

**START**

9613445.2837

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

0044351

LK4184-98

**LOCKHEED MARTIN**



May 19, 1995

Ms. Joan Kessner  
Bechtel Hanford, Inc.  
345 Hills  
P.O. Box 969  
Richland, WA 99352



RE: Log-in No.:	L4184
Quotation No.:	Q400000-B
SAF:	B95-028
Document File No.:	0401596
WHC Document File No.:	206
SDG No.:	LK4184

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 1 April 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 chain of Custody requested Volatile and Semi-Volatile Organic analyses with priority turn around time, however the SAF did not request organic analyses and requested normal turn around time. As per client's request, the Volatile and Semi-Volatile analyses were canceled and results are supplied under normal turn around time.

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 Hall at (509) 943-4423.

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**Lockheed Analytical Services**

Log-in No.: L4184  
Quotation No.: Q400000-B  
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Document File No.: 0401596  
WHC Document File No.:206  
SDG No.: LK4184  
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Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

" 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 Manger or a designee, as verified by the following signature."

Sincerely,

  
Kathleen M. Hall *for*  
Client Services Representative

cc: Client Services  
Document Control

0004

Lockheed Analytical Services

Log-in No.: L4184  
 Quotation No.: Q400000-B  
 SAF: B95-028  
 Document File No.: 0401596  
 WHC Document File No.:206  
 SDG No.: LK4184  
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**CASE NARRATIVE  
 INORGANIC NON METALS ANALYSES**

The routine calibration and quality control analyses performed for this batch include as applicable: instrument tune (ICP/MS only), initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), ICP interference check samples (ICP only), serial dilutions, analytical (post-digestion) spike samples, matrix spike (predigestion) sample(s), duplicate sample(s).

**Preparation and Analysis Requirements**

- One water sample was received for LK4184 and prepared as batch 401wh and analyzed for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following sample:

Client ID	LAL #		Method
BOF883	L4184-8	MS, DUP	353.2 Nitrate-Nitrate-Nitrogen

**Holding Time Requirements**

- All samples were analyzed within the specified holding time.

**Method Blanks**

- The concentration levels of all the requested analytes in the method blank were below the reporting detection limits.

**Internal Quality Control**

- All Internal Quality Control were within acceptance limits.

Kay McCann

April 10, 1995

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 Prepared By

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 Date

**Lockheed Analytical Services**

Log-in No.: L4184  
Quotation No.: Q400000-B  
SAF: B95-028  
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WHC Document File No.:206  
SDG No.: LK4184  
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## **CASE NARRATIVE RADIOCHEMICAL ANALYSES**

The routine calibration and quality control 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.

### **Holding Time Requirements**

All holding time requirements were met.

### **Analytical Method**

#### **Technetium-99**

The technetium-99 analysis was performed using LAL-91-SOP-0169. No problems were encountered during analysis, and all QC criteria were met, except as noted below:

Batch 21858 was reanalyzed as batch 22778 due to out of limits QC. The matrix spike analysis was not done on this batch.

Batch 22778 - The tracer chemical yield elevated the LCS activity, resulting in a high LCS recovery. The actual chemical yield is 100%. There was insufficient sample on the repeat analysis for a matrix spike analysis.

#### **Total Uranium KPA**

The total uranium analysis was performed using LAL-91-SOP-0168. No problems were encountered during analysis, and all QC criteria were met. Because the values for both the sample and its duplicate were 0.00, no uranium duplicate analysis result appears on the QC table.

Yvonne M. Jacoby  
Prepared By

May 19, 1995  
Date

0006

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

[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
<b>B</b>	<i>For CLP Analyses Only</i> – Reported value is less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
<b>C</b>	<i>For Routine, Non-CLP Analyses Only</i> – Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL).
<b>D</b>	Presence of high levels of interfering constituents required dilution of sample which increased the RDL by the dilution factor.
<b>E</b>	Estimated value due to presence of interference.
<b>H</b>	Sample analysis performed outside of method-or client-specified maximum holding time requirement.
<b>M</b>	<i>For CLP Analyses Only</i> – Duplicate injection precision criterion was not met.
<b>N</b>	Matrix spike recovery exceeded acceptance limits.
<b>S</b>	Reported value was determined from the method of standard addition.
<b>U</b>	<i>For CLP Reporting Only</i> – Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture).
<b>W</b>	<i>For AAS Only</i> – Post-digestion spike for Furnace AAS did not meet acceptance criteria and sample absorbance is less than 50% of spike absorbance.
<b>X, Y, or Z</b>	Analyst-defined qualifier.
<b>*</b>	Relative percent difference (RPD) for duplicate analysis exceeded acceptance limits.
<b>+</b>	Correlation coefficient (r) for the MSA is less than 0.995.
For Use on the QC Data Reporting Forms	
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and matrix spike 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 RDL.

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

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

[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
<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.
For Use on the QC Data Reporting Forms	
<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.

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# Sample Disposition Record

Control #: 95-0023  
Revision #:  
Date Initiated: 04/04/95

## Section 1 - BACKGROUND

SAF #: B95-028  
OU: 200-UP-1  
Project ID: 200-UP-1 Treat Test  
Task ID: 2  
Sampling Event: 200-UP-1 Treatability Process Chemistry  
Laboratory: Lockheed  
Project Coordinator: R. C. Smith  
Task Manager: F. W. Gustafson

## Section 2 - SAMPLE INFORMATION

Number of Samples: 1  
ID Numbers: B0F883  
Matrix: Water  
Collection Date: 03/30/95

## Section 3 - ISSUE

Class: Lab Direction  
NCR Number: N/A  
Type: Inconsistent Sample Documentation  
Description: 1) The COC requested VOA and Semi-VOA analyses; the SAF did not.  
2) The COC requested priority TAT; the SAF requested normal TAT.

N/A

NCR Validation (Print/Sign)

Date

## Section 4 - DISPOSITION

Type: Reject  
Description: Cancel VOA and Semi-VOA analyses for sample B0F883. Supply results under a normal TAT. Note in case narrative.

R. C. Smith/ *R. C. Smith*

4/4/95

Project Coordinator (Print/Sign)

Date

F. W. Gustafson/ *F. W. Gustafson*

4/7/95

Task Manager (Print/Sign)

Date

N/A

QA (Print/Sign)

Date

## Section 5 - INSPECTION (Issue Class: Nonconformance Only)

Inspection Number:  
Inspection Results:

N/A

0010

Inspector (Print/Sign)

Date

9613445.2844

LOGIN CHAIN OF CUSTODY REPORT (ln01)  
Apr 03 1995, 02:07 pm

Login Number: L4184  
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
L4184-1 temp 2;SAF# B95-028 Location: RFG01-43 Water 1 S SCREENING	BOF883	30-MAR-95	01-APR-95	06-MAY-95
			Hold:26-SEP-95	
L4184-2 temp 2;SAF# B95-028 Location: RFG18-48A6 Water 1 S NONE	BOF883	30-MAR-95	01-APR-95	06-MAY-95
			Hold:09-APR-95	
L4184-3 temp 2;SAF# B95-028 Location: RFG18-48A6	BOF883	30-MAR-95	01-APR-95	06-MAY-95
L4184-4 temp 2;SAF# B95-028 Location: RFG18-48A6	BOF883	30-MAR-95	01-APR-95	06-MAY-95
L4184-5 temp 2;SAF# B95-028 Location: RFG18-48A6	BOF883	30-MAR-95	01-APR-95	06-MAY-95
L4184-6 temp 2;SAF# B95-028 Location: RFG01-07A Water 1 S NONE	BOF883	30-MAR-95	01-APR-95	06-MAY-95
			Hold:09-APR-95	
L4184-7 temp 2;SAF# B95-028 Location: RFG01-07A	BOF883	30-MAR-95	01-APR-95	06-MAY-95
L4184-8 temp 2;SAF# B95-028 Location: RFG01-07A Water 1 S 353.2 NITRATE	BOF883	30-MAR-95	01-APR-95	06-MAY-95
			Hold:27-APR-95	
L4184-9 temp 2;SAF# B95-028 Location: 157 Water 1 S U TOTAL KPA LAL-0168	BOF883	30-MAR-95	01-APR-95	06-MAY-95
			Hold:26-SEP-95	
L4184-10 temp 2;SAF# B95-028 Location: 157	BOF883	30-MAR-95	01-APR-95	06-MAY-95



24184

Westinghouse Hanford Company

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

Data Turnaround

Priority  
 Normal

Collector <i>Doug Bowers</i>	Company Contact Frank Gustafson	Telephone No. 372-9372
Project Designation 200-UP-1 PILOT SCALE TREATABILITY	Sampling Location 200 WEST	SAF No. 895-028
Ice Chest No.	Field Logbook No. <i>N/A</i>	Method of Shipment AIR FREIGHT
Shipped To Lockheed	Offsite Property No. <i>W95-0-0204-27</i>	Bill of Lading/Air Bill No. <i>2904623802</i>

Possible Sample Hazards/Remarks	Preservative	H2SO4	HNO3	HCL	NONE	NONE	HCL	none									
	Type of Container	P	P/G	P/G	aGs	P/G	aGs	aG									
No. of Container(s)	1	4	1	1	1	4	2										
Special Handling and/or Storage KEEP NO2-NO3- SAMPLE AT 4C (WATER)	Volume	500mL	1000mL	40 mL	20mL	20mL	40mL	1 L									
SAMPLE ANALYSIS	NO2-NO3																
	TOTAL URANIUM																
	Tc-99																
	ACTIVITY SCAN																
	TOTAL ACTIVITY																
	VOA-TCL																
	Semi-VOA-TCL																

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Sample No.	Matrix*	Date Sampled	Time Sampled	NO2-NO3	TOTAL URANIUM	Tc-99	ACTIVITY SCAN	TOTAL ACTIVITY	VOA-TCL	Semi-VOA-TCL							
<i>BOF 883</i>	<i>W</i>	<i>3-30-95</i>	<i>1021</i>	<i>X</i>	<i>X</i>	<i>X</i>	<i>X</i>	<i>X</i>	<i>X</i>	<i>X</i>	<i>N-9083</i>						
	<i>W</i>								<i>1021</i>	<i>3-30-95</i>							
	<i>W</i>																
	<i>W</i>																
	<i>W</i>																
	<i>W</i>																

CHAIN OF POSSESSION	Sign/Print Names	SPECIAL INSTRUCTIONS	Matrix*
Relinquished By <i>Doug Bowers</i>	Date/Time <i>3-30-95/1300</i>	Received By <i>Eric</i>	Date/Time <i>1300</i>
Relinquished By <i>Eric</i>	Date/Time <i>0900</i>	Received By <i>Michelle B. Whitten</i>	Date/Time <i>3-30-95</i>
Relinquished By <i>Michelle B. Whitten</i>	Date/Time <i>3-31-95</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>Paul David</i>	Title <i>Sample Custodian</i>	Date/Time <i>4-01-95/8:30am</i>
FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

0013040154c

9613445.2847

SAMPLE STATUS REPORT FOR N 5083. RAD SCREEN BOF883 TIME: 3/31/95 1:50  
DISPATCHED: 3/27/95 14:39 SAMPLE HAS NOT BEEN SLURPED  
RECEIVED: 3/31/95 1:48

EXT.	DETER.	RESULTS OR STATUS	OUT OF RANGE?	GOOD ANS?	CHARGE CODE
****	*****	*****	***	***	*****
4271	TOT-ACT	< 5.00000E 01 pCi/G	N	Y	XR5158

END OF REPORT

# Sample Login

## Login Review Checklist

Lot Number L4194

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

### Sample Summary Report

Yes No

N/A

- |    |   |          |   |   |
|----|---|----------|---|---|
| 1. | Are all sample IDs correct?   | <u>Y</u> | — | — |
| 2. | Are all samples present?  | <u>Y</u> | — | — |
| 3. | Are all matrices correct?<br><small>(e.g., TCLP analyses should be on a TCLP leachate, field blanks should be water)</small>  | <u>Y</u> | — | — |
| 4. | Are all analyses on the chain of custody/login quotation included?  | <u>Y</u> | — | — |
| 5. | Are analyses logged in for the correct container?<br><small>(e.g., analyses requiring preservation logged in for a preserved container and vice versa)</small>  | <u>X</u> | — | — |
| 6. | Are samples logged in according to laboratory batching procedures?<br><small>(e.g., TCLP regular leaching and associated metals/semivolatile organics should be logged in on the same bottle)</small> | <u>X</u> | — | — |

### Login Chain of Custody Report

- |    |  |          |   |   |
|----|--|----------|---|---|
| 1. | Are the Collect, Receive, and Due dates correct for every sample?  | <u>X</u> | — | — |
| 2. | Have appropriate sample comments been included?<br><small>(e.g., MS/MSD designation, comments from the client concerning method modifications)</small> | <u>X</u> | — | — |

### Sample Receiving Checklist

- |    |  |   |   |
|----|--|---|---|
| 1. | Are any discrepancies between the chain of custody and the login noted? <u>X</u>   | — | — |
|    | <small>(e.g., client IDs different on chains of custody and bottle labels, samples not sent, samples lost from breakage)</small> |   |   |

<u>Mr. Miller</u>	<u>4-3-95</u>	<u>Mr. Miller</u>	<u>4-3-95</u>
Primary review signature	Date	Secondary review signature	Date

C41159C

L4184

Figure 1

### SAMPLE CHECK-IN LIST

(1 Per Shipping Container)

Date/Time Received 4-01-95/8:30am Client Name Wasting House - Hanford  
 Project/Client # \_\_\_\_\_ Batch or Case # N/A  
 Cooler ID (if noted on outside of cooler) Sml-423

1. Condition of shipping container? GOOD
2. Custody Seals on cooler intact? Yes  No
3. Custody Seals dated and signed? Yes  No
4. Chain of Custody record is taped on inside of cooler lid? Yes  No
5. Vermiculite/packing material is: Wet  Dry  \_\_\_\_\_
6. Each sample is in a plastic bag? Yes  No  \_\_\_\_\_
7. Number of sample containers in cooler: 13
8. Samples have: \_\_\_\_\_ tape \_\_\_\_\_ hazard labels  
 custody seals \_\_\_\_\_ appropriate sample labels
9. Samples are:  in good condition \_\_\_\_\_ leaking  
 \_\_\_\_\_ broken \_\_\_\_\_ have air bubbles  
 \_\_\_\_\_ other
10. Coolant Present? Yes  No  Sample Temperature 22
11. The following paperwork should be accounted for (N/A if not applicable):  
 Chain of Custody #(s) N/A  
 Request for Analysis #(s) N/A  
 Airbill # 290 4623 882 Carrier Fed Ex
12. Have any anomalies been identified above? Yes  No  N/A
13. Memos have been initiated for all anomalies identified above? Yes

Printed Name/Signature Paul Davis Date/Time 4-01-95-8:30am

C401546

Lockheed Analytical Services  
Sample Receiving Checklist

Client Name: *Westing House - Hartford*

Job No. *LY184*

Cooler ID: *11A*

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt:	<i>20</i>		
temperature of temp. blank upon receipt:	<i>1</i>		
	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		<input checked="" type="checkbox"/>	
are samples bi-phasic (if so, indicate sample ID'S):			<i>MA</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

*VOA and SVOA analysis have been cancelled per FAX from Kathleen Hill*

Completed by / date: *Murphy 4-3-95*

Sent to the client (date/initials): \_\_\_\_\_ \*\* 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

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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
BOF883 -	L4184-1		Water	SCREENING -
	L4184-2		Water	NONE -
	L4184-6		Water	NONE -
	L4184-8		Water	353.2 NITRATE -
	L4184-9		Water	U TOTAL KPA LAL-C
	L4184-13		Water	TC-99 LAL-0169
REPORT TYPE -	L4184-14		Water	EDD - DISK DEL.
	L4184-14		Water	INORG TYPE 2 RPT
	L4184-14		Water	RAD RPT TYPE 2 -

0020

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## LOCKHEED ANALYTICAL SERVICES

## COMMON IONS AND ADDITIONAL ANALYTES

## Sample Results

Client Sample ID: B0F883	Date Collected: 30-MAR-95
Matrix: Water	Date Received: 01-APR-95

Constituent	Units	Method	Result	Reporting Det Limit	Data Qualifier(s)	Date Analyzed	LAS Batch ID	LAS Sample ID
Nitrate-Nitrite-Nitrogen	mg/L	353.2	190	5	D(1:100)	05-APR-95	21241	L4184-8

## RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. \* Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0F883

LAL Sample ID: L4184-9

Date Collected: 30-MAR-95

Date Received: 01-APR-95

Matrix: Water

Login Number: L4184

SDG: LK4184

Constituent	Analyzed	Batch	Activity	Error	MOA	DataQual	Units
Uranium	24-APR-95	U TOTAL KPA LAL-0168_21504	0.00	0.00	0.00		ug/L

## RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. \* Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0F883

LAL Sample ID: L4184-13

Date Collected: 30-MAR-95

Date Received: 01-APR-95

Matrix: Water

Login Number: L4184

SDG: LK4184

Constituent	Analyzed	Batch	Activity	Error	MOA	DataQual	Units
Tc-99	16-MAY-95	TC-99 LAL-0169_22778	397.	40.	7.5		pCi/L

9613445 2855  
RADIATION RESULTS CHECK REPORT

Workgroup Number: TC-99 LAL-0169\_22778

Sample	Parameter	Value	Error	MDA
22778DUP1	Tc-99	384.501	35.5145	4.57041
22778DUP2	Tc-99	59.5977	11.119	6.40989
22778LCS1	Tc-99	159.864	13.9117	1.18167
22778MBB1	Tc-99	-0.208269	0.79427	1.0488
L4184-13	Tc-99	396.928	39.7878	7.45171
L4243-11	Tc-99	39.2133	7.69064	4.63935
L4271-11	Tc-99	99.8668	13.2644	4.98843

9613445 2856  
**CERTIFICATE OF CALIBRATION**  
**BETA STANDARD SOLUTION**

Radionuclide: Tc-99  
Half Life:  $(2.13 \pm 0.05) \times 10^5$  years  
Catalog No.: 7099  
Source No.: 389-22-1  
Customer: LOCKHEED ENGINEERING & SCIENCES Co.  
P.O.No.: 06LAB1036  
Reference Date: September 1 1991 12:00 PST.  
Contained Radioactivity: 1.003  $\mu\text{Ci}$

**Description of Solution**

a. Mass of solution: 4.9929 grams  
b. Chemical form:  $\text{NH}_4\text{TcO}_4$  in 0.1M  $\text{NH}_4\text{OH}$   
c. Carrier content: None added  
d. Density: 0.9974 gram/ml @ 20°C

**Radioimpurities**

None detected

**Radioactive Daughters**

None

**Radionuclide Concentration**

0.201  $\mu\text{Ci/gram}$

**Method of Calibration**

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

**Uncertainty of Measurement**

a. Systematic uncertainty in instrument calibration:  $\pm 2.1\%$   
b. Random uncertainty in assay:  $\pm 1.0\%$   
c. Random uncertainty in weighing(s):  $\pm 0.0\%$   
d. Total uncertainty at the 99% confidence level:  $\pm 3.1\%$

**NIST Traceability**

This calibration is implicitly traceable to the National Institute of Standards and Technology.

**Notes**

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)



**ISOTOPE PRODUCTS LABORATORIES**

1800 No. Keystone Street.,  
Burbank, California 91504

(818) 843 - 7000

*[Signature]*  
**QUALITY CONTROL**

9613445-2057 1710047  
ISOTOPE WEIGHT DILUTION RECORD

Isotope: Tc-99

Vendor: IPL

Total Received Activity: ~1  $\mu$ ci

Vendor ID: 389-22-1

Wt. Received: ~5 g

NIST Traceable  N Cert. # implicitly

Activity in Units/g: ~~0.20~~ 0.20  $\mu$ Ci/g

Reference Date: 9-1-91

Activity converted (dpm/g): \_\_\_\_\_ dpm/g

Receive Date: <sup>RW 1-23-93</sup> ~~N/A~~ 10-30-199

Half-life (Yrs or days)  $t_{1/2}$  =  $2.13 \times 10^5$  years

Receiver's Name: <sup>RW 1-23-93</sup> ~~N/A~~ Jimmy Muel

PRIMARY DILUTION:

Balance wt. check done

a: Source activity:  $2.01 \times 10^5$  pCi/g dpm/g <sup>RW</sup> (if  $t_{1/2}$  = <100yr decay to prep. date)

b: Wt. of Source transferred: 4.9320 g g

Diluent used: 0.1 M NH<sub>4</sub>OH

c: Total diluted <sup>volume</sup> weight 100 ml g <sup>RW</sup>

d: Activity of dilution (a\*b/c): N/A dpm/g

e: Calculated density of solution: N/A g/mL (4M HNO<sub>3</sub> = 1.1294  $\pm$  .0007 g/mL)

f: Activity by volume = (d\*e): 9910 pCi/ml dpm/mL <sup>RW</sup>

Dilution Log Book ID: 91-225-41-1

Preparation Date: 1-23-92 Preparer's Name: Joe Hutchinson

SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done ( )

Log Book ID of source being diluted: 91-225-42-1

a: Source activity: 9910 pCi/ml dpm/g \* (if  $t_{1/2}$  = <100yr decay to prep. date)

b: Wt. of Source transferred: 1.0051 g g

Diluent used: 0.1 M NH<sub>4</sub>OH

c: Total diluted weight: 50.621 g

d: Activity of dilution (a\*b/c): N/A dpm/g

e: Calculated density of solution: 1.997 g/ml g/mL (4M HNO<sub>3</sub> = 1.1294  $\pm$  .0007 g/mL)

f: Activity by volume =  $\frac{a \times b / c}{d \times e}$  196.8 pCi/mL dpm/mL

Dilution Log Book ID: 91-225-42-1

Preparer's Name: Joe Hutchinson Preparation Date: 1-27-92

Reviewed By: rg3 Review Date: 6/8/93

SEPARATE COVER.

# National Bureau of Standards

## Certificate

### Standard Reference Material 4288

#### Radioactivity Standard

Radionuclide	Technetium-99
Source identification	4288-83
Source description	Liquid in NBS borosilicate-glass ampoule
Solution composition	59.31 $\mu\text{g}$ of Tc(VII) as potassium pertechnetate per gram of approximately 0.001 molar KOH (1)*
Mass	4.910 grams
Radioactivity concentration	$3.759 \times 10^4 \text{ Bq g}^{-1}$
Reference time	November, 1982
Measuring instrument	Liquid-scintillation counter (2)
Random uncertainty	0.27 percent (3)
Systematic uncertainty	1.35 percent (4)
Total uncertainty (Random plus systematic)	1.62 percent
Photon-emitting impurities	None observed (5)
Half life	$(2.111 \pm 0.036) \times 10^5 \text{ years}$ (6)

This Standard Reference Material was prepared in the Center for Radiation Research, Nuclear Radiation Division, Radioactivity Group, Dale D. Boppes, Group Leader.

Washington, D.C. 20234  
November, 1982

George A. Uriano, Chief  
Office of Standard Reference Materials

\*Notes on back

9613445 2859 ISOTOPE WEIGHT DILUTION RECORD

Isotope: Tc-99

Vendor: NIST

Total Received Activity: 1.85E5 Bq

Vendor ID: SRM 4288

Wt. Received: 4.91 (0.001 M KOH)

NIST Traceable Y/N Source Cert. # 4288-83

Activity in Units/g: 3.759 x 10<sup>4</sup> Bq/g  
x 60/2.22 = 1.016 E6

Reference Date: NOV 1982

Activity converted (dpm/g): 4.988 x 10<sup>6</sup> dpm/g

Receive Date: 3-29-92 (3-30-1992)

Half-life (Yrs or days) t<sub>1/2</sub> = 2.111 E5 yrs

Receiver's Name: J. Males

PRIMARY DILUTION:

Balance wt. check done

a: Source activity: 1.016 E6 dpm/g (if t<sub>1/2</sub> < 100yr decay to prep. date)

b: Wt. of Source transferred: 4.8698 g

AA0128 Diluted

Diluent used: 0.1 M NH<sub>4</sub>OH

c: Total diluted weight: 146.81 g

d: Activity of dilution (a\*b/c): 3.37 E4 dpm/g

e: Calculated density of solution: 0.9956 g/mL (4M HNO<sub>3</sub>)

f: Activity by volume = (d\*e): 3.355 E4 dpm/mL

Dilution Log Book ID: LAL: 92-353-100-1

Preparation Date: 6/16/93 Preparer's Name: [Signature]

100 mL = 99.56 g  
U.S. Department of Commerce  
National Institute of Standards  
and Technology A40128  
<sup>99</sup>Tc Radioactivity Standard  
Amount 3.759 x 10<sup>4</sup> Bq g<sup>-1</sup>  
Date November 1, 1982  
SRM 4288

CAUTION  
RADIOACTIVE



SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done

Log Book ID of source being diluted: LAL 92-353-100-1

a: Source activity: 3.355 E4 dpm/mL (if t<sub>1/2</sub> < 100yr decay to prep. date)

b: Wt. of Source transferred: 2.3211 g

Diluent used: 0.1 M NH<sub>4</sub>OH

c: Total diluted weight: 71.89 g

d: Activity of dilution (a\*b/c): N/A dpm/g

e: Calculated density of solution: N/A g/mL (4M HNO<sub>3</sub> = 1.1294 ± .0007 g/mL)

f: Activity by volume = (d\*e): 1083 dpm/mL

Dilution Log Book ID: LAL 92-353-100-2

Preparer's Name: [Signature] Preparation Date: 6/16/93

Reviewed By: [Signature] Review Date: 6/16/93

## SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	<u>Tc-99</u>
Parent Barcode Number	<u>AA0128</u>
Vendor or Certificate I.D. # of Parent Standard:	<u>SRM 4288</u>
Diluted Source Logbook I.D. #:	<u>92-353-100-1</u>
Balance Verification?:	<u>yes</u>
Diluent Used:	<u>0.1 M NH<sub>4</sub>OH</u>

Dilution	
*Diluent:	<u>0.1 M NH<sub>4</sub>OH</u>
*Density of diluent (g/ml):	<u>0.9956</u> g/ml
a: Parent Specific Activity:	<u>3.355 E4</u> <sup>BW 11-16-94</sup> <del>pCi/g</del> pCi/ml
b: Amount of Source Transferred:	<u>36.0938</u> g
c: Total amount of Dilution:	<u>123.36</u> g
d: Total Volume of Dilution:	<u>N/A</u> ml
e: Activity of Dilution (a * b / c):	<u>N/A</u> pCi/g
f: Activity of Dilution (a * b / d):	<u>9816.37</u> pCi/ml
Dilution Logbook I.D. #:	<u>94-677-17-1</u>
Prepared By: <u>Rogues Wong</u>	Preparation Date: <u>11-16-94</u>
Reviewed By: <u>Joe Hutchins</u>	Review Date: <u>11/17/94</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>	

# Lockheed Analytical Laboratory

## Sample Preparation Worksheet for Total Uranium (KPA) Analysis

Date Prep Started : 4/24/95  
 Workgroup Number : U TOTAL KPA LAL-0168 21504

Matrix : Water  
 Prep Due Date : 26-Apr-95

CLIENT ID	LAL ID	QC	ALIQUOT (ml/g. sample)	DILUTION	COMMENTS	Client	Collection Date
L4184-9	21504DUP1	1	DUP1 10	1:1	REB = 0.00	DUP	04/10/95
Lab Ctrl Sample	21504LCS1	2	LCS1 1	10:1	LCS = 103%	LCS	04/10/95
Method Blank	21504MBB1	3	MBB1 10	1:1		MB	04/10/95
L4184-9	21504MS1	4	MSS1 10	1:1		MS	04/10/95
BOF883	L4184-9	5	SMPI 10 <del>MSS1</del>	1:1	Dilutions : 10 ml sample dried down, rehydrated back to 10 ml.	Bechtel Hanford, Inc. *	03/30/95
		6					
		7					
		8					
		9					
		10					
		11					
		12					
		13					
		14					
		15					
		16					
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		21					
		22					
		23					
		24					

COMMENTS: \_\_\_\_\_

Amount of CCV	<u>1ml</u>	Amount of LCS	<u>1ml</u>	Amount of MS	<u>1ml</u>
CCV Activity	<u>10 ug/L</u>	LCS Activity	<u>100 ug/L</u>	MS Activity	<u>100 ug/L Dilution to 10 ug/L</u>
CCV ID#	<u>95012A 1000X</u>	LCS ID#	<u>95012A</u>	MS ID#	<u>95012A</u>

Balance Number : \_\_\_\_\_ ( )      Pipette Number : 21008 (✓)      Tracer, LCS, & MS added by: T. Oppenham  
 Sample Prep Analyst : J. Oppenham      Witnessed by : DLH  
 Checked by : Joe Hutchman 4/25/95

9613415 286

9613445.2862  
RADIATION RESULTS CHECK REPORT

Workgroup Number: U TOTAL KPA LAL-0168\_21504

Sample	Parameter	Value	Error	MDA
21504DUP1	Uranium	0	0	0
21504MBB1	Uranium	0	0	0
21504MS1	Uranium	10.6376	0.916016	0
L4184-9	Uranium	0	0	0

For Russ

9613445.2863



# CERTIFICATE OF ANALYSIS

Catalog Number: PLU2-2X Lot No. 4-27U  
 Element and Matrix: U/HNO<sub>3</sub>/H<sub>2</sub>O  
 Starting Material: Uranium Oxide U<sub>3</sub>O<sub>8</sub>  
 Starting Material Lot Number: 12921A

DC ARC: Trace Metallic Impurities in starting material via DC ARC [40 elements checked; only values detected are listed].

Element	PPM
Pb	3-5
Cu	5-10
Ag	3-7

## Traceability Documentation For Solution Standard:

1. Classical Wet Assay: 1,005 ppm.

Gravimetry: Evaporate to dryness, ignite and weigh as U<sub>3</sub>O<sub>8</sub>.

2. Instrumentation Analysis By Inductively Coupled Plasma Spectrometer[ICP]: 998 ppm via NIST SRM 3164.

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  $\pm 0.5\%$  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. Kocherakote Chemical Production Manager, Date: AUG 94



Printed on Recycled Paper



## Certificate of Analysis

## Standard Reference Material 3164

## Spectrometric Standard Solution

## Uranium

Batch Code 390709

This Standard Reference Material (SRM) is intended for use in atomic absorption spectrometry, optical emission (plasma) spectrometry, spectrophotometry, or any other analytical technique that requires aqueous standard solutions for calibrating instruments. SRM-3164 is a single element solution prepared gravimetrically to contain 10 mg/mL of uranium with a nitric acid concentration (V/V) of 10 percent. The certified value is based on a gravimetric procedure, i.e., weight per volume composition of the high-purity uranium oxide dissolved in NIST high-purity reagents. The uncertainty listed is based on gravimetric and volumetric uncertainties of the preparation and the effect of solvent transpiration through the container walls for one year after the bottle is removed from the plastic sleeve.

Metal	Concentration (mg/mL)	Source Purity, %	Acid Conc. (V/V) Approximate
U	10.00 ± 0.03	NBL-CRM 129 (99.968%) (formerly SRM 950b)	HNO <sub>3</sub> , 10%

## Procedures for Use

**Stability:** This certification is valid for one year from the date of shipment from NIST provided the solutions are kept tightly capped and stored under normal laboratory conditions. NIST will monitor the stability of representative solutions from this SRM lot and if changes occur that invalidate this certification, NIST will notify purchasers.

**Preparation of Working Standard Solutions:** All solutions should be brought to 22 ± 1 °C and all glass or plastic surfaces coming into contact with the standard must have been previously cleaned. A working standard solution can be prepared from the SRM solution by serial dilution. Dilutions should be made with certified volumetric class A flasks and 5 or 10 mL class A pipets. All volumetric transfers of solutions should be performed using a proven analytical technique. Each dilution should be acidified with an appropriate high-purity acid and diluted to calibrated volume using high-purity water. The stability of the working standard solution will depend on the final acid concentration; therefore, care should be exercised to ensure that the final acid concentration of the dilution closely approximates that of the SRM. To achieve the highest accuracy, the analyst should prepare daily working solutions from 100 µg/mL dilutions of the original SRM solution.

SRM 3164 was prepared by T.A. Butler of the NIST Inorganic Analytical Research Division. Inductively coupled plasma emission spectrometric analyses were made by T.A. Butler and L.J. Wood.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane.

Gaithersburg, MD 20899  
October 5, 1993

Thomas E. Gills, Acting Chief  
Standard Reference Materials Program