

**START**

9613477.0449

LK 6428-LAS 152  
0045274

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**



March 5, 1996

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



RE: Log-in No: L6428  
Quotation No: Q400000-B  
Document File No: 0215596  
BHI Document Control No: 328  
SDG No.: LK6428

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 15 February 1996.

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,

*Kathleen M. Hall*

Kathleen M. Hall  
Client Services Representative

cc: Client Services  
Document Control

**Lockheed Analytical Services**

Log-in No.: L6428  
Quotation No.: Q400000-B  
SAF: B96-036  
Document File No.: 0215596  
WHC Document File No.: 328  
SDG No.: LK6428

## **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 (MDAs) 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-91-SOP-0196. The samples were analyzed in workgroup 34046. 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. No re-analyses were performed.

Yvonne M. Jacoby  
Prepared By

February 29, 1996  
Date

**Lockheed Analytical Services**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**

[Revised 08/28/92]

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
<b>C</b>	Presence of high TDS in sample required reduction of sample size which increased the MDA.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only</i> -- FWHM exceeded acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.

9613477.0452

LOCKHEED ANALYTICAL SERVICES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Feb 15 1996, 10:53 am

Login Number: L6428  
 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
L6428-1 temp 2 Location: 157 Water 1 S SCREENING	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
		Hold:11-AUG-96		
L6428-2 temp 2 Location: 157 Water 1 S SR-90 LAL-0196	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
		Hold:11-AUG-96		
L6428-3 temp 2 Location: 157	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
L6428-4 temp 2 Location: 157	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
L6428-5 temp 2 Location: 157	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
L6428-6 Location: Water 1 S EDD - DISK DEL. Water 1 S RAD RPT TYPE 2	REPORT TYPE	15-FEB-96	15-FEB-96	01-MAR-96

Page 1

Signature: *[Handwritten Signature]*Date: 2-15-96

0215596

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

L6418

Data Turnaround

- Priority
- Normal

Collector <i>A. Rizzo / M. Mehlhorn</i>	Company Contact J.V. Borghese	Telephone (509) 373-4790
Project Designation 100-NR-2 Monthly Performance Monitoring - Feb.	Sampling Location 100 N	SAF No. B96-036
Ice Chest No. <i>OWS-056</i>	Field Logbook No. <i>ERL1058</i>	Method of Shipment Hand Delivered
Shipped To Lockheed	Offsite Property No. <i>W96-0-0640-29</i>	Bill of Lading/Air Bill No. <i>2904651285</i>

Possible Sample Hazards/Remarks	Preservation					HNO <sub>3</sub>	Cool 4°C						
	Type of Container					P/G	P/G						
	No. of Container(s)					4	1						
Special Handling end/or Storage Maintain samples between 2°C and 6°C.	Volume					1L	20mL						

SAMPLE ANALYSIS

Sample No.	Matrix*	Date Sampled	Time Sampled										
BOH8L5	W	<i>2-13-96</i>	<i>1115</i>					X	X				

CHAIN OF POSSESSION	Sign/Print Names	SPECIAL INSTRUCTIONS	Matrix*
Relinquished By <i>M. Mehlhorn</i>	Date/Time <i>2-14-96</i>	Received By <i>Eric White</i>	Date/Time <i>0800</i>
Relinquished By <i>Eric White</i>	Date/Time <i>0830</i>	Received By <i>Eric White</i>	Date/Time <i>2-14-96</i>
Relinquished By <i>Eric White</i>	Date/Time <i>2-14-96</i>	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

- 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

LABORATORY SECTION	Received By <i>A. Rizzo</i>	Title <i>Sample Custodian</i>	Date/Time <i>2-15-96/0900</i>
FINAL SAMPLE	Disposal Method	Disposed By	Date/Time

0613077 0153  
0613077 0153  
0613077 0153

### SAMPLE CHECK-IN LIST

Date/Time Received: 2-15-96/0900 SDG#: NH

Work Order Number: NH SAF #: B96-036

Shipping Container ID: GWS-056 Chain of Custody #: NH

- 1. Custody Seals on shipping container intact? Yes  No
- 2. Custody Seals dated and signed? Yes  No
- 3. Sample temperature 2°C
- 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: Admille LAS Date: 2-15-96

Telephoned To: Kathleen Hall On 2-15-96 By Anthony Miller

# LOCKHEED MARTIN

## Sample Login Login Review Checklist

Lot Number LL 428

The login review should be conducted by that person logging in the samples as well as a peer. Please use this checklist to ensure that such reviews occur in a uniform basis. Please sign and date below to verify that a login review has occurred. This checklist should be affixed to each login package prior to distribution.

For effective login review, at a minimum, five reports from the login process are required. These are the COC (or equivalent), the login COC report, the sample summary report, the sample receiving checklist, and the login quotation. Before beginning review, ensure that these five components are available. Jobs with single component samples, the sample summary report may be omitted.

### SAMPLE SUMMARY REPORT

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>Comment</u>
1. Are all sample ID's correct?	<u>X</u>	—	—	_____
2. Are all samples present?	<u>X</u>	—	—	_____
3. Are all matrices indicated correctly?	<u>X</u>	—	—	_____
4. Are all analyses on the COC logged in for the appropriate samples?	<u>X</u>	—	—	_____
5. Are all analyses logged in for the correct container?	<u>X</u>	—	—	_____
6. Are samples logged in according to LAS batching procedures?	<u>X</u>	—	—	_____

### LOGIN CHAIN OF CUSTODY

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>Comment</u>
1. Are the collect, receive, and due dates correct for every sample?	<u>X</u>	—	—	_____
2. Have all appropriate comments been indicated in the comment section?	—	—	<u>X</u>	_____

### SAMPLE RECEIVING CHECKLIST

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>Comment</u>
1. Are all discrepancies between the COC and the login noted (if applicable)?	—	—	<u>X</u>	_____

Admiral  
primary review signature

2-15-96  
date

Paul Davis  
secondary review signature

2-15-96  
date

2715596

Lockheed Analytical Services  
Sample Receiving Checklist

Client Name: *Beechell-Hanford*

Job No. *66428*

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	<input checked="" type="checkbox"/>		
chain of custody present	<input checked="" type="checkbox"/>		
blue ice (or equiv.) present/frozen	<input checked="" type="checkbox"/>		
rad survey completed	<input checked="" type="checkbox"/>		

SAMPLE CONDITION UPON RECEIPT

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

MISCELLANEOUS ITEMS

	Yes	No	* Comments/Discrepancies
samples with short holding times		<input checked="" type="checkbox"/>	
samples to subcontract		<input checked="" type="checkbox"/>	

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: *[Signature]* *2-15-96*

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

9613477.0456

M21554

10

9613477.0457

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. \* Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0H6L5

LAL Sample ID: L6428-2

Date Collected: 13-FEB-96

Date Received: 15-FEB-96

Matrix: Water

Login Number: L6428

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Total radio-strontium	27-FEB-96	SR-90 LAL-0196_34046	373.	19.	1.0		pCi/L

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

Calibration Certificate

Description	Principal radionuclide	Strontium-90		Half-life	28.6 years
	Nominal activity	27	nano curies		
	Nominal volume	5	ml in ampoule/bottle number	94003-1	

Measurement Activity of principal radionuclide

Activity per gram of this solution

5.40	nano curies	of	Strontium-90
			at 0400 hours PST on
			April 1, 1994

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

5.40	nano curies	Per gram
------	-------------	----------

of the daughter nuclide

Yttrium-90

Total mass of this solution

Approximately 5.0	grams
-------------------	-------

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

0.0

half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

August 1994

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

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* 023

# INITIAL STANDARD DILUTION RECORD

## Standard Information:

Isotope:	<u>Sr-90</u>	Vendor:	<u>EPA</u>
Activity of Standard Received:	<u><math>2.7 \times 10^4</math> uCi</u>	Vendor I.D. #	<u>94003-1</u>
Weight of Standard Received (g):	<u>50 g</u>	LAL I.D. #:	<u>AC5281</u>
Standard Activity (pCi/g):	<u><math>5.4 \times 10^3</math> 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><math>5.4 \times 10^3</math> 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><del>93-474-81-1</del> <sup>73-474-82-1</sup> CP 4/1/95</u>
Prepared By: <u>Agnes Wong</u>	Preparation Date: <u>6-15-94</u>
Reviewed By: <u>Joe Hutchison</u>	Review Date: <u>6/30/94</u>
Purity/Cross Check Performed By: _____	Check Date: _____

*[Handwritten signature]*

## SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	<u>Sr-90</u>
Ref. 4-1-94 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 Hittman</u>	Review Date: <u>3/3/95</u>
<small>* 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.</small>	

Signed

Date

Signed

Date

Dynes Wong 3-3-95 025  
 3-3-95

**Strontium Carrier Standardization**

**Strontium Carrier (10 mg/mL):**

Use commercially available 10,000  $\mu\text{g Sr/mL}$  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	<del>68</del> 6550.76	6528.26 <del>6520</del>
Net wt. of carrier added (mg)	12.27	12.17	12.30

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

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

# 94-658-20

Walter Luch 10-11-95

Continued on Page \_\_\_\_\_

Read and Understood By

WL  
Signed

10-4-95  
Date

Thomas Wany  
Signed

1-16-96  
Date



# CERTIFICATE OF ANALYSIS

Catalog Number: PLSR2-3X Lot No. G3-153SR  
 Element and Matrix: Sr/HNO<sub>3</sub>/H<sub>2</sub>O  
 Starting Material: Strontium Carbonate SrCO<sub>3</sub>  
 Starting Material Lot Number: 05941D

Trace Metallic Impurities in the actual solution via ICP of the concentrate.

Element	PPM	Element	PPM	Element	PPM
Ag	<.05	Cu	<.05	P	<.05
Al	<.05	Fe	<.05	Pb	.06
As	<.05	Ga	<.05	Sb	<.10
B	<.05	In	<.05	Si	<.05
Ba	<.05	K	<.05	Sn	<.10
Be	<.05	Li	<.05	Ti	<.05
Bi	<.05	Mg	<.05	Tl	<.05
Ca	<.05	Mn	<.05	V	<.05
Cd	<.05	Mo	<.10	Zn	<.05
Co	<.05	Na	<.05	Zr	<.10
Cr	<.05	Ni	<.05		

## Traceability Documentation For Solution Standard:

1. Classical Wet Assay: 10,050 ppm.

Titrimetry: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against NIST Pb(NO<sub>3</sub>)<sub>2</sub> SRM 928.

2. Instrumentation Analysis By Inductively Coupled Plasma Spectrometer[ICP]: 10,009 ppm via NIST SRM 3153a.

3. Balances are calibrated with NIST weight sets N.J. #92589 and #92550, according to NIST circular 547 3.4.3.

SPEX plasma solution standards are guaranteed stable and accurate to ± 0.5% of labeled concentration for one year from date of shipment. This value is the sum of cumulative errors associated with analytical determinations, pipetting and diluting to final volume. For these solutions we use high purity acids, 18 megohm double deionized water and triple rinsed bottles. All glassware used is class A.

Signed by:

*N. Kochendakota*

Chemical Production Manager,

Date:

SEP 95



Printed on Recycled Paper