

Lockheed Environmental Systems & Technologies Co.
Lockheed Analytical Services
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LK5351

0044405

LOCKHEED MARTIN 

October 7, 1995

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



RE: Log-in No.: L5351
Quotation No.: Q400000-B
SAF: B95-080
Document File No.: 0914596
WHC Document File No.: 272
SDG No.: LK5351

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 14 September 1995.

The temperature of the cooler upon receipt was 5 °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 Hall at (509) 943-4423.

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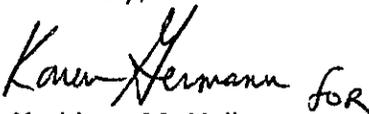
Lockheed Analytical Services

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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,

A handwritten signature in black ink that reads "Kathleen M. Hall for". The signature is written in a cursive style.

Kathleen M. Hall
Client Services Representative

cc: Client Services
Document Control

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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 LK5351 and analyzed in batch 914 bh for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following sample:

| Client ID | LAL # | | Method |
|-----------|---------|---------|---------------|
| BOGFV2 | L5351-3 | MS, DUP | 375.4 Sulfate |

Holding Time Requirements

- All samples were analyzed within method-specific 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
Prepared By

September 27, 1995
Date

**CASE NARRATIVE
INORGANIC 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

All samples were received on September 14, 1995. The samples were logged in as L5351 and were prepared and analyzed in batch 914 bh.

Holding Time Requirements

- All samples were analyzed within the method-specific holding times.

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.

Shellee McGrath
Prepared By

September 29, 1995
Date

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Lockheed Analytical Services

Log-in No.: L5351
Quotation No.: Q400000-B
SAF: B95-080
Document File No.: 0914596
WHC Document File No.: 272
SDG No.: LK5351

**CASE NARRATIVE
ORGANIC ANALYSES**

Analytical Method 418.1

Analytical Batch 092695-418.1

NOTE: Sample BOGFV2 (L5351-4) was the native sample used for the matrix spike (MS) and matrix spike duplicate (MSD), 27753MS/MSD.

The samples were extracted within the required holding time on September 25, 1995 and analyzed within the required holding time on September 26, 1995. The initial and continuing calibrations met the method-specified criteria. Total recoverable petroleum hydrocarbon (TRPH) was not detected in the method blank. TRPH compound recovery was within QC limits in the MS, MSD, laboratory control sample (LCS), and laboratory control sample duplicate (LCS DUP). The relative percent difference between the MS/MSD and LCS/LCS DUP recoveries was within QC limits.

Andrea Tippett
Prepared By

October 7, 1995
Date

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**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.

Analytical Method Strontium-90

The strontium-90 analysis was performed using standard operating procedure, LAL-91-SOP-0196. The samples were analyzed in workgroup 27451. No problems were encountered during the analysis and all QC criteria were met with the following exceptions: The minimum detectable activity was slightly above the reporting detection limit. Data quality is not believed to be adversely affected. No re-analyses were performed.

Andrea Tippett
Prepared By

September 25, 1995
Date

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Lockheed Analytical Services
DATA QUALIFIERS FOR INORGANIC ANALYSES

[Revised 08/28/92]

| For Use on the Analytical Data Reporting Forms | |
|---|---|
| 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). |
| C | <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). |
| D | Presence of high levels of interfering constituents required dilution of sample which increased the RDL by the dilution factor. |
| E | Estimated value due to presence of interference. |
| H | Sample analysis performed outside of method-or client-specified maximum holding time requirement. |
| M | <i>For CLP Analyses Only</i> -- Duplicate injection precision criterion was not met. |
| N | Matrix spike recovery exceeded acceptance limits. |
| S | Reported value was determined from the method of standard addition. |
| U | <i>For CLP Reporting Only</i> -- Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture). |
| W | <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. |
| X, Y, or Z | Analyst-defined qualifier. |
| * | Relative percent difference (RPD) for duplicate analysis exceeded acceptance limits. |
| + | Correlation coefficient (r) for the MSA is less than 0.995. |
| For Use on the QC Data Reporting Forms | |
| a¹ | 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. |
| b¹ | The RPD cannot be computed because the sample and/or duplicate concentration was below the RDL. |

¹ Used as footnote designations on the QC summary form.

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Lockheed Analytical Services
DATA QUALIFIERS FOR ORGANIC ANALYSES

[Revised 04/12/1995]

| For Use On The Analytical Data Reporting Forms | |
|---|--|
| A | <i>For CLP analyses Only</i> -- The TIC is a suspected aldol-condensation product. |
| B | Any constituent that was also detected in the associated blank whose concentration was greater than the practical or reporting detection limit (PQL or RDL). |
| C | Constituent confirmed by GC/MS analysis. <i>[pesticide/PCB analyses only]</i> |
| D | Constituent detected in the diluted sample. It also indicates that an accurate quantitation is not possible due to <u>surrogates</u> being diluted out of the samples during the course of the analysis. |
| E | Constituent concentration exceeded the calibration range. |
| G | The quantitation is not gasoline or diesel but believed to be some other combination of hydrocarbons. |
| H | Sample analysis performed outside of method- or client-specified maximum holding time requirement. |
| J | <i>Estimated value</i> -- (1) constituent detected at a level less than the RDL or PQL and greater than or equal to the MDL; (2) estimated concentration for TICs (<i>For CLP Reporting Only</i>). |
| N | <i>For CLP Reporting Only</i> -- Tentatively identified constituents (TICs) identified based on mass spectral library search. |
| P | <i>For CLP Reporting Only</i> -- The percent difference between the concentrations detected on both GC columns was greater than 25 percent <i>[pesticide/PCB analyses only]</i> . |
| U | <i>For CLP Reporting Only</i> -- Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture). |
| X, Y, or Z | Analyst-defined qualifier. |
| N/A (% Moisture) | N/A in the % moisture cell indicates that data are reported on an "as received" basis. A value in the % moisture cell indicates that data are reported based on a "dry weight" basis. |
| For Use On The QC Data Reporting Forms | |
| * | QC data (i.e., percent recovery data for matrix spike, matrix spike duplicate, laboratory control standard, or surrogates; and RPD for matrix spike duplicate or unspiked duplicate) exceeded acceptance limits. |
| a¹ | 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. |
| b¹ | The RPD cannot be computed because the sample and/or duplicate concentration was below the RDL. |

¹ Used as footnote designations on the QC Summary Form.

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Lockheed Analytical Services
DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES

[Revised 08/28/92]

| For Use on the Analytical Data Reporting Forms | |
|---|---|
| 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). |
| C | Presence of high TDS in sample required reduction of sample size which increased the MDA. |
| D | Constituent detected in the diluted sample. |
| E | Constituent concentration exceeded the calibration or attenuation curve range. |
| F | <i>For Alpha Spectrometry Only</i> -- FWHM exceeded acceptance limits. |
| H | Sample analysis performed outside of method-specified maximum holding time requirement. |
| Y | Chemical yield exceeded acceptance limits. |
| For Use on the QC Data Reporting Forms | |
| * | QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits. |
| a¹ | 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. |
| b¹ | The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA. |

¹ Used as foot note designations on the QC summary form.

SAMPLE STATUS REPORT FOR N 5860. RAD SCREEN 199N103A TIME: 9/13/95 7:35
 DISPATCHED: 8/28/95 9: 3 SAMPLE HAS NOT BEEN SLURPED
 RECEIVED: 9/12/95 14:11

| EXT. | DETER. | RESULTS OR STATUS | OUT OF RANGE? | GOOD ANS? | CHARGE CODE |
|------|---------|---------------------|---------------|-----------|-------------|
| *** | ***** | ***** | *** | *** | ***** |
| 4271 | TOT-ACT | < 5.00000E 01 pCi/G | N | Y | XR5807 |

END OF REPORT

BOG-FV2
BW
9-13-95

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0914596

SAMPLE CHECK-IN LIST

Date/Time Received: 9-14-95/0900 SDG#: ML

Work Order Number: ML SAF #: 895-090

Shipping Container ID: G-WSOT3 Chain of Custody #: ML

- 1. Custody Seals on shipping container intact? Yes No
- 2. Custody Seals dated and signed? Yes No
- 3. Sample temperature 5°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 ^{ML} 9-14-95 No

Notes: COC has 4 liters for SL-90. we received only 3 liters.

Sample Custodian/Laboratory: [Signature] Date: 9-14-95
Telephoned To: Karlheinz Hall On 9-14-95 By Anthony Miller

LOCKHEED MARTIN



Sample Login Login Review Checklist

Lot Number LSJ51

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? | X | — | — | _____ |
| 2. Are all samples present? | X | — | — | _____ |
| 3. Are all matrices indicated correctly? | X | — | — | _____ |
| 4. Are all analyses on the COC logged in for the appropriate samples? | X | — | — | _____ |
| 5. Are all analyses logged in for the correct container? | X | — | — | _____ |
| 6. Are samples logged in according to LAS batching procedures? | X | — | — | _____ |

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? | X | — | — | _____ |
| 2. Have all appropriate comments been indicated in the comment section? | — | — | X | _____ |

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)? | X | — | X | _____ ^{See 9-14-95} |

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[Signature]
primary review signature

9-14-95
date

[Signature]
secondary review signature

09/14/95
date

0914596

Lockheed Analytical Services
Sample Receiving Checklist

Client Name: *Berkel-Hanford*

Job No. *L5351*

Cooler ID:

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: *5°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>MA</i> |
| are samples bi-phasic (if so, indicate sample ID'S): | | | <i>MA</i> |

MISCELLANEOUS ITEMS

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

ADDITIONAL COMMENTS/DISCREPANCIES

SEE Checklist

Completed by / date: *mmll 9-14-95*

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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0914596

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

| Client Sample Number | LAL Sample Number | SDG Number | Matrix | Method |
|-------------------------|----------------------|---------------|--------|-------------------|
| BOGFV2- | L5351-1 | | Water | SCREENING - |
| | L5351-2 | | Water | 6010 ICP METALS - |
| | L5351-3 | | Water | 375.4 SULFATE - |
| | L5351-4 | | Water | 418.1 TPH - |
| | L5351-6 | | Water | SR-90 LAL-0196 - |
| REPORT TYPE - | L5351-9 | | Water | EDD - DISK DEL. |
| | L5351-9 | | Water | INORG TYPE 2 RPT |
| | L5351-9 | | Water | RAD RPT TYPE 2 |

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0914.596

LOCKHEED ANALYTICAL SERVICES

Sample Results

| | |
|--------------------------|---------------------------|
| Client Sample ID: BOGFV2 | Date Collected: 12-SEP-95 |
| Matrix: Water | Date Received: 14-SEP-95 |
| Percent Solids: N/A | |

| Constituent | Units | Method | Result | Project Reporting Limit | Data Qualifier(s) | Date Analyzed | LAS Batch ID | LAS Sample ID |
|-------------|-------|--------|--------|-------------------------|-------------------|---------------|--------------|---------------|
| SULFATE | mg/L | 375.4 | 13. | 5.0 | | 25-SEP-95 | 27588 | L5351-3 |

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LOCKHEED ANALYTICAL SERVICES

Sample Results

| | |
|--------------------------|---------------------------|
| Client Sample ID: B0GFV2 | Date Collected: 12-SEP-95 |
| Matrix: Water | Date Received: 14-SEP-95 |
| Percent Solids: N/A | |

| Constituent | Units | Method | Result | Project Reporting Limit | Data Qual | Dilution | Date Analyzed | LAS Batch ID | LAS Sample ID |
|------------------|-------|--------|--------|-------------------------|-----------|----------|---------------|--------------|---------------|
| CALCIUM, TOTAL | mg/L | 6010 | 25. | 0.032 | | 1 | 28-SEP-95 | 27707 | L5351-2 |
| MAGNESIUM, TOTAL | mg/L | 6010 | 4.9 | 0.050 | B | 1 | 28-SEP-95 | 27707 | L5351-2 |

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LOCKHEED ANALYTICAL SERVICES

TOTAL PETROLEUM HYDROCARBONS BY FTIR
418.1 TPH

| | | | |
|-------------------|-----------------|----------------------|--------------|
| Client Sample ID: | BOGFV2 | LAL Sample ID: | L5351-4 |
| Date Collected: | 12-SEP-95 | Date Received: | 14-SEP-95 |
| Date Analyzed: | 26-SEP-95 | Date Extracted: | 25-SEP-95 |
| Matrix: | Water | Analytical Batch ID: | 092695-418.1 |
| QC Group: | 418.1 TPH_27753 | Dilution Factor: | 1 |

| CONSTITUENT | RESULT mg/L | PRACTICAL QUANTITATION LIMIT mg/L | DATA QUALIFIER(%) |
|-------------|----------------|---|----------------------|
| TRPH | <1.00 | 1.00 | |

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LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0GFV2

LAL Sample ID: L5351-6

Date Collected: 12-SEP-95

Date Received: 14-SEP-95

Matrix: Water

Login Number: L5351

| Constituent | Analyzed | Batch | Activity | Error | MDA | Data Qual | Units |
|-----------------------|-----------|----------------------|----------|-------|-----|-----------|-------|
| Total radio-strontium | 20-SEP-95 | SR-90 LAL-0196_27451 | 7.4 | 1.0 | 1.1 | | pCi/L |

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 Sr(NO₃)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.

Sr Carrier #91-208-100-1 was recalibrated to give a new calibrated value. Prepped on 1-5-95

| | Calib # 1 | Calib # 2 | Calib # 3 |
|-------------------------------|-----------|-----------|------------------------|
| Carrier plus planchet wt. | 6.60823 | 6.65050 | 6.818936 ⁸⁰ |
| Tare wt. of planchet | 6.59582 | 6.63805 | 6.80698 |
| Net wt. of carrier added (mg) | 0.01241 | 0.01245 | 0.012068 |

AVERAGE Sr(NO₃)₂ ± STD DEV. = 0.01231 g

Expected mg of Sr(NO₃)₂ = cert. value (*10mg of Sr/mL) * 0.5 mL * 2.41

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

Initial and Date: JW 1-10-95

Read and Understood By

*Raymond Wong
1-10-95*

Signed

Date

Signed

Date

000062

D Jones
W
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 _____

D Jones
Signed

3-15-94
Date

Read and Understood By DA Review
Gue-Med-Lin
Signed

000063
8/11/94
Date

AC 5051
R/S

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 ampule/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.

000064
CST 30

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

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>50 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>0.1M 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 ⁷³⁻⁴⁷⁴⁻⁸²⁻¹ 214/95</u> |
| Prepared By: <u>Dyane 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: _____ |

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Signed

Date

Signed

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Date

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

| Dilution Source Information | |
|--|-------------------------------------|
| Isotope: | <u>Sr-90</u> |
| Parent Barcode Number | <u>Ref. 4-1-94</u> <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...</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 Dynes Wong

Date 3-3-95

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