

Lockheed Environmental Systems & Technologies Co.
 Lockheed Analytical Services
 975 Kelly Johnson Drive Las Vegas, Nevada 89119-3705
 Telephone 702-361-0220 800-582-7605 Facsimile 702-361-8146

LOCKHEED MARTIN

December 18, 1995

Joan Kessner
 Bechtel Hanford, Inc.
 P.O. Box 969
 1022 Lee Boulevard
 Richland, WA 99352

RE: Log-in No: L5983
 Quotation No: Q40000-B
 Document File No: 1207596
 WHC Document Control No: 300



The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 7 December 1995.

The temperature of the cooler upon receipt was 2°C. Sample containers received agree with the chain-of-custody documentation. Sample containers were received intact. Samples were received in time to meet the analytical holding time requirements.

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Kathleen M. Hall at (509) 375-4741.

"I certify that this data package is in compliance with the SOW, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or a designee, as verified by the following signature."

Sincerely,

Karen Hermann for

Kathleen M. Hall
 Client Services Representative

cc: Client Services
 Document Control

**CASE NARRATIVE
RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, duplicate samples.

NOTE: Chemical recoveries and minimum detectable activities can be found on the preparation sheets and calculation sheets on the attached raw data for each method.

Holding Time Requirements

All holding times were met.

Gas Proportional Counter

Analytical Method Strontium-90

The strontium-90 analysis was performed using standard operating procedure, LAL-92-SOP-0196. The samples were analyzed in workgroup 31329. The instrument calibration verification met criteria. The method blank was within QC criteria. The laboratory control sample recovery was within QC criteria. The duplicate recoveries were within QC criteria. The minimum detectable activity was slightly above the reporting detection limit. The data is not believed to be adversely affected. No re-analyses were performed.

Yvonne M. Jacoby
Prepared By

December 18, 1995
Date

LOCKHEED ANALYTICAL SERVICES
 LOGIN CHAIN OF CUSTODY REPORT (ln01)
 Dec 07 1995, 03:09 pm

Login Number: L5983
 Account: 596 Bechtel Hanford, Inc. * Richland, WA
 Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L5983-1 temp 2; SAF# B96-036 Location: 157 Water 1 S SCREENING	BOGYX3	05-DEC-95	07-DEC-95	22-DEC-95
		Hold:02-JUN-96		
L5983-2 temp 2; SAF# B96-036 Location: 157 Water 1 S SR-90 LAL-0196	BOGYX3	05-DEC-95	07-DEC-95	22-DEC-95
		Hold:02-JUN-96		
L5983-3 temp 2; SAF# B96-036 Location: 157	BOGYX3	05-DEC-95	07-DEC-95	22-DEC-95
L5983-4 temp 2; SAF# B96-036 Location: 157	BOGYX3	05-DEC-95	07-DEC-95	22-DEC-95
L5983-5 temp 2; SAF# B96-036 Location: 157	BOGYX3	05-DEC-95	07-DEC-95	22-DEC-95
L5983-6 SAF# B96-036 Location: Water 1 S EDD - DISK DEL. Water 1 S RAD RPT TYPE 2	REPORT TYPE	07-DEC-95	07-DEC-95	22-DEC-95

Signature: _____

Date: _____

006

[Handwritten Signature]

12-7-95

1207596

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

LS983

Data Turnaround
 Priority
 Normal

Collector <i>A. Rizz</i>	Company Contact J.V. Borghese	Telephone (509) 373-4790
Project Designation 100-NR-2 Monthly Performance Monitoring - Wells, Dec.	Sampling Location 100 N	SAF No. B96-036
Ice Chest No. <i>GWS-013</i>	Field Logbook No. <i>EFL-1058</i>	Method of Shipment Federal Express
Shipped To Lockheed	Offsite Property No. <i>N/A</i>	Bill of Lading/Air Bill No. <i>N/A</i>

Possible Sample Hazards/Remarks	Preservation				HNO ₃	Cool 4°C					
	Type of Container				P/G	P/G					
	No. of Container(s)				<i>4 145- 8 1A</i>	1					
	Special Handling and/or Storage Maintain samples between 2°C and 6°C.	Volume				1L	125mL				
SAMPLE ANALYSIS											

Sample No.	Matrix*	Date Sampled	Time Sampled										
BOGYX3	W	<i>12-5-95</i>	<i>0920</i>					<i>Y</i>	<i>Y</i>				

CHAIN OF POSSESSION	Sign/Print Names	SPECIAL INSTRUCTIONS	Matrix*
Relinquished By <i>A.S. Rizz</i> Date/Time <i>12-5-95 1355</i>	Received By <i>ER</i> Date/Time <i>1355</i>		<ul style="list-style-type: none"> S = Soil SE = Sediment SO = Solid SL = Sludge W = Water O = Oil A = Air DS = Drum Solids DL = Drum Liquids T = Tissue WI = Wipe L = Liquid V = Vegetation X = Other
Relinquished By <i>A.S. Rizz (ERIC)</i> Date/Time <i>12-5-95 1355</i>	Received By <i>Bechtel</i> Date/Time <i>1355 12-5-95</i>		
Relinquished By <i>ER</i> Date/Time <i>0930</i>	Received By _____ Date/Time _____		
Relinquished By <i>Bechtel</i> Date/Time <i>12-6-95</i>	Received By _____ Date/Time _____		
Relinquished By _____ Date/Time _____	Received By _____ Date/Time _____		

LABORATORY SECTION	Received By <i>[Signature]</i>	Title <i>Sample Custodian</i>	Date/Time <i>12-7-95/0945</i>
FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

12-7-95

SAMPLE CHECK-IN LIST

Date/Time Received: 12-02-95/9:45 SDG#: N/A

Work Order Number: N/A SAF #: B96-036

Shipping Container ID: GWS-013 Chain of Custody # N/A

- 1. Custody Seals on shipping container intact? Yes No
- 2. Custody Seals dated and signed? Yes No
- 3. Sample temperature 22
- 4. Vermiculite/packing materials is Wet Dry
- 5. Each sample is in a plastic bag? Yes No
- 6. Sample holding times exceeded? Yes No

7. Samples have:
 tape hazard labels
 custody seals appropriate sample labels

8. Samples are:
 in good condition leaking
 broken have air bubbles

9. Is the information on the COC and Sample bottles in agreement?
 Yes No

Notes: _____

Sample Custodian/Laboratory: Indiville Date: 12-7-95
 Telephoned To: Kathleen Hall On 12-7-95 By Anthony Miller

**Lockheed Analytical Services
Sample Receiving Checklist**

Client Name: *Bahfel - Hanford*

Job No. *LS983*

Cooler ID:

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: *2°C*

temperature of temp. blank upon receipt:

	Yes	No	* Comments/Discrepancies
custody seals intact	<i>X</i>		
chain of custody present	<i>X</i>		
blue ice (or equiv.) present/frozen	<i>X</i>		
rad survey completed	<i>X</i>		

SAMPLE CONDITION UPON RECEIPT

	Yes	No	* Comments/Discrepancies
all bottles labeled	<i>X</i>		
samples intact	<i>X</i>		
proper container used for sample type	<i>X</i>		
sample volume sufficient for analysis	<i>X</i>		
proper pres. indicated on the COC	<i>X</i>		
VOA's contain headspace			<i>NA</i>
are samples bi-phasic (if so, indicate sample ID'S):			<i>NA</i>

MISCELLANEOUS ITEMS

	Yes	No	* Comments/Discrepancies
samples with short holding times		<i>X</i>	
samples to subcontract		<i>X</i>	

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: *[Signature]* *12-7-95*

Sent to the client (date/initials): *[Signature]* ** Client's signature upon receipt:

Notes: * = contact the appropriate CSR of any discrepancies immediately upon receipt

** = please review this information and return via facsimile to the appropriate CSR (702) 361-8146

120759c

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Lockheed Analytical Laboratory
SAMPLE SUMMARY REPORT (su02)
Bechtel Hanford, Inc. * Richland, WA

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
BOGYX3 —	L5983-1 L5983-2		Water Water	SCREENING — SR-90 LAL-0196 —
REPORT TYPE —	L5983-6 L5983-6		Water Water	EDD - DISK DEL. — RAD RPT TYPE 2 —

011

1007596

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0GYX3

LAL Sample ID: L5983-2

Date Collected: 05-DEC-95

Date Received: 07-DEC-95

Matrix: Water

Login Number: L5983

Constituent	Analyzed	Batch	Activity	Error	MDA	Dataqual	Units
Total radio-strontium	14-DEC-95	SR-90 LAL-0196_31329	44.3	2.9	1.1		pCi/L

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION LOG FOR STRONTIUM ANALYSIS
TOTAL RADIOSTRONTIUM - LAL-91-SOP-0196

019

Date Prep Started : 12-13-95
WorkGroup : SR-90 LAL-0196 31329

Matrix : Water
Prep Due Date : 12/15/95

CUSTOMER ID	PARENT LAL ID	NO	QC	CHILD LAL ID	ALIQOT VOLUME (g or L)	SR CARRIER (mL)	YTTRIUM SEP DATE	YTTRIUM SEP TIME	PLANCHET TARE WT (grams)	PLANCHET GROSS WT (grams)	* RESIDUE WEIGHT (grams)	COMMENTS
L5983-2	31329DUP1	1	DUP1	31329-01	500ml	0.5ml	12-14-95	18:23	6.60834	6.61634		
Lab Ctrl Sample	31329LCS1	2	LCS1	31329-02		↓	↓	↓	6.56257	6.57127		
Method Blank	31329MBB	3	MBB1	31329-03		↓	↓	↓	6.60059	6.60945		
BOGYX3	L5983-2	4	SMP1	31329-04	500ml	↓	↓	↓	6.47535	6.48425		
		5										
		6										
		7										
		8										
		9										
		10										
		11										
		12										
		13										
		14										
		15										
		16										
		17										
		18										
		19										
		20										
		21										
		22										
		23										
		24										

Conc & Vol of Carrier : 0.01225 g / 0.5 ml ; 0.5 ml
Carrier Exp Date : 9-30-96
Carrier ID# : 94-658-20

Act & Vol of LCS : 26.78 pCi/ml ; 1.0 ml
LCS Ref Date : 4-1-94
LCS ID# : 94-677-44-1

Prep Anlst : AW
Start Date : 12-13-95
Count Anlst : _____

Balance Number : 41020021 ()

Pipette Number : 134488 (✓)
139746 (✓)

Carrier and LCS added by : AW 12-13-95
Witnessed by : _____

Comments : _____

Analyst : A. Wong by AW

Checked by : AW 12/14/95

Cnt Rm Custody/Date : _____

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION LOG FOR STRONTIUM ANALYSIS
TOTAL RADIOSTRONTIUM - LAL-91-SOP-0196

020

Date Prep Started : 12/13/95

Matrix : Water

WorkGroup : SR-90 LAL-0196 31329

Prep Due Date : 12/15/95

CUSTOMER ID	PARENT LAL ID	NO	QC	CHILD LAL ID	ALIQOT VOLUME (L)	SR CARRIER (mL)	YTTRIUM SEP DATE	YTTRIUM SEP TIME	PLANCHET TARE WT (grams)	PLANCHET GROSS WT (grams)	* * *	RESIDUE WEIGHT (grams)	COMMENTS
L5983-2	31329DUP1	1	DUP1	31329-01	0.5	0.5	12/14/95	18:23	6.60834	6.61634		0.008	
Lab Ctrl Sample	31329LCS1	2	LCS1	31329-02	0.5	0.5	12/14/95	18:23	6.56257	6.57127		0.0087	
Method Blank	31329MBB	3	MBB1	31329-03	0.5	0.5	12/14/95	18:23	6.60059	6.60945		0.00886	
BOGYX3	L5983-2	4	SMP1	31329-04	0.5	0.5	12/14/95	18:23	6.47535	6.48425		0.0089	
		5											
		6											
		7											
		8											
		9											
		10											
		11											
		12											
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		18											
		19											
		20											
		21											
		22											
		23											
		24											
Conc & Vol of Carrier		24.50 mg/mL; 0.5 mL			Act & Vol of LCS		26.78 pCi/mL; 1.0 mL			Prep Anlst		AW	
Carrier Exp Date		30-Sep-96			LCS Ref Date		01-Apr-94			Start Date		12/13/95	
Carrier ID#		94-658-20			LCS ID#		94-677-44-1			Count Anlst		LV	

Balance Number : 40020021 ()

Pipette Number : 134488 ()

Carrier and LCS added by: AW

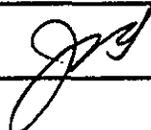
()

139746 ()

Witnessed by : WF

Comments :

Analyst : DATA ENTERED BY: LY FOR ALW

Checked by : 

Cnt Rm Custody/Date : _____

K-12 5/3177
ACSR
RIS

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide Half-life

Nominal activity

Nominal volume ml in ampoule/bottle number

Measurement Activity of principal radionuclide

Activity per gram of this solution

of

at 0400 hours PST on

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

Per gram

of the daughter nuclide

Total mass of this solution

Method of measurement

The activity of the primary solution was measured by liquid scintillation counting.

The activity of the dilution was measured by liquid scintillation counting.

Useful Life

This radionuclide has decayed through half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

This dilution was prepared for the 1994 ASTM Collaborative Study of a test method for the determination of Sr-90 in water.

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be.

- (1) less than % of the principal activity equal to
- (2) less than % of the principal activity equal to
- (3) less than % of the principal activity equal to

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.1\%$ (The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom ($n-1$)).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta - \delta'$). These have been estimated not to exceed $+3.8\%$ or -3.8%

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error $[t(sm)]$ at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$) The overall uncertainty is therefore calculated on the basis of $+ [t(sm) + \delta], - [t(sm) + \delta']$ and is $+4.0\%, -4.0\%$ of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Strontium-90 decays 100 percent by beta emission to yttrium-90. Yttrium-90 also decays 100 percent by beta emission.

Chemical Composition of Solution

Carrier content per gram of solution:
30 micrograms strontium

Other components:
0.1 M HCl

Preservative:

Remarks

Date Certificate Prepared April 26, 1994

Approval Signature

Paul B. Fahn

025

Sr-90

INITIAL STANDARD DILUTION RECORD

Standard Information:	
Isotope: <u>Sr-90</u>	Vendor: <u>EPA</u>
Activity of Standard Received: <u>2.7×10^4 uCi</u>	Vendor I.D. #: <u>94003-1</u>
Weight of Standard Received (g): <u>5.0 g</u>	LAL I.D. #: <u>AC5281</u>
Standard Activity (pCi/g): <u>5.4×10^3 pCi/g</u>	NIST Traceable? <u>yes</u>
Half-life in Years or Days: <u>28.6 yrs</u>	Certificate #: <u>94003-1</u>
Reference Date: <u>4-1-1994</u>	Receiver's Name: <u>K. Free</u>
	Date Received: <u>5-3-94</u>

Primary Dilution	
Balance Verification?:	<u>yes</u>
Diluent Used:	<u>0.1 M HCl</u>
a: Decay Corrected Standard Activity (pCi/g):	<u>5.4×10^3 pCi/g</u>
b: Weight of the Source Transferred (g):	<u>4.9670 g</u>
c: Total diluted weight (g):	<u>49.91 g</u>
d: Total Diluted Volume (mL):	<u>50 mL</u>
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	<u>537.4 pCi/g</u>
f: Calculated Density of Solution (g/mL) [c / d]:	<u>0.9982 g/mL</u>
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	<u>536.44 pCi/mL</u>
h. Dilution Logbook I.D. #:	<u>93-474-81-1 ⁷³⁻⁴⁷⁴⁻⁸²⁻¹ CP47/95</u>
Prepared By: <u>Ignace Wong</u>	Preparation Date: <u>6-15-94</u>
Reviewed By: <u>Joe Hutchinson</u>	Review Date: <u>6/30/94</u>
Purity/Cross Check Performed By: _____	Check Date: _____

[Handwritten signature]

026

Signed

Date

Signed

Date

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	<u>Sr-90</u>
Ref. <u>4-1-94</u> Parent Barcode Number	<u>AC5281</u>
Vendor or Certificate I.D. # of Parent Standard:	<u>EPA 94003-1</u>
Diluted Source Logbook I.D. #:	<u>93-474-82-1</u>
Balance Verification?:	<u>Yes</u>
Diluent Used:	<u>0.1 M HCl</u>

Dilution	
* Diluent:	<u>0.1 M HCl</u>
* Density of diluent (g/ml):	<u>N/A</u>
a: Parent Specific Activity:	<u>536.44 pCi/ml</u>
b: Amount of Source Transferred:	<u>5.0018 g</u>
c: Total amount of Dilution:	<u>100.20 g</u>
d: Total Volume of Dilution:	<u>N/A</u>
e: Activity of Dilution (a * b / c):	<u>N/A</u>
f: Activity of Dilution (a * b / d):	<u>26.78 pCi/ml</u>
Dilution Logbook I.D. #:	<u>94-677-44-1</u>
Prepared By: <u>Dynes Wong</u>	Preparation Date: <u>3-2-95</u>
Reviewed By: <u>Joe H. H.</u>	Review Date: <u>3/3/95</u>

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Dynes Wong
3-3-95

D Jones
Wony
3-15-94

Strontium Carrier Standardization

Strontium Carrier (10 mg/mL):

Use commercially available 10,000 μg Sr/mL ICP Standard or equivalent. Alternately, Dissolve 24.16 g of $\text{Sr}(\text{NO}_3)_2$ in water and dilute to 1 L in a volumetric flask with water.

Perform calibration check on a 0.5 mL pipet and then carefully pipet 3 - 0.5 mL portions of the strontium carrier solution into separate cleaned dried and tared planchets. Dry the planchet under a drying lamp. Cool the planchets in a desiccator and weigh.

	Calib # 1	Calib # 2	Calib # 3
Carrier plus planchet wt.	6.58185 g	6.49626 g	6.56816 g
Tare wt. of planchet	6.56968 g	6.48464 g	6.55620 g
Net wt. of carrier added (mg)	0.01217 g	0.01162	0.01196 g

AVERAGE $\text{Sr}(\text{NO}_3)_2 \pm \text{STD DEV.} = \underline{0.01192 \text{ g} \pm 0.000277}$

Expected mg of $\text{Sr}(\text{NO}_3)_2 = \text{cert. value} (=10 \text{ mg of Sr/mL}) * 0.5 \text{ mL} * 2.41$

Within 3% of expected (12.08 mg/0.5 mL) value (yes/no) yes

Initial and Date: DW 3-6-94

Continued on Page

Read and Understood By DA Review: 028

D Jones Wony
Signed

3-15-94
Date

Yee-Mei-Lee
Signed

8/14/94
Date

Strontium Carrier Standardization

Strontium Carrier (10 mg/mL):

Use commercially available 10,000 μg Sr/mL ICP Standard or equivalent. Alternately, Dissolve 24.16 g of $\text{Sr}(\text{NO}_3)_2$ in water and dilute to 1 L in a volumetric flask with water.

Perform calibration check on a 0.5 mL pipet and then carefully pipet 3 - 0.5 mL portions of the strontium carrier solution into separate cleaned dried and tared planchets. Dry the planchet under a drying lamp. Cool the planchets in a desiccator and weigh.

	Calib # 1	Calib # 2	Calib # 3
Carrier plus planchet wt. (mg)	6865.84	6562.93	6540.56
Tare wt. of planchet (mg)	6853.57	68 6550.76	6528.26 6520
Net wt. of carrier added (mg)	12.27	12.17	12.30

AVERAGE $\text{Sr}(\text{NO}_3)_2 \pm \text{STD DEV.} = \underline{12.25 \pm 0.0681}$ $\left(0.01225\text{g} \pm 0.0001\text{g} \text{ per } 0.5\text{mL}\right)$

Expected mg of $\text{Sr}(\text{NO}_3)_2 = \text{cert. value} (=10\text{mg of Sr/mL}) * 0.5 \text{ mL} * 2.41$

Within 3% of expected (12.08 mg/0.5 mL) value (yes/no) yes

Initial and Date: WL 10-5-95

Walter L. H. 10-11-95

Continued on Page _____

Read and Understood By

030

WL
Signed

10-4-95
Date

Signed

Date