	0	200	200	200	9.1821	47.5	1	
1	8	1223001-8	SMP	10	9.0877	0.0000	0	200	200	200	9.1314	43.7	1.5	
1	9	1223001-9	SMP	10	9.0922	0.0000	0	200	200	200	9.1383	46.1	1.5	
1	10	1223001-10	SMP	10	9.0712	0.0000	0	200	200	200	9.1347	63.5	2	
1	11	1223001-11	SMP	10	9.1302	0.0000	0	200	200	200	9.2113	81.1	2	
1	12	1223001-12	SMP	10	9.1044	0.0000	0	200	200	200	9.1980	93.6	2.5	
1	13	1223001-13	SMP	10	9.1418	0.0000	0	200	200	200	9.2370	95.2	2.5	
1	14	1223001-14	SMP	10	9.1031	0.0000	0	200	200	200	9.2192	116.1	3	
1	15	1223001-15	SMP	10	9.1182	0.0000	0	200	200	200	9.2089	90.7	3	
1	16	1223001-16	SMP	10	9.1173	0.0000	0	200	200	200	9.2515	134.2	3.5	
1	17	1223001-17	SMP	10	9.0956	0.0000	0	200	200	200	9.2298	134.2	3.5	
1	18	1223001-18	SMP	10	9.1276	0.0000	0	200	200	200	9.2792	151.6	4	
1	19	1223001-19	SMP	10	9.1131	0.0000	0	200	200	200	9.2691	156	4	
1	20	1223001-20	SMP	10	9.0751	0.0000	0	200	200	200	9.0964	21.3	0.5	
1	21	1223001-21	SMP	10	9.1113	0.0000	0	200	200	200	9.1331	21.8	0.5	
1	22	1223001-22	SMP	10	9.0713	0.0000	0	200	200	200	9.0910	19.7	0.5	
1	23	1223001-23	SMP	10	9.1326	0.0000	0	200	200	200	9.1531	20.5	0.5	
1	24	1223001-24	SMP	10	9.1320	0.0000	0	200	200	200	9.1532	21.2	0.5	
1	25	1223001-25	SMP	10	9.1188	0.0000	0	200	200	200	9.1399	21.1	0.5	
1	26	1223001-26	SMP	10	9.0872	0.0000	0	200	200	200	9.1087	21.5	0.5	
1	27	1223001-27	SMP	10	9.1133	0.0000	0	200	200	200	9.1340	20.7	0.5	

295 of 328

Gross α standards

<u>MO</u>	<u>WASS</u>	<u>Std</u>					
21.3	1	20mg R1	0.5ml salt,	0.1ml	955, 4095.10	.0751	.0964
1.8	2	R2				.1113	.1331
9.7	3	R3				.0713	.0910
20.5	4	R4				.1326	.1531
21.2	5	R5				.1320	.1532
21.1	6	20mg + U		0.05ml of	10mg/ml nat. U	.1188	.1399
21.5	7					.0872	.1087
20.7	8					.1133	.134

OUTLIER TEST

FILE	DET	SAMPLE ID	Alpha CPM	Relative % diff. from mean	Within acceptability range	Outlier?
ABA1118	A1(1)	1223001-20	1163.818	0.71%	YES	NO
ABA1118A	A1(1)	1223001-21	1074.100	8.36%	YES	OUTLIER!
ABA1118B	A1(1)	1223001-22	1248.300	6.50%	YES	NO
ABA1118C	A1(1)	1223001-23	1203.900	2.71%	YES	NO
ABA1119	A1(1)	1223001-24	1170.500	0.14%	YES	NO

Mean of all five planchets:

Average= 1172.12 Upper
 Std dev= 64.21220433 Lower
 2 Std Dev= 128.42

Acceptability range

1300.55
 1043.70

relative range

+/- 10.96%

10.96%

Sample 1223001-21 rejected as outlier.

Criteria: Potential outliers fall outside acceptability range; which is the mean of all five measurements +/- 2 std dev per the Grubbs statistical test.

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1118
 Batch ID: OUTLIER TEST
 Count Preset (m): 11
 Batch Ended: 11/18/12 16:44

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a \cdot (a \cdot (\text{mass} - x_0))$	Beta Attenuation Calibration $y = b \cdot m^a \cdot (a \cdot (\text{mass} - x_0))$
Alpha b = 1.02810	Beta b = 1.0002
m = 0.99320	m = 0.9995
a = 0.9951	a = 0.7685
x0 = 0.0600	x0 = 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b = 0.2360	b -> a xtalk b = -5.900E-09
a -> b xtalk m = 1.0002	b -> a xtalk m = 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity								Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.		
A1	1223001-20	11/18/12 16:44	11.00	21.3	1163.818	0.114	0.060	0.2633	0.890	n/a	n/a	300.818	1.998	296.6420	0.3879	0.992	n/a	n/a		

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev. 12/29/03 JE

Data file name: ABA1118A
 Batch ID: OUTLIER TEST
 Count Presel (m): 10
 Batch Ended: 11/18/12 17:02

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m \cdot (a \cdot (\text{mass} - x_0))$	Beta Attenuation Calibration $y = b \cdot m \cdot (a \cdot (\text{mass} - x_0))$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99220	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.900E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity						Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
					A1	1223001-21	11/18/12 17:02	10.00	21.8	1074.100	0.114	0.056	0.2633	0.887	n/a	n/a	280.100	1.998

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1118B
 Batch ID: OUTLIER TEST
 Count Preset (mj): 10
 Batch Ended: 11/18/12 17:13

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a [a \cdot \text{mass} - x0]$	Beta Attenuation Calibration $y = b \cdot m^a [a \cdot \text{mass} - x0]$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99320	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.800E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-22	11/18/12 17:13	10.00	19.7	1248.300	0.114	0.070	0.2633	0.899	n/a	n/a	350.400	1.998	318.2792	0.3879	0.993	n/a	n/a

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1118C
 Batch ID: OUTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/18/12 17:37

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m \cdot [a \cdot (\text{mass} - x_0)]$	Beta Attenuation Calibration $y = b \cdot m \cdot [a \cdot (\text{mass} - x_0)]$
Alpha b= 1.02810	Beta b= 1.0002
m= 0.99920	m= 0.9995
a= 0.9951	a= 0.7685
x0= 0.0000	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b= 0.2560	b -> a xtalk b= -5.900E-09
a -> b xtalk m= 1.0002	b -> a xtalk m= 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A1	1223001-23	11/18/12 17:37	10.00	20.5	1203.900	0.114	0.068	0.2833	0.895	n/a	n/a	332.000	1.998	306.9084	0.3879	0.992	n/a	n/a

PAI - Gas Flow Proportional Sample Analysis LB4100-A

Unit Type: LB4100-A/W
 Counting Unit ID: Orange
 High Voltage Mode: Simultaneous
 Application Revision: C
 Application Version: PA
 Rev.12/29/03 JE

Data file name: ABA1119
 Batch ID: OJTLIER TEST
 Count Preset (m): 10
 Batch Ended: 11/19/12 9:42

Background logfile: BKGAB
 Date of Bkg. Cal: 11/14/12
 Alpha efficiency logfile: Am241R-12/11
 Alpha attenuation calibration: AAM0108
 Beta efficiency logfile: Sr90F-10/12
 Beta attenuation calibration: ASR1123

Alpha prog. logfile: n/a
 Alpha prog. attenuation: n/a
 Beta prog. logfile: n/a
 Beta prog. attenuation: n/a

Alpha Attenuation Calibration $y = b \cdot m^a \cdot (a \cdot (\text{mass} - x_0))$	Beta Attenuation Calibration $y = b \cdot m^a \cdot (a \cdot (\text{mass} - x_0))$
Alpha b = 1.02810	Beta b = 1.0002
m = 0.99320	m = 0.9995
a = 0.9951	a = 0.7685
x0 = 0.0000	x0 = 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot x$	Beta to Alpha X-talk $y = b \cdot \text{mass} + m$
a -> b xtalk b = 0.2560	b -> a xtalk b = -5.900E-09
a -> b xtalk m = 1.0002	b -> a xtalk m = 0.0002

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity							
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	
A1	1223001-24	11/19/12 9:42	10.00	21.2	1170.500	0.114	0.066	0.2633	0.890	n/a	n/a	331.600	1.998	298.3512	0.3879	0.992	n/a	n/a	n/a

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110619-4

Prep Procedure: GROSS_BETA MASS ATTEN. CALIB.

Analytical QASS / NCR? Y N WA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1118007-1	SMP	200	200	ml	pCi/l	8.1											<div style="display: flex; justify-content: space-between;"> <div style="width: 30%; border-left: 1px solid black; border-right: 1px solid black; height: 400px; margin: 0 auto;"></div> <div style="width: 30%; border-left: 1px solid black; border-right: 1px solid black; height: 400px; margin: 0 auto;"></div> <div style="width: 30%; border-left: 1px solid black; border-right: 1px solid black; height: 400px; margin: 0 auto;"></div> </div> <p style="font-size: 1.5em; margin-top: 10px;">See Maintenance log 3710 pg 86</p> <p style="font-size: 1.5em; margin-top: 10px;">JP 6/13/10</p>
1	1118007-2	SMP	200	200	ml	pCi/l	7.7											
1	1118007-3	SMP	200	200	ml	pCi/l	19.8											
1	1118007-4	SMP	200	200	ml	pCi/l	19											
1	1118007-5	SMP	200	200	ml	pCi/l	39.9											
1	1118007-6	SMP	200	200	ml	pCi/l	40.4											
1	1118007-7	SMP	200	200	ml	pCi/l	61.5											
1	1118007-8	SMP	200	200	ml	pCi/l	61.6											
1	1118007-9	SMP	200	200	ml	pCi/l	83.7											
1	1118007-10	SMP	200	200	ml	pCi/l	84.3											
1	1118007-11	SMP	200	200	ml	pCi/l	106.2											
1	1118007-12	SMP	200	200	ml	pCi/l	106.8											
1	1118007-13	SMP	200	200	ml	pCi/l	126.6											
1	1118007-14	SMP	200	200	ml	pCi/l	127.4											
1	1118007-15	SMP	200	200	ml	pCi/l	158.6											
1	1118007-16	SMP	200	200	ml	pCi/l	148											

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.018	DPM/ml	06/19/11	1	ml	RS-005

Sample Barcodes

1118007-1 AB110619-4PS1		1118007-2 AB110619-4PS2		1118007-3 AB110619-4PS3	
1118007-4 AB110619-4PS4		1118007-5 AB110619-4PS5		1118007-6 AB110619-4PS6	
1118007-7 AB110619-4PS7		1118007-8 AB110619-4PS8		1118007-9 AB110619-4PS9	
1118007-10 AB110619-4PS10		1118007-11 AB110619-4PS11		1118007-12 AB110619-4PS12	

303 of 328

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB110619-4

Prep Procedure: **GROSS_BETA**

Analytical QASS / NCR? Y **N**

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1118007-13	AB110619-4PS13							1118007-14						1118007-15				
								AB110619-4PS14						AB110619-4PS15				
1118007-16	AB110619-4PS16																	

Reporting Units

LabID:	TstGrpName:	RptUnits:
1118007-1	GrossBeta	pCi/l
1118007-2	GrossBeta	pCi/l
1118007-3	GrossBeta	pCi/l
1118007-4	GrossBeta	pCi/l
1118007-5	GrossBeta	pCi/l
1118007-6	GrossBeta	pCi/l
1118007-7	GrossBeta	pCi/l
1118007-8	GrossBeta	pCi/l
1118007-9	GrossBeta	pCi/l
1118007-10	GrossBeta	pCi/l
1118007-11	GrossBeta	pCi/l
1118007-12	GrossBeta	pCi/l
1118007-13	GrossBeta	pCi/l
1118007-14	GrossBeta	pCi/l
1118007-15	GrossBeta	pCi/l
1118007-16	GrossBeta	pCi/l

304 of 328

Radiochemistry Prep Worksheet

ALS Environmental -- FC

Prep Batch: AB110619-4

Prep Procedure: **GROSS_BETA**

Reviewed By: *gdw*

Review Date: 6/20/2011

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

Prep SOP: PAI 702 Rev: 20 Prep Analyst: Gabriel D. Wagner *gdw* Balance: 13

Prep SOP: NONE Prep Date: 6/19/2011 Balance: _____

Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1118007-1	SMP		200	200	Unfiltered	S1	<i>gdw</i> <i>06-20-11</i>
2	1	1118007-2	SMP		200	200	Unfiltered	S1	
3	1	1118007-3	SMP		200	200	Unfiltered	S1	
4	1	1118007-4	SMP		200	200	Unfiltered	S1	
5	1	1118007-5	SMP		200	200	Unfiltered	S1	
6	1	1118007-6	SMP		200	200	Unfiltered	S1	
7	1	1118007-7	SMP		200	200	Unfiltered	S1	
8	1	1118007-8	SMP		200	200	Unfiltered	S1	
9	1	1118007-9	SMP		200	200	Unfiltered	S1	
10	1	1118007-10	SMP		200	200	Unfiltered	S1	
11	1	1118007-11	SMP		200	200	Unfiltered	S1	
12	1	1118007-12	SMP		200	200	Unfiltered	S1	
13	1	1118007-13	SMP		200	200	Unfiltered	S1	
14	1	1118007-14	SMP		200	200	Unfiltered	S1	
15	1	1118007-15	SMP		200	200	Unfiltered	S1	
16	1	1118007-16	SMP		200	200	Unfiltered	S1	

Comments
Gross beta mass attenuation curve. All samples desiccated on 06/19/2011 @ 14:48.

Spiked By: Gabriel D. Wagner *gdw* Date: 6/19/2011

Witnessed By: Justin D. Anderson Date: 6/19/2011

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	Sr-90	777.3020.11	4,268.018	DPM/ml	06/19/11	1	ml	RS-005

305 of 328

Project 955.4095.10 Am-241
Continued from Page _____

Working Intermediate Standard
MEL 11/8/11

MEL 11/8/11

Prepare a working dilution of 955, Am-241

1. Density of 1M HCl, lot # K22032

Mass of 100mL vol. flask:	<u>66.4295g</u>	Balance # <u>12</u>
Mass of flask & 100mL acid:	<u>167.9701g</u>	Balance# <u>12</u>
Net Mass:	<u>101.5406g</u>	
Density:	<u>1.0154g/mL</u>	

2. Mass of 955 transferred:

Mass of empty voa vial:	<u>21.3568g</u>	Balance# <u>12</u>
Mass of voa vial & standard:	<u>26.4318g</u>	Balance# <u>12</u>
Net mass of standard transferred:	<u>5.0750g</u>	

MEL 11/8/11

3. Dilute to final volume:

Mass of vial, standard, & diluent:	<u>42.8085g</u>	Balance# <u>12</u>
Mass of empty voa vial:	<u>21.3568g</u>	Balance# <u>12</u>
Net mass of new dilution:	<u>21.4517g</u>	

4. Final activity calculation:

$$(1.965 \times 10^4 \text{ Bq}) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{5.0750 \text{ g}}{5.1344 \text{ g}} \right) \left(\frac{1.0154 \text{ g/mL}}{21.4517 \text{ g}} \right) = 55,161.32 \text{ dpm/mL}$$

MEL 11/8/11
55,161.33 dpm/mL

MEL 11/8/11

Std ID: 955.4095.10

RG 11/29/11

Description: Am-241

Expiration: 11/11/2012

Activity: 55161.33 dpm/mL

2s Uncertainty: 992.90 dpm/mL

Ref. Date: 10/25/2011

Ref Time: N/A

Prep Date: 11/8/2011 Prep by: MEL

Matrix/Comp. 3M HCl

Half Life (y): 4.33E+02

Reverification Log		
Analysis Date	Initials	Expiration Date

RG 11/29/11

RG 11/29/11

Continued on Page _____

Megan Jones
Signed

11/8/11
Date

Read and Understood By
Koree Kelly
Signed

11/29/11



Eckert & Ziegler
Analytics

RS# 955
Rec 10-31-11

1380 Seaboard Industrial Blvd.
 Atlanta, Georgia 30318
 Tel 404-352-8677
 Fax 404-352-2837
 www.analyticinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

85983-307

Am-241 5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group / Fort Collins
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u_A	u_B	U	
Am-241	1.580E+05	1.965E+04	0.1	0.9	1.8	10/25/2011

***Uncertainty:** U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %, α -impurities < 0.1 %. 5.13441 g 1M HCl solution, carrier free.

Source Prepared by: *M. I. Taskaeva*
 M. I. Taskaeva, Radiochemist

QA Approved: *J. D. McCorvey*
 J. D. McCorvey, QA Manager Alternate

Date: 26 Oct 11

ANA Form005 Rev. 11

Single Isotope Certificate, Rev 1 9/28/2009



Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318 **309 of 328**

Prepare a primary dilution of RSO #777 (Analytics #69573-307) in 0.1M HCl to a final volume of approx. 500 mL.

- 1) Prepare 0.1M HCl by diluting 8.3 mL HCl (12M) (Fisher Scientific Lot #055784) to a final volume of 1L.
- 2) Determine the density of 0.1M HCl

Weight of empty volumetric flask (100mL) 68.54g Bal 26
 Mass of flask + 100mL 0.1M HCl 168.31g
 Mass of 100mL of 0.1M HCl 99.77g
 $\div 100\text{mL} = \text{density} = 0.9977$

- 3) Transfer #777 to a 500mL

Mass of bottle 47.9687 Bal 26
 Mass of bottle + std. 52.9160
 Mass of std. 4.9473

- 4) Dilute to volume w/ 0.1M HCl

Mass of bottle + std. + soln 494.52g Bal 26
 Mass of bottle (from above) - 47.9687g
 Mass of soln 446.551g Bal 26

- 5) Final activity (dpm/mL)

$$\frac{(3.812 \times 10^4 \text{ cps}) \left(\frac{60 \text{ sec}}{1 \text{ min}}\right) (4.9473 \text{ g})}{(5.0596 \text{ g}) - (446.55 \text{ g})} = \frac{5010.94 \text{ dpm}}{5.00825 \text{ g}}$$

$$\frac{5010.94 \text{ dpm}}{5.00825 \text{ g}} \times 0.9977 \text{ g/mL} = 4999.42 \text{ dpm} / 4996.73 \text{ mL}$$

Reverification Log	
Analysis Date	Expiration Date
7/7/10	7/7/11
4/1/11	4/1/12

3/19/06
 RG
 Description: Sr-90
 Expiration: 2/27/07
 Activity: 4996.73 dpm/mL
 2s Uncertainty: 99.93 dpm/mL
 Ref. Date: 12/2/04
 Ref Time: N/A
 Prep Date: 2/8/06
 Matrix/Comp: 0.1 M HCl
 Half Life (y): 2.88E+01
 AG 5/19/06

ANALYSIS DATE = 06/06/10
 NEW EXP. DATE = 07/06/11
 rep by: HB
 Read and Understood

Reverification Log		
Analysis Date	Initials	Expiration Date
11/3/06	RG	11/8/07
3/3/07	JCS	3/3/08
2/28/08	MBC	2/25/09
1/30/09	RG	1/30/2010
7/17/09	RG	7/17/2010

Signed: Deborah Barker Date: 2/8/06 Signed: [Signature] Date: 2/8/06

ANALYTICS

RSO #777
Rec'd 12/9/04
JCS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

69573-307

Sr-90 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE: Sr-90
ACTIVITY (dps): 3.812 E4
HALF-LIFE: 28.79 years
CALIBRATION DATE: December 2, 2004 12:00 EST
RELATIVE EXPANDED
UNCERTAINTY (k=2): 2.0%

Impurities: γ -impurities <0.1%

5.05960 grams in 0.1M HCl solution with 30 μ g/g Sr carrier.

This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

P O NUMBER 71069, Item 1

SOURCE PREPARED BY:

M. Dimitrova
M. Dimitrova, Radiochemist

Q A APPROVED:

JM. Muty 12-6-04

Internal Calculation Verifications

ICBs

&

ICVs

Gross Alpha/Beta LB4100C ICV's/ICB's AM241/SR90

Atten. Constants		b	m	a	x0
Alpha		0.8949	0.9914	0.9119	21.4875
Beta		0.9681	0.9996	0.9174	0.0

X-Talk Constants		m	b
$\alpha > \beta$		0.9990	0.2414
$\beta > \alpha$		0.0018	1.118E-05

Detector	Sample ID	Initial Aliquot	Final Sam. Size	Count Date	Count Dur.	Residual Mass (mg)	Alpha					Beta						
							Gross CPM	Bkg CPM	$\beta > \alpha$ X-Talk	Net CPM	Atten.	Efficiency	Gross CPM	Bkg CPM	$\alpha > \beta$ X-Talk	Net CPM	Atten.	Efficiency
A2	1224001-1	0.200	0.200	6/11/2017	360	21.4	16.761	0.094	0.083	16.584	0.896	0.2221	42.139	1.336	4.1105	36.6925	0.9605	0.4238
B3	1224001-2	0.200	0.200	6/11/2017	360	43.8	15.022	0.084	0.094	14.844	0.751	0.204	42.767	1.545	3.7676	37.4544	0.9527	0.4289
C1	1224001-3	0.200	0.200	6/11/2017	360	64.0	13.211	0.110	0.009	13.092	0.640	0.2054	43.011	1.540	3.3717	38.0993	0.9456	0.4214
D2	1224001-4	0.200	0.200	6/11/2017	360	91.2	12.131	0.087	0.110	11.934	0.517	0.2166	40.619	1.607	3.1852	35.8268	0.9362	0.4107
A4	AB121206-3AMB	0.200	0.200	6/11/2017	360	22.4	0.128	0.083	0.001	0.044	0.888	0.2068	1.817	1.532	0.0111	0.2739	0.9602	0.4284
B2	AB121206-3BMB	0.200	0.200	6/11/2017	360	46.4	0.136	0.117	0.000	0.019	0.735	0.2192	1.856	1.650	0.0048	0.2012	0.9518	0.4122
C3	AB121206-3CMB	0.200	0.200	6/11/2017	360	69.8	0.133	0.096	0.000	0.037	0.612	0.2134	1.778	1.640	0.0096	0.1284	0.9436	0.4278
D3	AB121206-3EMB	0.200	0.200	6/11/2017	360	96.0	0.142	0.171	0.000	-0.029	0.498	0.2056	1.836	1.665	-0.0077	0.1787	0.9346	0.4196

Spike Information					
Alpha Std ID	Ref. Date	Act (dpm/ml)	Spike Vol (mL)	Decay Corr. Spike Act. Added	
616.4095.13	4/18/2002	100.000	1.0	97.599	

Spike Information					
Beta Std ID	Ref. Date	Act (dpm/ml)	Spike Vol (mL)	Decay Corr. Spike Act. Added	
931.4095.33	4/11/2011	51.950	1.0	44.783	

Acceptance criteria for LCS's --> 70-130%

Sample ID	Alpha					Beta				
	Act (pCi/L)	TPU (2 sig)	MDC	% Recov.	Act<MDCa	Act (pCi/L)	TPU (2 sig)	MDC	% Recov.	Act<MDCa
1224001-1	187.79	30.3	1.25	85.4%	NA	203.01	32.6	3.21	100.6%	NA
1224001-2	218.31	35.3	1.63	99.3%	NA	206.46	33.1	3.16	102.3%	NA
1224001-3	224.22	36.3	1.58	102.0%	NA	215.34	34.5	3.11	106.7%	NA
1224001-4	240.12	39.0	2.34	109.2%	NA	209.85	33.7	3.19	104.0%	NA
AB121206-3AMB	0.54	0.5	0.96	0.2%	PASS	1.50	0.9	1.71	NA	PASS
AB121206-3BMB	0.26	0.6	1.28	0.1%	PASS	1.16	1.0	1.85	NA	PASS
AB121206-3CMB	0.63	0.0	1.44	0.3%	PASS	0.72	0.0	1.80	NA	PASS
AB121206-3EMB	-0.65	0.0	2.40	-0.3%	PASS	1.03	0.0	1.86	NA	PASS

Alpha CU (1 sig)	Alpha TPU (1 sig)	Beta CU (1 sig)	Beta TPU (1 sig)
2.4519	15.1519	1.9934	16.2865
3.0168	17.6419	1.9936	16.5586
3.2868	18.1523	2.0408	17.2664
3.7150	19.4762	2.0567	16.8348
0.2572	0.2608	0.4452	0.4609
0.3112	0.3119	0.4741	0.4829

OK JP 6/12/17

PAI - Gas Flow Proportional Sample Analysis LB4100-C

Unit Type: LB4100 -C
 Counting Unit ID: Magenta
 High Voltage Mode: Simultaneous
 Application Revision: 2
 Rev.12/01/08 JCP

Data file name: ABC0611
 Batch ID: AB121206-3
 Count Preset (m): 360
 Batch Ended: 6/11/2017 17:49

Background logfile: BKGABW
 Date of Bkg. Cal: 6/8/2017
 Alpha efficiency logfile: Am241R-06/17
 Alpha attenuation calibration: AAM0610, 061
 Beta efficiency logfile: Sr90F-06/17
 Beta attenuation calibration: ASR0611

Alpha Attenuation Calibration	Beta Attenuation Calibration
$y = b \cdot m^a (e^{(mass-x0)})$	$y = b \cdot m^a (e^{(mass-x0)})$
Alpha b= 0.89490	Beta b= 0.9681
m= 0.99140	m= 0.9996
a= 0.9119	a= 0.9174
x0= 21.4875	x0= 0.0000
Alpha to Beta X-talk $y = b \cdot m^a \cdot mass$	Beta to Alpha X-talk $y = b \cdot mass + m$
a -> b xtalk b= 0.2414	b -> a xtalk b= 1.12E-05
a -> b xtalk m= 0.9990	b -> a xtalk m= 0.0018

Det. ID	Sample ID	Count End Date & Time	Count Dur. (min)	Resid. Mass (mg)	Alpha Activity							Beta Activity						
					Gross CPM	Bkg. CPM	b>a xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.	Gross CPM	Bkg. CPM	a>b xtlk CPM	Base Eff	Base Cor.Fact.	Progeny Eff	Progeny Cor.Fact.
A2	1224001-1	6/11/2017 17:48	360.00	21.4	16.761	0.094	0.083	0.2221	0.896	n/a	n/a	42.139	1.336	4.1105	0.4238	0.961	n/a	n/a
A4	AB121206-3AMB	6/11/2017 17:48	360.00	22.4	0.128	0.083	0.001	0.2068	0.888	n/a	n/a	1.817	1.532	0.0111	0.4284	0.960	n/a	n/a
C1	1224001-3	6/11/2017 17:49	360.00	64.0	13.211	0.110	0.104	0.2054	0.640	n/a	n/a	43.011	1.540	3.3717	0.4214	0.946	n/a	n/a
C3	AB121206-3CMB	6/11/2017 17:49	360.00	69.8	0.133	0.096	0.000	0.2134	0.612	n/a	n/a	1.778	1.640	0.0097	0.4278	0.944	n/a	n/a
B2	AB121206-3BMB	6/11/2017 17:49	360.00	46.4	0.136	0.117	0.000	0.2192	0.735	n/a	n/a	1.856	1.650	0.0048	0.4122	0.952	n/a	n/a
B3	1224001-2	6/11/2017 17:49	360.00	43.8	15.022	0.084	0.094	0.2040	0.751	n/a	n/a	42.767	1.545	3.7676	0.4289	0.953	n/a	n/a
D2	1224001-4	6/11/2017 17:49	360.00	91.2	12.131	0.087	0.110	0.2166	0.517	n/a	n/a	40.619	1.607	3.1851	0.4107	0.936	n/a	n/a
D3	AB121206-3EMB	6/11/2017 17:49	360.00	96.0	0.142	0.171	0.000	0.2056	0.498	n/a	n/a	1.836	1.665	0.0000	0.4196	0.935	n/a	n/a

JCP 6/12/17

Date 6/12/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	✓	P			✓	P			P
2	↓				↓				↓
3	↓				↓				↓
4	↓				↓				↓
5	↓				↓				↓
6	↓				↓				↓
7	↓				↓	Hα	JCB	P	↓
8	↓				↓	P			↓
9	↓				↓	Hβ	JCB	P	↓
10	↓				↓	P			↓
11	↓				↓				↓
12	↓				↓				↓
13	↓				↓				↓
14	↓				↓				↓
15	↓				↓	Hα	JCB	P	↓
16	↓				↓	Hβ	JCB	Hβ	Hβ

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BXC0607W			
Dr B				
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply	P-10 Flow	
Tank 1	1900	Dr A	10
	↓	Dr B	
Tank 2	1900	Dr C	
	↓	Dr D	

Comments:

Date 6/11/17

SOP 724r 12

ALS
Low Background Gas Flow Proportional Counter Log
Instrument: LB4100C

Instrument Daily Response and Background Checks

Det.	Daily Response Check				Background Check				Det. Status
	Start 1	Status	Start 2	Status	Start 1	Status	Start 2	Status	
1	✓	P			✓	P			P
2	↓	↓			↓	↓			↓
3	↓	↓			↓	↓			↓
4	↓	↓			↓	↓			↓
5	↓	↓			↓	↓			↓
6	↓	↓			↓	↓			↓
7	↓	↓			↓	↓			↓
8	↓	↓			↓	↓			↓
9	↓	↓			↓	↓			↓
10	↓	↓			↓	↓			↓
11	↓	↓			↓	↓			↓
12	↓	↓			↓	↓			↓
13	↓	↓			↓	↓			↓
14	↓	↓			↓	↓			↓
15	↓	↓			↓	↓			↓
16	↓	↓			↓	(HB)			(HB)

Det = Detector; α = Alpha; β = Beta; P = Pass; H = High; L = Low; OL = Offline; R = Recount; W = Weekly; NP = Not Processed

Weekly Background Calibration

	Current Calib. File ID	Weekly Calib. Started	Status	File ID
Dr A	BK00607W			
Dr B	↓			
Dr C				
Dr D				

Dr = Drawer

Gas Supply

	P-10 Supply	P-10 Flow	
Tank 1	2200	Dr A	10
	↓	Dr B	
Tank 2	1800	Dr C	
	↓	Dr D	

Comments:

Date 6/11/17

SOP 724r 12

ALS
 Low Background Gas Flow Proportional Counter Log
 Instrument: LB4100C

Det.	Sample ID	Batch	Test	Count Dur. (min)	Start Time	Analyst Initials	File ID	Output Initials
1-16	Daily EP	—	—	30	6:20	JP	EFC0611	JP
1-16	Daily Bks	—	—	30	6:30	JP	BKCO611	JP
1-16	1223001-1-36-14 → 16-19	AB121109-1	Am241 Attn	30	7:11	JP	AAM0611	JP
1-16	1118007-1-16	AB110619-4	Sr90 Attn	30	9:10	JP	ASR0611	JP
2	1224001-1	AB121206-3	LIB	360	11:48	JP	ABC0611	JP
7	-2		ICVs/ ICBs	360				
9	-3							
14	-4							
4	AB121206-3AMB							
6	BMB							
11	CMB							
15	EMB							

JP 6/11/17
 JP 6/11/17

JP 6/12/17

Comments:

Radiochemistry Instrument Worksheet

ALS Environmental -- FC

Prep Batch: AB121206-3

Prep Procedure: GAB ICB's, ICV's

Analytical QASS/NCR? Y **N** WA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Residual Mass (mg)	Cnt 1 File	Cnt 1 Inst/Det	Cnt 1 Pos Chk By	Cnt 2 File	Cnt 2 Inst/Det	Cnt 2 Pos Chk By	Cnt 3 File	Cnt 3 Inst/Det	Cnt 3 Pos Chk By	Notes	
1	1224001-1	SMP	200	200	ml	PCI/L	21.4	ABC0611	2	TP								/
1	1224001-2	SMP	200	200	ml	PCI/L	43.8		7									
1	1224001-3	SMP	200	200	ml	PCI/L	64		9									
1	1224001-4	SMP	200	200	ml	PCI/L	91.2		14									
1	AB121206-3A	MB	200	200	ml	PCI/L	22.4		4									
1	AB121206-3B	MB	200	200	ml	PCI/L	46.4		6									
1	AB121206-3C	MB	200	200	ml	PCI/L	69.8		11									
1	AB121206-3E	MB	200	200	ml	PCI/L	96		15									JPG/13/17

Spike Solution Information							
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Pipet ID
S1	AM-241	616.4095.13	98.308	DPM/ml	12/06/12	1	ml RS-016
S2	Sr-90	931.4095.33	49.916	DPM/ml	12/06/12	1	ml RS-016

Sample Barcodes

1224001-1 AB121206-3PS1		1224001-2 AB121206-3PS2	
1224001-3 AB121206-3PS3			
1224001-4 AB121206-3PS4		AB121206-3AMB AB121206-3PS5	
		AB121206-3BMB AB121206-3PS6	
AB121206-3CMB AB121206-3PS7		AB121206-3EMB AB121206-3PS8	

Reporting Units

LabID:	TstGrpName:	RptUnits:
1224001-1	GrossAlpha/Beta	PCI/L
1224001-2	GrossAlpha/Beta	PCI/L
1224001-3	GrossAlpha/Beta	PCI/L
1224001-4	GrossAlpha/Beta	PCI/L

318 of 328

Radiochemistry Prep Worksheet

Prep Batch: **AB121206-3**

ALS Environmental -- FC

Prep Procedure: **GAB**

Reviewed By: JL

Review Date: 12/6/2012

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 702 Rev: 20 Prep Analyst: Jeffrey T. Lee Balance: 13
 Prep SOP: NONE Prep Date: 12/6/2012 Balance:
 Matrix Class: liquid Prep Dept: RS

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1224001-1	SMP		200	200	Unfiltered	S1,S2	<i>deleted</i>
2	1	1224001-2	SMP		200	200	Unfiltered	S1,S2	
3	1	1224001-3	SMP		200	200	Unfiltered	S1,S2	
4	1	1224001-4	SMP		200	200	Unfiltered	S1,S2	
5	1	AB121206-3A	MB		200	200	Unfiltered		
6	1	AB121206-3B	MB		200	200	Unfiltered		
7	1	AB121206-3C	MB		200	200	Unfiltered		
8	1	AB121206-3E	MB		200	200	Unfiltered		

Comments

ICV/ICBs. Samples desiccated on 12/6/12 @ 17:15.

Spiked By: Jeffrey T. Lee Date: 12/6/2012

Witnessed By: Eric K. Gobel Date: 12/6/2012

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.4095.13	98.308	DPM/ml	12/06/12	1	ml	RS-016
S2	Sr-90	931.4095.33	49.916	DPM/ml	12/06/12	1	ml	RS-016

Reagent Solution IDs

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

Radiochemistry Prep Worksheet

Prep Batch: AB121206-3

ALS Environmental -- FC

Prep Procedure: GAB

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 702 Rev: 20
 Prep SOP: NONE
 Matrix Class: liquid

Prep Analyst: Jeffrey T. Lee *JTL*
 Prep Date: 12/6/2012
 Prep Dept: RS

Balance: 13
 Balance: _____

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq ml	Fin Alq ml	Prep Basis	Standards	Prep Notes
1	1	1224001-1	SMP		200	200	Unfiltered	S1,S2	
2	1	1224001-2	SMP		200	200	Unfiltered	S1,S2	
3	1	1224001-3	SMP		200	200	Unfiltered	S1,S2	
4	1	1224001-4	SMP		200	200	Unfiltered	S1,S2	
5	1	AB121206-3A	MB		200	200	Unfiltered		
6	1	AB121206-3B	MB		200	200	Unfiltered		
7	1	AB121206-3C	MB		200	200	Unfiltered		
8	1	AB121206-3E	MB		200	200	Unfiltered		

Comments

Spiked By: JTL Date: 12/6/12
 Witnessed By: EKG Date: 12/6/12

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	AM-241	616.4095.13	98.308	DPM/ml	12/06/12	1	ml	RS-016
S2	Sr-90	931.4095.33	49.916	DPM/ml	12/06/12	1	ml	RS-016

S1: 4/12/13
 S2: 9/10/13

J12036

*Except where otherwise noted, all reagents were applied in accordance with the specifications of the preparation methods associated with this batch.

Radiochemistry Gravimetric Worksheet

ALS Environmental -- FC

Prep Batch: **AB121206-3**

Prep Procedure: **GAB**

Reviewed By: jtl *JN*

Review Date: 12/6/2012

Prep Num	Planc. Num	LabID	QC Type	Test Aliq (ml)	Tare Mass (g)	Initial Gross Mass (g)	Initial Net Mass (mg)	Suggested Aliq (ml)	Samp Vol Available (ml)	Samp Vol Taken (ml)	Fin Gross Mass (g)	Final Net Mass (mg)	Salt Sol. Added (ml)	Flag
1	1	1224001-1	SMP	10	9.1723	0.0000	0	200	200	200	9.1937	21.4	0.5	
1	2	1224001-2	SMP	10	9.1914	0.0000	0	200	200	200	9.2352	43.8	1	
1	3	1224001-3	SMP	10	9.2220	0.0000	0	200	200	200	9.2860	64	1.5	
1	4	1224001-4	SMP	10	9.1331	0.0000	0	200	200	200	9.2243	91.2	2	
1	5	AB121206-3A	MB	10	9.1271	0.0000	0	200	200	200	9.1495	22.4	0.5	
1	6	AB121206-3B	MB	10	9.2092	0.0000	0	200	200	200	9.2556	46.4	1	
1	7	AB121206-3C	MB	10	9.1743	0.0000	0	200	200	200	9.2441	69.8	1.5	
1	8	AB121206-3E	MB	10	9.2158	0.0000	0	200	200	200	9.3118	96	2	

MEL 1/6/12

Prepare a working dilution of 616.2382.91

1. Density of 1M HCl, lot # K43J20
 Mass of 100mL vol. flask: 56.4421g Balance # 12
 Mass of flask & 100mL acid: 157.7445g Balance# 12
 Net Mass: 101.3024g
 Density: 1.0130g/mL

2. Mass of 616.2382.91 transferred:
 Mass of open empty nalgene: 74.7685g Balance# 12
 Mass of nalgene & standard: 78.4340g Balance# 12
 Net mass of standard transferred: 3.6655g Balance# NA

3. Dilute to final volume:
 Mass of nalgene, standard, & diluent: 1084.8g Balance# 26
 Mass of empty nalgene (from above): 74.7685g Balance# 12
 Net mass of new dilution: 1010.0315g Balance# NA

4. Final activity calculation:

$$27,201.49 \text{ dpm/g} \left(\frac{3.6655\text{g}}{1010.0315\text{g}} \right) (1.0130\text{g/mL}) = 100.00 \text{ dpm/mL}$$

MEL 1/6/12

JP 5/1/12

Std ID: 616.4095.13

Description: Am-241

Expiration: 4/21/2013

Activity: 100.00 dpm/mL

2s Uncertainty: 3.30 dpm/mL

Ref. Date: 4/18/2002

Ref Time: N/A

Prep Date: 4/21/2012 Prep by: TE

Matrix/Comp. 1M HCl

Half Life (y): 4.32E+02

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 5/1/12

JP 5/1/12

JP 5/1/12

Continued on Page _____

Megan Lane
 Signed _____

1/6/12
 Date _____

Read and Understood By [Signature]
 Signed _____

05/01/12
 Date _____

Am-241 intermediary dilution

Prepare an intermediate dilution of 616.2382.38 by diluting with 1M HCL (lot 43015)

(1) Determine the density of 1M HCL

mass of 100 ml class A volumetric flask	127.5757g (601)
mass of flask and 1M HCL	168.8580g
net mass of 1M HCL	101.2823

$$\rho = 1.0128 \text{ g/ml}$$

(2) Transfer Am-241 (616.2382.38) to a 40 ml NDA vial

mass of empty vial without lid & 50 ml beaker	54.0248g (601)
mass of standard, transfer pipet & 50 ml beaker (initial)	95.0640g ↓
mass of standard, transfer pipet & 50 ml beaker after transfer	75.0076g
net mass of standard transferred	20.0564g

(3) Dilute to final volume with 1M HCL

mass of empty vial w/o lid & 50 ml beaker (from above)	54.0248g (601)
mass of standard, 1M HCL vial & 50 ml beaker	92.4609g ↓
net mass of standard	38.4361g

(4) final activity calculation

$$\frac{52.2896}{38.4361} \times 20.0564 \text{ g} \approx \frac{27116.7}{27201.49} \text{ dpm/g}$$

Continued on Page

Read and Understood By

C Moncavage

4/25/03

Renee Kelleys

5/5/03

Signed

Date

Signed

Date

Am-241 primary dilution

prepare a primary dilution of R50 1010 (NIST: ~~SRS~~ ^{CRM 1402} SRS 103051-307) by diluting w/ 1M HCl

1) Determine the density of 1M HCl (lot # 42223 & lot # 42216)

mass of 100ml vol flask	62.4712 g (Bal 12)
mass of flask + 1M HCl	163.862 g
Net mass of std HCl	101.33090 g

2) Transfer contents of ampule to 40 ml vol Vial

mass of VOA Vial w/o lid	22.3577 g (Bal 12)
mass of ampule ^{CRM 1402} + 30 ml beaker	37.9238 g
mass of beaker + empty ampule	32.9862 g
Net mass of std transferred	4.93760 g

3) Dilute std to final vol w/ 1M HCl

mass of VOA Vial w/o lid (from above)	22.3577 g (Bal 12)
mass of std + VOA Vial + 1M HCl	63.7403 g
Net mass of diluted std	41.38260 g

4) Final Activity Calc

$$\left(\frac{3.728 \times 10^4 \text{ dps}}{5.11972 \text{ g}} \right) \left(60 \frac{\text{dpm}}{\text{dps}} \right) \left(4.9376 \text{ g} \right)$$

41.3826g

JCS 7/24/03

$$= \frac{52,066 \text{ dpm/g}}{52,128.96 \text{ g/g}}$$

ANALYTICS
 1388 Seaboard Ind Blvd, Atlanta, GA 30318, USA, 404-952-8677

Am-241
 SRS 63651-307 Amount 1.808 uCi QA *Am-241*
 Date 4/16/02 12:00 EST Exp: _____
 PO # EW040502, Item 3
 5.11972 g 1M HCl solution

CAUTION RADIOACTIVE MATERIAL

JCS

Continued on Page

Read and Understood By

OM/AS 10-14-02
 Signed Date

Rybel 2/4/03
 Signed Date



ANALYTIX

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 U.S.A.

Phone (404) 862-8677
Fax (404) 862-2837

PAI.FO 0616
rec'd 4-22-02

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

63651-307

Am-241 5 mL Liquid in Flame Sealed Vial

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting.

Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and assay date for this source are given below.

ANALYTIX maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

ISOTOPE:	Am-241
ACTIVITY (dps):	3.728 E4
HALF-LIFE:	4.322 E2 years
CALIBRATION DATE:	April 18, 2002 12:00 EST
TOTAL UNCERTAINTY*:	3.3%
SYSTEMATIC:	3.0%
RANDOM:	0.3%

*99% confidence level.

Impurities: γ -impurities <0.1%

5.11972 grams 1M HCl solution.

P O NUMBER EW040502, Item 3

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: M. Rost 4-19-02

TE 9/8/12
 Prepare a working dilution of 931.4095.11

1. Density of 0.1 M HCl lot # L09031
 Mass of 100mL vol. flask: 68.5649g Balance # 12
 Mass of flask & 100mL acid: 168.4557g Balance # 12
 Net Mass: 99.8908g
 Density: 0.9989g/mL

TE 9/8/12

2. Mass of 931.4095.11 transferred:
 Mass of open empty nalgene: 75.0081g Balance # 12
 Mass of nalgene & standard: 76.5548g Balance # 12
 Net mass of standard transferred: 1.5467g Balance # N/A

TE 9/8/12

3. Dilute to final volume:
 Mass of nalgene, standard, & diluent: 1085.2g Balance # 26
 Mass of empty nalgene (from above): 75.0081g Balance # 12
 Net mass of new dilution: 1010.1919g Balance # N/A

4. Final activity calculation:

$$33,966.93 \text{ dpm/g} (0.9989 \text{ g/mL}) \left(\frac{1.5467 \text{ g}}{1010.1919 \text{ g}} \right) = 51.95 \text{ dpm/mL}$$

TE 9/8/12

MC 10/17/2012

MC 10/17/2012

Std ID: 931.4095.33

Description: Sr-90
 Expiration: 9/8/2013
 Activity: 51.95 dpm/mL
 2s Uncertainty: 93.51 dpm/mL
 Ref. Date: 4/11/2011
 Ref Time: N/A
 Prep Date: 9/8/2012 Prep by: TE
 Matrix/Comp. 0.1 M HCl
 Half Life (y): 2.88E+01

Reverification Log		
Analysis Date	Initials	Expiration Date

MC 10/17/2012

MC 10/17/2012

Continued on Page _____

TE
 Signed

9/8/12
 Date

Read and Understood by
[Signature]
 Signed

9/8/12
 Date

MEL 12/14/11

Prepare an intermediate dilution of 931 Sr-90

1. Density of 0.1M HCl, lot # K30039
 Mass of 100mL vol. flask: 66.4305g Balance # 12
 Mass of flask & 100mL acid: 166.2718g Balance# 12
 Net Mass: 99.8413g
 Density: 0.9984g/mL

2. Mass of 931 transferred:
 Mass of open empty 40mL Voa vial: 21.7293g Balance# 12
 Mass of Voa vial and standard: 27.0645g Balance# 12
 Net mass of standard transferred: 5.3352g

3. Dilute to final volume:
 Mass of open empty 40mL Voa vial: 21.7293g Balance# 12
 Mass of vial, standard, & diluent: 56.1105g Balance# 12
 Net mass of new dilution: 34.3812g

4. Final activity calculation:

$$1.967 \times 10^4 \text{ Bq} \left(\frac{5.3352 \text{ g}}{5.39174 \text{ g}} \right) \left(\frac{60 \text{ dpm}}{1 \text{ Bq}} \right) \left(\frac{0.9984 \text{ g/mL}}{34.3812 \text{ g}} \right) = \frac{33,966.93 \text{ dpm/g}}{33,912.59 \text{ dpm/mL}}$$

MEL 12/14/11

MEL 12/14/11

MEL 12/14/11

JP 6/20/12

Std ID: 931.4095.11

Description: Sr-90
 Expiration: 1/19/2013
 Activity: 33912.59 dpm/mL
 2s Uncertainty: 610.43 dpm/mL
 Ref. Date: 4/11/2011
 Ref Time: N/A
 Prep Date: 12/14/2011 Prep by: ML
 Matrix/Comp. 0.1 M HCl
 Half Life (y): 2.88E+01

Reverification Log		
Analysis Date	Initials	Expiration Date

JP 6/20/12

JP 6/20/12

JP 6/20/12

Continued on Page _____

Megan Lee 12/14/11
 Signed Date

Read and Understood By T. Elst 12/14/11
 Signed Date



Eckert & Ziegler
Analytics

*rec
4-5-11 RSO# 931*

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytiscinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

84379-307

5 mL Liquid in Flame Sealed Vial

Customer: ALS Laboratory Group/Fort Collins, CO
P.O. No.: 73625, Item 1

This standard radionuclide source was prepared gravimetrically from a master solution, calibrated by Eckert & Ziegler Analytics. The master solution was calibrated by liquid scintillation counting. Radionuclide purity and calibration were checked by germanium gamma-ray spectrometry and liquid scintillation counting. The nuclear decay rate and reference date for this source are given below. Eckert & Ziegler Analytics (EZA) maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST." EZA is accredited by the Health Physics Society (HPS) for the production of NIST-traceable sources, and this source was produced in accordance with the HPS accreditation requirements. Customers may report any concerns with the accreditation program to the HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101.

Isotope	Half-Life, Days	Activity (Bq)	Uncertainty*, %			Reference Date (12:00 PM EST)
			u_A	u_B	U	
Sr-90	1.052E+04	1.967E+04	0.1	0.9	1.8	04/11/2011

*Uncertainty: U - Relative expanded uncertainty, $k = 2$. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

Impurities: γ -impurities < 0.1 %. 5.39174 grams 0.1M HCl solution with approximately 30 $\mu\text{g/g}$ each of Sr and Y carriers.

NOTE: This source also contains Y-90 in secular equilibrium with Sr-90. The Y-90 activity is equal to the Sr-90 activity. Since Sr-90 and Y-90 both decay 100% by beta emission, the total beta emission rate for the source is twice the certified Sr-90 activity. The half-life for Y-90 is 64.08 hours.

Source Prepared by: W. Mao
W. Mao, Radiochemist

QA Approved: J. D. McCorvey
J. D. McCorvey, QA Manager Alternate

Date: 3/31/11



Single Isotope Certificate, Rev 1 9/29/2009

Corporate Office
24937 Avenue Tibbitts Valencia, California 91355

Laboratory
1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

APPENDIX C – FIELD INSTRUMENT DOCUMENTATION

PORTABLE INSTRUMENT RESPONSE CHECK SHEET

Page ___ of ___

Instrument: 2224 Serial No: 183047 Probe: 43-37-1 Serial No: 177875

Cal. Due Date: 8-30-17 Response Check Location: EPA Las Vegas - POS 23

α Channel			
Source Isotope: <u>Tl-230</u>	Source ID: <u>3937-01</u>	Source Jig ID: <u>Floor</u>	
Source Reference Reading: <u>354.2</u>	+20% <u>425.04</u>	-20%	<u>283.36</u>

β Channel			
Source Isotope: <u>SrY-90</u>	Source ID: <u>2909-01</u>	Source Jig ID: <u>Floor</u>	
Source Reference Reading: <u>1105.2</u>	+20% <u>1326.24</u>	-20%	<u>884.16</u>

Response Checks						
Date/Time	α Bkg.	β Bkg.	α Reading	β Reading <small>same as 12-13-16</small>	Remarks	Initials
12-13-16 1115	10	653	376	8 ¹¹³⁷	Did Not use	JMM
12-14-16 1300	8	603	356	993		JMM
12-14-16 1635	8	580	326	1121		JMM
6-5-17 1030	5	780	301	1278	Did Not use	JMM
6-6-17 1030	1	715	376	1047	Did Not use	JMM
6-7-17 0900	6	600	364	1025		JMM
6-7-17 1100	8	775	369	1208		JMM
6-8-17 0915	5	625	401	1206		JMM
6-8-17 1310	2	745	407	1270		JMM
6-15-17 0900	4	652	359	1144		JMM
6-15-17 1200	6	675	360	1160		JMM

Review: *[Signature]* Date: 12-16-16 / 6-15-17

INSTRUMENT QC CHECK SHEET

Date: 12/13/16 Time: 1020

Instrument: 2224 Serial No: 183047

Probe: 43-37-1 Serial No: 177875

Cal. Performed Date: 8-30-16 Cal. Due Date: 8-30-17

Source Isotope: SrY-90 Source #: 2909-01

QC Check Location: EPA Las Vegas POS 23

Jig Used: Yes No (circle one) Jig ID# Floor

QC Counting Results	
Count No.	Count Result
1	1103
2	1097
3	1088
4	1134
5	1104
	Add results, list in Total
Total	5526
	Divide the total by 5
Source Reference Reading (Average)	1105.2

Range Calculation

Source Ref. Reading: 1105.2 X 20% = 221.04

Avg. + 20% = 1326.24

Avg. - 20% = 884.16

Acceptable Range:

From 884.16 to 1326.24
(Avg. - 20%) (Avg. + 20%)

Comments: _____

Performed By: Tom Maveal (Tom Maveal) Date: 12-13-16

RSO Review: [Signature] Date: 12-16-16 / 6-15-17

INSTRUMENT EFFICIENCY DETERMINATION

Date: 12/13/16 Time: 1020
 Instrument: 2224 Serial No: 183047
 Probe: 43-37-1 Serial No: 177875
 Cal. Performed Date: 8-30-2016 Cal. Due Date: 8-30-2017
 Source Isotope: Tc-99 Source #: 78264-693
 Efficiency Location: EPA Las Vegas - POS 23
 Jig Used: Yes No
(circle one) Jig ID# Floor
 Location of Source on Probe Center of Probe

Efficiency Counting Results			
Count No.	Bkg counts	Src counts	net counts
1	653	2333	1680
2	585	2476	1891
3	628	2382	1754
4	535	2380	1845
5	632	2423	1791
6	612	2484	1872
7	617	2389	1772
8	590	2448	1858
9	569	2367	1798
10	576	2362	1786
Total	5997		18047
cpm	599.7		1804.7

Decay corrected source DPM 9768

$$eff = \frac{net\ cpm}{decayed\ source\ dpm * \left(\frac{probe\ area}{source\ area} \right)}$$

NOTE: probe area/source area correction is required only if source area is larger than probe area.
 (e.g., 43-89 = 125 cm², 43-93 = 100 cm², and not used for 2929)

Probe Area 821 cm² Source Area 206 cm² Eff = 0.184

Comments: _____

Performed By: Tom Maveal / Tom Maveal Date: 12/13/16
 RSO Review: [Signature] Date: 12-16-16 / 6-15-17

INSTRUMENT EFFICIENCY DETERMINATION

Date: 12/13/16 Time: 1020
 Instrument: 2224 Serial No: 183047
 Probe: 43-37-1 Serial No: 177875
 Cal. Performed Date: 8-30-16 Cal. Due Date: 8-30-17
 Source Isotope: Th-230 Source #: 78265-693
 Efficiency Location: EPA Las Vegas - POS 23
 Jig Used: Yes No
(circle one) Jig ID# Floor
 Location of Source on Probe Center of Probe

Efficiency Counting Results			
Count No.	Bkg counts	Src counts	net counts
1	8	210	202
2	10	194	184
3	9	217	208
4	11	211	200
5	11	239	228
6	12	203	191
7	4	218	214
8	6	244	238
9	9	251	242
10	8	271	263
Total	88		2170
cpm	8.8		217.0

Decay corrected source DPM 9846

$$eff = \frac{net\ cpm}{decayed\ source\ dpm * \left(\frac{probe\ area}{source\ area} \right)}$$

NOTE: probe area/source area correction is required only if source area is larger than probe area.
 (e.g., 43-89 = 125 cm², 43-93 = 100 cm², and not used for 2929)

Probe Area 821 cm² Source Area 206 cm² Eff = 0.072

Comments: _____

Performed By: Tom Maveal / Tom Maveal Date: 12-13-16
 RSO Review: [Signature] Date: 12-16-16 / 6-15-17



Calibration Certificate
ID Number: 183047102572-0

Customer: Heath Downey
AMEC - CO
 2275 Logos Ct.
 Suite A
 Grand Junction, CO 81505

Instrument
 Ludlum Model 2224

Serial Number
 183047

Probe Model
 Ludlum 43-37

Serial Number
 177875

Precision Check				
Test 1	Test 2	Test 3	Mean	Results
1.00 Kcpm	1.00 Kcpm	1.00 Kcpm	1.00 Kcpm	Satisfactory

Accuracy Check			
Range	Target Value	As Found	As Left
X1000	400 Kcpm	400 Kcpm #	400 Kcpm #
X1000	100 Kcpm	100 Kcpm #	100 Kcpm #
X100	40 Kcpm	40 Kcpm #	40 Kcpm #
X100	10 Kcpm	10 Kcpm #	10 Kcpm #
X10	4 Kcpm	4 Kcpm #	4 Kcpm #
X10	1 Kcpm	1 Kcpm #	1 Kcpm #
X1	400 cpm	400 cpm #	400 cpm #
X1	100 cpm	100 cpm #	100 cpm #

Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10% of Target value
 Readings with # indicate ranges were calibrated using a pulser


Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
43-37 177875	Cl-36	0.1801 C/D	Cl-36 (SN: 8933)	On Flat Surface
43-37 177875	Th-230	0.1536 C/D	Th-230 (SN: S-963)	On Flat Surface

MTE Instrument Type	Model	CalDueDate
Pulser	Ludlum 500-4SN: 98756	07/22/2017

Outer Physical Check: <i>Pass</i>	Mechanical Zero: <i>Pass</i>
Internal Check: <i>Pass</i>	Tap Test: <i>Pass</i>
Geotropism Check: <i>Pass</i>	

Electronics Checks	As Found	As Left
High Voltage	1698 Volts	1698 Volts

Comments: All As Left readings taken subsequent to repair. Stated efficiencies are the average of 1 minute readings taken in each of the eight sectors of the detector

Calibrated by:  QA Review: 

Date: 08/30/2016
 Expires: 08/30/2017

Atmospheric Conditions - Temperature: 74° F Humidity: 41% Barometric Pressure: 30.03 in/hg
 This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
 Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
 J.L. Shepherd and Associates: Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
 RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%.
 Unless otherwise stated, calibrations performed in conformance to the following documents: ANSI N323AB-2013; RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
 Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994
 This calibration certificate shall not be reproduced except in full without the express written consent of RSCS, Inc.

PORTABLE INSTRUMENT RESPONSE CHECK SHEET Page ___ of ___

Instrument: 2224-1 Serial No: 312990 Probe: 43-93 Serial No: 342019

Cal. Due Date: 11/7/17 Response Check Location: EPA Las Vegas POS 23

α Channel			
Source Isotope: <u>Th-230</u>	Source ID: <u>3937-01</u>	Source Jig ID: <u>001</u>	
Source Reference Reading: <u>707.4</u>	+20% <u>848.88</u>	-20% <u>565.92</u>	

βγ Channel			
Source Isotope: <u>SrY-90</u>	Source ID: <u>2909-01</u>	Source Jig ID: <u>001</u>	
Source Reference Reading: <u>727.4</u>	+20% <u>872.88</u>	-20% <u>581.92</u>	

Response Checks						
Date/Time	α Bkg.	βγ Bkg. <small>from 12-12-16</small>	α Reading	βγ Reading	Remarks	Initials
12/12/16/1200	1	95475	707	727	5 minute background	JMM
12-13-16 0750	3	513	741	766	Not Used	JMM
12-14-16 1005	5	466	747	810		JMM
12-14-16 1645	7	500	752	747		JMM
12-15-16 0825	0	430	706	747		JMM
12-15-16 1425	5	554	755	806		JMM
12-15-16 0740	10	504	743	735		JMM
12-16-16 1405	1	484	720	780		JMM
6-5-17 1100	3	466	737	767	5 min background	JMM
6-6-17 0840	1	465	727	743		JMM
6-6-17 1515	5	500	75709	752		JMM
6-7-17 0730	0	515	724	767		JMM
6-7-17 1540	3	472	728	729		JMM
6/8/17 0735	1	548	811	734		JMM
6/8/17 1520	2	467	662	724		JMM
6/11/17 6/12/17						
6-12-17 1230	1	475	713	735		JMM
6-12-17 1500	2	467	658	768		JMM
6-15-17 0730	1	499	681	697		JMM
6-15-17 1210	3	594	675	734		JMM

Review: *[Signature]*

Date: 12-16-16 / 6 15-17

INSTRUMENT QC CHECK SHEET

Date: 12-12-16 Time: 1000

Instrument: 2224-1 Serial No: 312990

Probe: 43-93 Serial No: 342019

Cal. Performed Date: 11-7-16 Cal. Due Date: 11-7-17

Source Isotope: SrY-90 Source #: 2909-01

QC Check Location: EPA Las Vegas POS 23

Jig Used: Yes No
(circle one) Jig ID# 001

QC Counting Results	
Count No.	Count Result
1	699
2	711
3	754
4	730
5	743
	Add results, list in Total
Total	3637
	Divide the total by 5
Source Reference Reading (Average)	727.4

Range Calculation

Source Ref. Reading: 727.4 X 20% = 145.48

Avg. + 20% = 872.88

Avg. - 20% = 581.92

Acceptable Range:

From 581.92 to 872.88
(Avg. - 20%) (Avg. + 20%)

Comments: _____

Performed By: Tom Maveal Date: 12/12/16

RSO Review: *A. Sanchez* Date: 12-16-16 / 6-15-17

INSTRUMENT QC CHECK SHEET

Date: 12/12/16 Time: 1000

Instrument: 2224-1 Serial No: 312996

Probe: 43-93 Serial No: 342019

Cal. Performed Date: 11-7-16 Cal. Due Date: 11-7-17

Source Isotope: Th-230 Source #: 3937-01

QC Check Location: EPA LAS VEGAS POS 23

Jig Used: Yes No
(circle one) Jig ID# 001

QC Counting Results	
Count No.	Count Result
1	692
2	727
3	685
4	694
5	737
	Add results, list in Total
Total	3537
	Divide the total by 5
Source Reference Reading (Average)	707.4

Range Calculation

Source Ref. Reading: 707.4 X 20% = 141.48

Avg. + 20% = 848.88

Avg. - 20% = 565.92

Acceptable Range:

From 565.92 to 848.88
(Avg. - 20%) (Avg. + 20%)

Comments: _____

Performed By: Tom Maveal Date: 12-12-16

RSO Review: [Signature] Date: 12-16-16 / 6-15-17

INSTRUMENT EFFICIENCY DETERMINATION

Date: 12-12-16 Time: 1000
 Instrument: 2224-1 Serial No: 312990
 Probe: 43-93 Serial No: 342019
 Cal. Performed Date: 11-7-16 Cal. Due Date: 11-7-17
 Source Isotope: TC-99 Source #: 78264-693
 Efficiency Location: EPA Las Vegas POS 23
 Jig Used: ^{Summ stream 12-12-16} Yes No (circle one) Jig ID# 001 ^{Summ 12-12-16} Counter Top
 Location of Source on Probe Center of Source

Efficiency Counting Results			
Count No.	Bkg counts	Src counts	net counts
1	97	513	416
2	98	533	435
3	96	546	450
4	94	509	413
5	104	550	446
6	86	533	447
7	92	512	420
8	105	589	484
9	87	513	426
10	94	513	419
Total	955		4356
cpm	95.5		435.6

Decay corrected source DPM 9768

$$eff = \frac{net\ cpm}{decayed\ source\ dpm * \left(\frac{probe\ area}{source\ area} \right)}$$

NOTE: probe area/source area correction is required only if source area is larger than probe area.
 (e.g., 43-89 = 125 cm², 43-93 = 100 cm², and not used for 2929)

Probe Area 100 cm² Source Area 206 cm² Eff = 0919 ^{Summ 12-13-16}
~~0918~~

Comments: _____

Performed By: Tom Maveal Date: 12-12-16
 RSO Review: [Signature] Date: 12-16-16 / 6-15-17

INSTRUMENT EFFICIENCY DETERMINATION

Date: 12-12-16 Time: 1000
 Instrument: 2224-1 Serial No: 312990
 Probe: 43-93 Serial No: 342019
 Cal. Performed Date: 11-7-16 Cal. Due Date: 11-7-17
 Source Isotope: Th-230 Source #: 78265-693
 Efficiency Location: EPA Las Vegas POS 23
 Jig Used: Yes No (circle one) Jig ID# Counter Top
 Location of Source on Probe Center of Source

Efficiency Counting Results			
Count No.	Bkg counts	Src counts	net counts
1	3	574	571
2	1	510	509
3	1	581	580
4	0	560	560
5	1	505	504
6	0	542	542
7	2	553	551
8	2	568	566
9	1	581	580
10	0	580	580
Total	11	5554	5539.9
cpm	1.1	555.4	553.99

12-13-16
 5543
 554.3

Decay corrected source DPM 9846

12-13-16

$$eff = \frac{net\ cpm}{decayed\ source\ dpm * \left(\frac{probe\ area}{source\ area} \right)}$$

NOTE: probe area/source area correction is required only if source area is larger than probe area
 (e.g., 43-89 = 125 cm², 43-93 = 100 cm², and not used for 2929)

Probe Area 100cm² Source Area 206cm² Eff = 0.116

12-13-16
 0.116
 1054

Comments: _____

Performed By: Tom Maveal Date: 12-12-16

RSO Review: [Signature] Date: 12-16-16 / 6-15-17



Calibration Certificate
ID Number: 312990104800-0

Customer: Robert Posner
 AMIEC - CO
 2275 Logos Ct.
 Suite A
 Grand Junction, CO 81505

Instrument
 Ludlum Model 2224-1
Serial Number
 312990

Probe Model
 Ludlum 43-93
Serial Number
 342019

Precision Check				
Test 1	Test 2	Test 3	Mean	Results
1.99 Kcpm	1.99 Kcpm	2.00 Kcpm	1.99 Kcpm	Satisfactory

Accuracy Check			
Range	Target Value	As Found	As Left
X1000	800 kcpm	800 kcpm #	800 kcpm #
X1000	200 kcpm	200 kcpm #	200 kcpm #
X100	80 kcpm	80 kcpm #	80 kcpm #
X100	20 kcpm	20 kcpm #	20 kcpm #
X10	8 kcpm	8 kcpm #	8 kcpm #
X10	2 kcpm	2 kcpm #	2 kcpm #
X1	0.8 kcpm	0.8 kcpm #	0.8 kcpm #
X1	0.2 kcpm	0.2 kcpm #	0.2 kcpm #

Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10% of Target value
 Readings with # indicate ranges were calibrated using a pulser

Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
43-93 342019	Tc-99	0.1225 C/D	Tc-99 (SN: 63963 (Beta))	On Flat Surface
43-93 342019	Th-230	0.2011 C/D	Th-230 (SN: S-963)	On Flat Surface

MTE Instrument Type	Model	CalDueDate
Pulser	Ludlum 500-4SN: 98756	07/22/2017

Outer Physical Check: Pass	Mechanical Zero: Pass
Internal Check: Pass	Tap Test: Pass
Geotropism Check: Pass	

Electronics Checks	As Found	As Left
High Voltage	645 Volts	645 Volts

Comments: Analog and digital scaler displays reflect appropriate congruence
 Customer observed problem with occasional "beta counts peak" could not be replicated. Meter and probe appear to be functioning normally

Chris Pirie
 Calibration
 Technician

QA
 Review:

Date: 11/07/2016
 Expires: 11/07/2017

Atmospheric Conditions - Temperature: 72° F Humidity: 28% Barometric Pressure: 30.34 in/hg
 This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
 Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547877) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 0.0%.
 J.L. Shepherd and Associates Model 99 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A8 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547877) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
 RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 0.4%.
 The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%.
 Unless otherwise stated, calibrations performed in conformance with the following documents: ANSI N323AB-2013; RSCS New Hampshire Radioactive Material License Number 381R. RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
 Calibration Laboratory is operated in accordance with ANSI/NCCL Z540-1-1994
 This calibration certificate shall not be reproduced except in full without the express written consent of RSCS, Inc.

Counting System Chi-Squared Test Data Sheet

System Model <u>2929</u>	Serial No. <u>86484</u>	
Detector Model <u>43-10-1</u>	Serial No. <u>83085</u>	Cal Due Date <u>8-25-17</u>
α Source ID No. <u>3937-01</u>	β - γ Source ID No. <u>2909-01</u>	
α Source Isotope <u>Th-230</u>	β - γ Source Isotope <u>Sm-147</u>	
α Source Activity <u>4350</u> dpm	β - γ Source Activity <u>3440</u> dpm	
α Source Diameter <u>47mm</u> mm	β - γ Source Diameter <u>47mm</u> mm	
α Source Assay Date <u>12/11/01</u>	β - γ Source Assay Date <u>7-25-01</u>	

Alpha			
n	x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
1	1358	23.6	557.0
2	1311	-23.4	547.6
3	1322	-12.4	153.8
4	1300	-34.4	1183.4
5	1304	-30.4	924.2
6	1375	40.6	1648.4
7	1279	-55.4	3069.2
8	1378	43.6	1901.0
9	1297	-37.4	1398.8
10	1395	60.6	3672.4
11	1351	16.6	275.6
12	1377	42.6	1814.8
13	1381	46.6	2171.6
14	1273	-61.4	3770.0
15	1346	11.6	134.6
16	1331	-3.4	11.6
17	1335	0.6	0.4
18	1295	-39.4	1552.4
19	1308	-26.4	697.0
20	1372	37.6	1413.8
$\sum x_i$	26,688	$\sum (x_i - \bar{x})^2$	26,897.6

Beta-Gamma			
n	x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
1	903	1.35	1.8
2	913	11.35	128.8
3	861	-40.65	1652.4
4	881	-20.65	426.4
5	921	19.35	374.4
6	906	4.35	18.9
7	857	-44.65	1993.6
8	885	-16.65	277.2
9	909	7.35	54.0
10	892	-9.65	93.1
11	853	-48.65	2366.8
12	942	40.35	1628.1
13	962	60.35	3642.1
14	911	9.35	87.4
15	952	50.35	2533.1
16	878	-23.65	559.3
17	967	63.35	4270.6
18	918	16.35	267.3
19	876	-25.65	657.9
20	846	-55.65	3096.9
$\sum x_i$	18,033	$\sum (x_i - \bar{x})^2$	24,132.1

$$\bar{x} = \sum x_i / 20$$

$$= 26688 / 20$$

$$= 1334.4 \text{ cpm}$$

$$\chi^2 = \frac{\sum (x_i - \bar{x})^2}{\bar{x}}$$

$$\chi^2 = 20.2$$

Chi-Squared Limits: 8.9 to 32.9

α Chi-Squared Test Result Pass
 Fail

Performed by: Tom Maveal / Tom Maveal

Reviewed by: Art Samirban

$$\bar{x} = \sum x_i / 20$$

$$= 18033 / 20$$

$$= 901.65 \text{ cpm}$$

Chi-Squared Limits: 8.9 to 32.9

β - γ Chi-Squared Test Result Pass
 Fail

Date: 6/5/17

Date: 6-15-17

FRN-0049a

Counting System Set Up Data Sheet

System Model <u>2929</u>	Serial No. <u>86484</u>	
Detector Model <u>43-10-1</u>	Serial No. <u>83085</u>	Cal Due Date <u>8/25/17</u>
α Source ID No. <u>T8263A-693</u>	β - γ Source ID No. <u>78262-693</u>	
α Source Isotope <u>Th-230</u>	β - γ Source Isotope <u>Tc-99</u>	
α Source Activity <u>10,200</u> dpm	β - γ Source Activity <u>10062</u> dpm	
α Source Diameter <u>47mm</u> mm	β - γ Source Diameter <u>47mm</u> mm	
α Source Assay Date <u>9/30/08</u>	β - γ Source Assay Date <u>9/30/08</u>	

Background Data	
α Background <u>0.1</u> cpm	β - γ Background <u>53.75</u> cpm

Counting System Efficiency Data			
Alpha		Beta-Gamma	
20 minute count <u>52493</u>		20 minute count <u>34780</u>	
Gross count rate <u>2624.65</u> cpm		Gross count rate <u>1739</u> cpm	
Net count rate <u>2624.55</u> cpm		Net count rate <u>1685.25</u> cpm	
Source activity <u>10,200</u> dpm		Source activity <u>10062</u> dpm	
Efficiency <u>0.257</u>		Efficiency <u>0.167</u>	

Source <u>3937-01, Th-230</u> Activity = <u>4350 dpm</u> Alpha	Acceptable Source Range	Source <u>2909-01, Sr-90</u> Activity = <u>3446 dpm</u> Beta-Gamma
20 minute count <u>26688</u>		20 minute count <u>18033</u>
Gross count rate <u>1334.4</u> cpm		Gross count rate <u>901.65</u> cpm
Net count rate <u>1334.3</u> cpm		Net count rate <u>847.92</u> cpm
$\sigma = \sqrt{\frac{R_g}{1} + \frac{R_b}{20}}$		
Alpha σ = <u>36.5</u> cpm		Beta-Gamma σ = <u>30.1</u> cpm
1 σ = <u>1297.8</u> to <u>1370.8</u>		1 σ = <u>817.8</u> to <u>878.0</u>
2 σ = <u>1261.3</u> to <u>1407.3</u>		2 σ = <u>787.7</u> to <u>908.12</u>

FRN-0049b

Performed by: Tom Mawral / Tom Mawral Date: 6/5/17

Reviewed by: Art Samikhan Date: 6-15-17

Alpha Counting System Daily Check Data Sheet

Model: 2929 Serial No: 86484 Cal. Due Date: 8-25-17

Detector Model: 43-10-1 Detector Serial No: 83085

Alpha Source ID No: 3937-01 Isotope: Th-230

Source Activity: 4350 dpm Source Diameter: 47 mm

Alpha Source Ranges: $1\sigma =$ 1297.8 to 1370.8 cpm

$2\sigma =$ 1261.3 to 1407.3 cpm

Date/Time	Alpha Background Counts	Alpha Background cpm	Alpha Source Counts	Alpha Source NET cpm	Sat/Unsat	MDA	Initials
6-5-17 1030	2	0.1	1334	1333.90	SAT		stmm
6-6-17 0825	3	0.15	1274	1273.85	SAT		stmm
6-6-17 1910	3	0.15	1373	1372.85	SAT		stmm
6-7-17 0745	10	0.50	1288	1287.50	SAT		stmm
6-7-17 1535	10	0.50	1374	1373.50	SAT		stmm
6-8-17 0755	19	0.95	1345	1344.05	SAT		stmm
6-8-17 1515	19	0.95	1278	1277.05	SAT		stmm
6-9-17 0835	2	0.1	1349	1348.90	SAT		stmm
6-9-17 1120	2	0.1	1344	1343.90	SAT		stmm
6-15-17 0740	6	0.3	1332	1331.07	SAT		stmm
6-15-17 1205	6	0.3	1287	1286.07	SAT		stmm

FRN-0049c

Reviewed by: *A. Amala* Date: 6-15-17

Beta-Gamma Daily Check Data Sheet

Model: 2929 Serial No: 86484 Cal. Due Date: 8/25/17

Detector Model: 43-10-1 Detector Serial No: 83085

Beta-Gamma Source ID No: 2909-01 Isotope: SrY-90

Source Activity: 3440 dpm Source Diameter: 47 mm

Beta-Gamma Source Ranges: 1σ = 817.8 to 878.0 cpm

2σ = 787.7 to 908.12 cpm

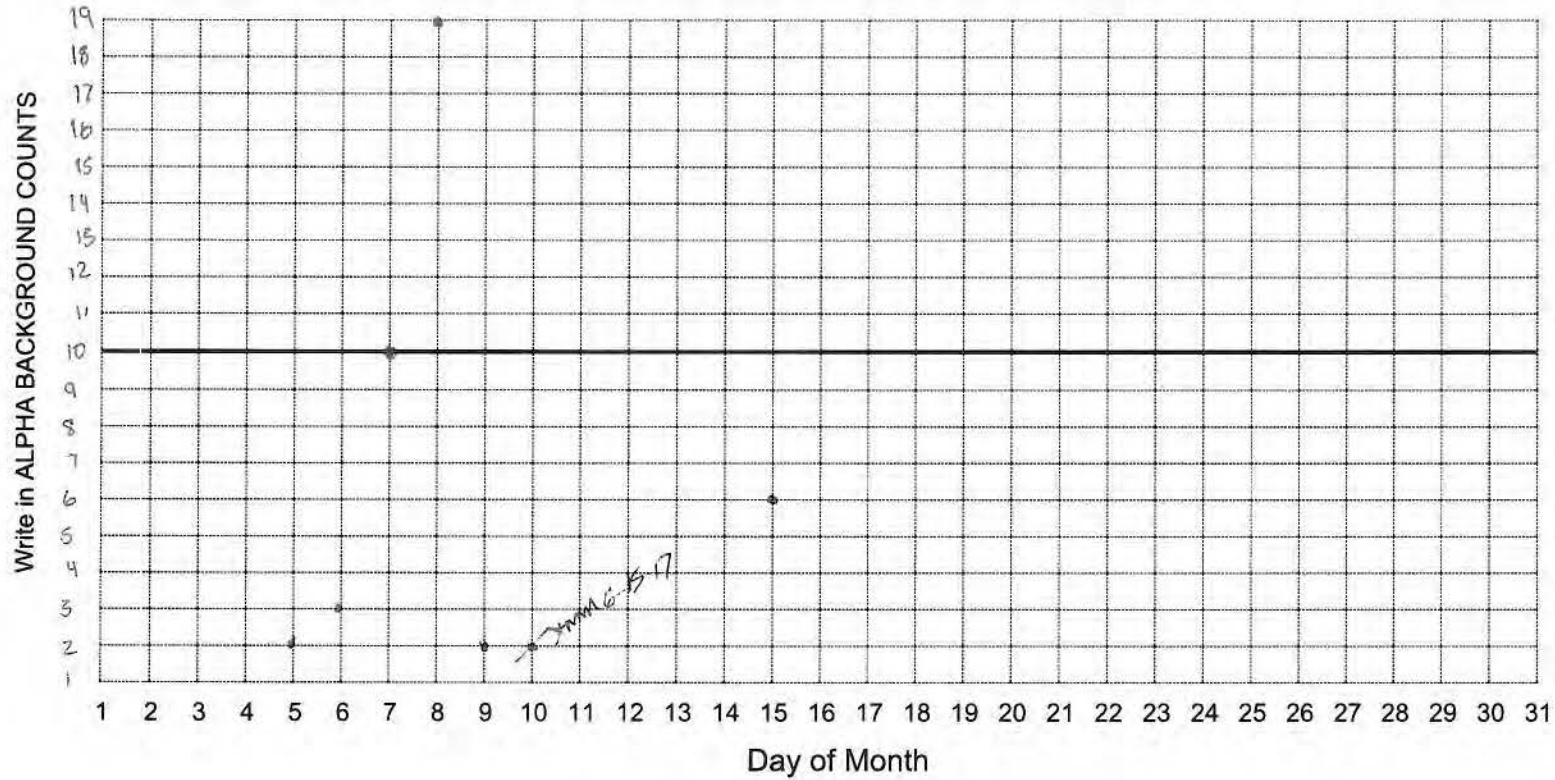
Date/Time	Beta-Gamma Background Counts <small>Stmm-6-5-17</small>	Beta-Gamma Background cpm	Beta-Gamma Source Counts <small>Stmm-6-5-17</small>	Beta-Gamma Source ^{NET} cpm	Sat/ Unsat	MDA	Initials
6/5/17 1030	54 1075	53.75	84 901	847.25	SAT		Stmm
6/6/17 0825	1122	56.10	900	843.90	SAT		Stmm
6/6/17 1510	1122	56.10	916	859.90	SAT		Stmm
6/7/17 0745	1111	55.55	896	840.45	SAT		Stmm
6/7/17 1535	1111	55.55	894	838.45	SAT		Stmm
6/8/17 0755	1079	53.95	931	877.05	SAT		Stmm
6/8/17 1515	1079	53.95	884	830.05	SAT		Stmm
6/9/17 0835	1113	55.65	862	806.35	SAT		Stmm
6/9/17 1120	1113	55.65	852	796.35	SAT		Stmm
6/15/17 0740	1112	55.60	942	886.40	SAT		Stmm
6/15/17 1205	1112	55.60	880	824.40	SAT		Stmm

FRN-0049d

Reviewed by:  Date: 6-15-17

Alpha Background Control Chart

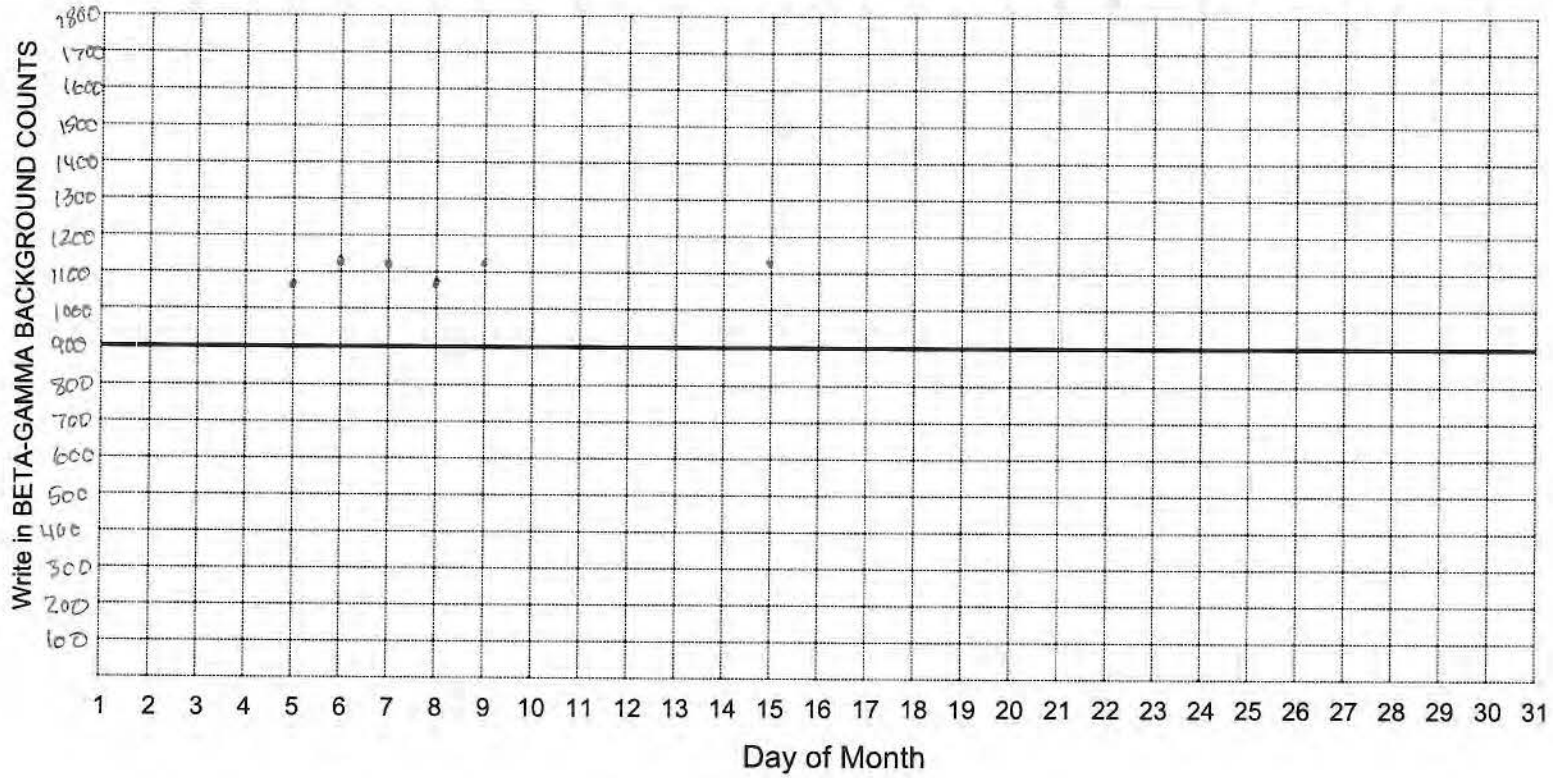
Instrument: 2929 Serial No.: 86484 Cal Due: 8-25-17 Month/Year: June 2017



Reviewed By: *A. Acosta* Date: 6-15-17

Beta-Gamma Background Control Chart

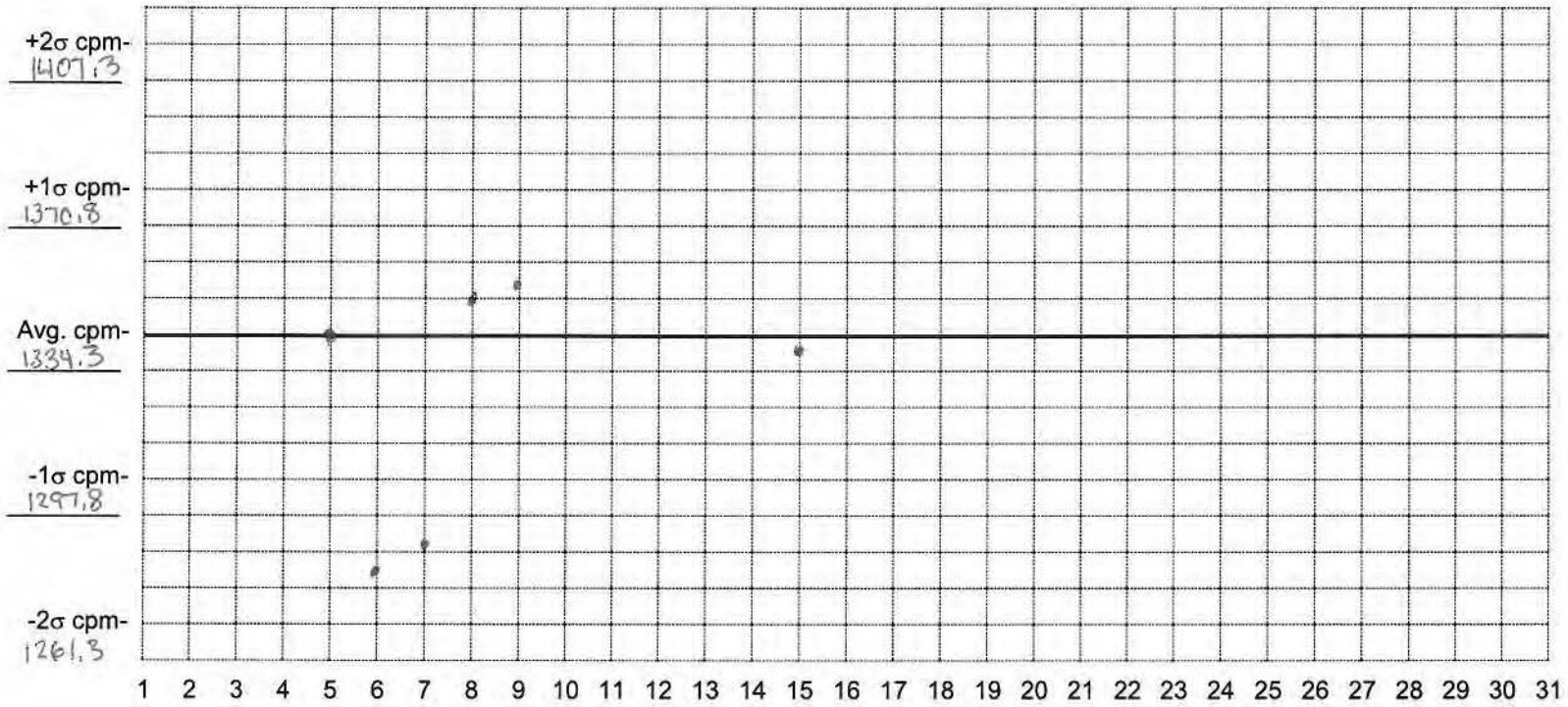
Instrument: L2929 Serial No.: 86484 Cal Due: 8/25/17 Month/Year: June 2017



Reviewed By: *[Signature]* Date: 6-15-17

Alpha Source Response Check Control Chart

Instrument: L2929 Serial No.: 86484 Cal Due: 8/25/17 Month/Year: June 2017



Day of Month
Reviewed By: *A. Stumpf* Date: 6-15-17



Calibration Certificate
ID Number: 86484102573-0

Customer: Heath Downey
AMEC - CO
 2275 Logos Ct.
 Suite A
 Grand Junction, CO 81505

Instrument
 Ludlum Model 2929

Serial Number
 86484

Probe Model
 Ludlum 43-10-1

Serial Number
 083085

Precision Check				
Test 1	Test 2	Test 3	Mean	Results
4.01 Kcpm	4.00 Kcpm	4.01 Kcpm	4.01 Kcpm	Satisfactory

Accuracy Check			
Range	Target Value	As Found	As Left
X1000	400 Kcpm	400.486 Kcpm #	400.486 Kcpm #
X1000	100 Kcpm	99.996 Kcpm #	99.996 Kcpm #
X100	40 Kcpm	40.047 Kcpm #	40.074 Kcpm #
X100	10 Kcpm	9.979 Kcpm #	9.979 Kcpm #
X10	4 Kcpm	4.006 Kcpm #	4.006 Kcpm #
X10	1 Kcpm	0.996 Kcpm #	0.996 Kcpm #
X1	400 cpm	400 cpm #	400 cpm #
X1	100 cpm	100 cpm #	100 cpm #

Readings with * indicate ranges where As-Found readings are >20% of Target value. Readings with ** indicate As-left readings are >10% of Target value
 Readings with # indicate ranges were calibrated using a pulser


Probe Model & SN	Isotope	Efficiency	NIST Source ID	Geometry
43-10-1 083085	Tc-99	0.1736 C/D	Tc-99 (SN: 63963 (Beta))	In Holder
43-10-1 083085	Th-230	0.3743 C/D	Th-230 (SN: S-963)	In Holder

MTE Instrument Type	Model	CalDueDate
Pulser	Ludlum 500-4SN: 98756	07/22/2017

Outer Physical Check: *Pass*
 Tap Test: *Pass*

Electronics Checks	As Found	As Left
High Voltage	946 Volts	946 Volts

Comments: High Voltage pot set to 3.84 turns for 946 V.

Calibrated by: 

QA Review: 

Date: 08/25/2016
 Expires: 08/25/2017

Atmospheric Conditions - Temperature: 75° F Humidity: 40% Barometric Pressure: 29.91 in/hg
 This calibration was performed by RSCS using one or more of the following NIST Traceable radiation sources:
 Tech Ops Model 773 Cs-137 Beam Calibrator (S/N S-1110), characterized using Exradin Model A6 (S/N 185) and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-008, with estimated uncertainty of 6.0%.
 J.L. Shepherd and Associates Model 89 Cs-137 Box Calibrator (S/N 9141), characterized using Exradin, Model A6 (S/N 185), A3 (S/N 197), A12 (S/N XA091124), and Keithley Electrometer Model 617 (S/N 0547677) in accordance with methods specified in RSCS TSD 11-001, with estimated uncertainty of 2.7%.
 RSCS Neutron Calibrator, AmBe Source Model NUMEC-AM-31 (S/N Am-478), characterized using Far West Technologies Model FWAD-1 "HAWK" TEPC (S/N 021) in accordance with the methods specified in RSCS TSD 13-002, with estimated uncertainty of 9.4%.
 Unless otherwise stated, calibrations performed in conformance to the following documents: ANSI N323AB-2013; RSCS New Hampshire Radioactive Material License Number 381R
 RSCS calibration services are performed in accordance with the RSCS Radiation Protection Program Manual and Standard Operating Procedures.
 Calibration Laboratory is operated in accordance with ANSI/NCSL Z540-1-1994
 This calibration certificate shall not be reproduced except in full without the express written consent of RSCS, Inc.



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Analytcs

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytcsinc.com

CERTIFICATE OF CALIBRATION Standard Radionuclide Source

78262-693

Tc-99 47 mm Diameter Glass Fiber Filter in Aluminum Planchet

Customer: MACTEC Inc. at ABB
P.O. No.: 200816814, Item 1

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting. The calibration was checked by beta counting after source preparation.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

Isotope:	Tc-99	
Activity (Bq):	1.677 E2	0.004532 μ Ci
Half-Life:	2.111 E5 years	10062 dpm
Calibration Date:	September 30, 2008 12:00 EST	
Relative Expanded Uncertainty (k=2):	3.3%	

Comments:

Impurities: γ -impurities <0.05%

Diameter of active area: 48 mm. Low smooth bottom planchet. Source covering 0.8 mg/cm² mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: N.E. Tibbitts
N.E. Tibbitts, Radiochemist

QA Approved: D.M. Montgomery QA Mgr
D. M. Montgomery, QA Manager

Date: 9/30/08

End of Certificate



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CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

78263A-693

Th-230 47 mm Diameter Glass Fiber Filter in Aluminum Planchet

Customer: MACTEC Inc. at ABB
P. O. No.: 200818514, Item 2.

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting. The calibration was checked by alpha counting after source preparation.

ANALYTIX maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

Isotope:	Th-230	
Activity (Bq):	1.700 E2	0.004595 μ g
Half-Life:	7.538 E4 years	10200 DAm
Calibration Date:	September 30, 2008 12:00 EST	
Relative Expanded Uncertainty (k=2):	3.3%	

Comments:

Impurities: γ -impurities <0.1%, α -impurities <0.01%.

Diameter of active area: 45 mm. Low smooth bottom planchet. Source covering 0.8 mg/cm² mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: N.E. Tibbitts
N.E. Tibbitts, Radiochemist

QA Approved: D.M. Montgomery QA Mgr
D. M. Montgomery, QA Manager

Date: 9/30/08

End of Certificate

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

78265-693

Th-230 4.5 Inch x 8.5 Inch Planar Source

Customer: MACTEC Inc. at ABB
P. O. No.: 200816814, Item 4

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting. The calibration was checked by alpha counting after source preparation.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.1S, Revision 1.

Isotope:	Th-230	
Activity (Bq):	1.641 E2	0.004435 μ Ci
Half-Life:	7.538 E4 years	9846 DAY
Calibration Date:	September 30, 2008 12:00 EST	206 cm^2
Relative Expanded Uncertainty (k=2):	3.3%	

Comments:

Impurities: γ -impurities <0.1%, α -impurities <0.01%.
4 inch x 8 inch active area on 0.005 inch thick polycarbonate. Source covering 0.5 mg/cm^2 mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: N.E. Tibbitts
N.E. Tibbitts, Radiochemist

QA Approved: D. M. Montgomery QA Mgr
D. M. Montgomery, QA Manager

Date: 9/30/08

End of Certificate



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Fax 404-352-2837
www.analyticinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

78264-693

Tc-99 4.5 Inch x 8.5 Inch Planar Source

Customer: MACTEC Inc at ABB
P.O. No.: 200816814, Item 3

This standard radionuclide source was prepared gravimetrically from a calibrated master solution. The master solution was calibrated by liquid scintillation counting. The calibration was checked by beta counting after source preparation.

ANALYTICS maintains traceability to the National Institute of Standards and Technology through Measurements Assurance Programs as described in USNRC Reg. Guide 4.15, Revision 1.

Isotope:	Tc-99	
Activity (Bq):	1.828 E3	0.0044 μ Ci
Half-Life:	2.111 E5 years	9768 d/m
Calibration Date:	September 30, 2008 12:00 EST	206 cm ²
Relative Expanded Uncertainty (k=2):	3.3%	

Comments:

Impurities: γ -impurities <0.1%
4 inch x 8 inch active area on 0.005 inch thick polycarbonate. Source covering 0.6 mg/cm² mylar.

No expiration date has been given for this source due to the fragile nature of the mylar covering. This source should be carefully tested for leakage at least every six months. If leakage is detected this source should be disposed of by approved radioactive waste disposal procedures.

Source Prepared By: N.E. Tibbitts
N.E. Tibbitts, Radiochemist

QA Approved: D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 9/30/08

End of Certificate

APPENDIX D – FIELD NOTES AND DOCUMENTATIO

RESEARCH NOTEBOOK



NATIONAL EXPOSURE RESEARCH LABORATORY

NOTEBOOK NO. 7094

ISSUED TO: Amec Foster Wheeler -

DATE ISSUED: July 11, 2016

PROJECT / PROGRAM: TRANSITION MANAGEMENT Support 2

DEPARTMENT: _____

RETURNED ON: _____

Catalog number 2001



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Table of Contents

Page

July 11, 2016	1
July 12, 2016	2
July 13, 2016	3
July 14, 2016	4
July 15, 2016	5
July 18, 2016	6
July 19, 2016	7-8
July 20, 2016	9
July 21, 2016	10-11
July 22, 2016	12
July 25, 2016	13
July 26, 2016	14
July 27, 2016	15
July 28, 2016	16
September 19, 2016	17
September 20, 2016	18
September 21, 2016	19
September 22, 2016	20
September 23, 2016	21
September 26, 2016	22
September 27, 2016	23
September 28, 2016	24
September 29, 2016	25
September 30, 2016	26

Table of Contents

Page

October 24, 2016	27
October 25, 2016	28
October 26, 2016	29
October 27, 2016	30
December 12, 2016	31
December 13, 2016	32-33
December 14, 2016	34-35
December 15, 2016	^{MS} 6-8-17 35 36
December 16, 2016	^{MS} 6-8-17 36 37
January 25, 2017	38
June 5, 2017	39
June 6, 2017	40
June 7, 2017	41
June 8, 2017	42
June 9, 2017	43
June 10, 2017 PD 6/16/17	
June 11, 2017 PD 6/16/17	
June 12, 2017	^{PD} 6/16/17 44 43
June 13, 2017	^{PD} 6/14/17 45 44
June 14, 2017	45
June 15, 2017	46
June 16, 2017	47

From Page No. 41

6-8-17

- 0730 - Arrived on site
Art Samiljan
Tom Maveal
Joe Dorton (BAH)
- 0745 - instrument QC
- 0750 - pre job safety briefing
- 0800 - daily meeting with EPA
- 0930 - drive to Sunrise Warehouse to survey concrete floor
and collect 14 concrete samples.
- ~~1240~~
1340 - lunch
- 1340 - continue warehouse survey; collect concrete samples
- 1440 - completed warehouse survey and sampling; return
to EPA HAC.
- 1515 - QC instruments; prepare survey paperwork
- 1600 - left site

A. Samiljan 6-8-17

To Page No. 43

Witnessed & Understood by me, 	Date	Invented by:	Date	
	6/8/17	Recorded by:	6/8/17	

6-9-17

0720 - Arrived on site
Tom MAUEAL
Art SAMIBAN
Joe Dorton (BAH)

0730 - pre job safety briefing

0740 - instrument QC

0800 - daily meeting with EPA

0900 - prepare SUNRISE warehouse concrete samples for FedEx shipment to ALS; complete sunrise survey reports

1200 - left site

@ sample 6-9-17

Witnessed & Understood by me,

Tom MAUEAL

Date

6/9/17

Invented by:

Recorded by:

Date

6-9-17

CAH