START 9613420.0375 0043547 LK5628-LAS 168

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

APR 1996 RECEIVED EDMC

November 29, 1995

DEC 1995 RECEIVED Data Log In

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

RE:	Log-in No.:	L5628/L5644
	Quotation No.:	Q400000-B
	SAF:	B95-103
	Document File No.:	1018596/1019596
	BHI Document File No.:	286/287
	SDG No.:	LK5628

L5628- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 18 October 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.

L5644- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 19 October 1995. The temperature of the cooler upon receipt was 4°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) 375-4741.

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 1

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,

Karen Hermann for

Kathleen M. Hall
Client Services Representative

cc: Client Services
Document Control

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 2

CASE NARRATIVE
INORGANIC NON METALS ANALYSES
WATER

The routine calibration and quality control analyses performed for this batch include as applicable: initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), matrix spike sample(s), and duplicate sample(s).

Preparation and Analysis Requirements

- Two water samples were received for LK5628 and analyzed in batch 1018 bh for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following samples:

Client ID	LAL #		Method
BOGNW7	L5628-5	DUP	9050 Conductivity
	L5628-4	MS, DUP	300.0 Fluoride and Sulfate
	L5628-4	DUP	9040 pH

Holding Time Requirements

- All samples were analyzed within the 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

November 10, 1995
Date

CASE NARRATIVE
INORGANIC METALS ANALYSES
WATER

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

- Two water samples were analyzed for total metals analysis. The samples were batched as LAS batch 1018BHT for total metals analysis. Sample B0GNW7 (L5628-2) and (L5628-3) were used for matrix spike, duplicate and serial dilution analyses. All data flags due to the performance of the above-mentioned QC samples are also associated with every sample analyzed with this batch.

Holding Time Requirements

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

Method Blanks

- The level of analytes in the method blanks were less than the reporting detection limits.

Internal Quality Control

All internal quality control were within acceptance limits.

Sample Results

- The following qualifiers are reported on the basis of the techniques employed to perform the analyses:
  "P" Trace ICP-AES
  "P" ICP-AES
  "AV" Cold Vapor AA

Nalini Prabhakar
Prepared by

11/16/95
Date

CASE NARRATIVE
INORGANIC METALS ANALYSES
FILTERED WATER

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

- Two filtered water samples were analyzed for dissolved metals analysis. As the measured turbidity of the samples was less than 1 NTU, they were batched as LAS batch 1018BHD for dissolved metals analysis. Sample B0GNW8 (L5628-16) and (L5628-17) were used for matrix spike, duplicate and serial dilution analyses. All data flags due to the performance of the above-mentioned QC samples are also associated with every sample analyzed with this batch.

Holding Time Requirements

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

Method Blanks

- The level of analytes in the method blanks were less than the reporting detection limits.

Internal Quality Control

All internal quality control were within acceptance limits.

Sample Results

- The following qualifiers are reported on the basis of the techniques employed to perform the analyses:
  "P" Trace ICP-AES
  "P" ICP-AES
  "AV" Cold Vapor AA

Nalini Prabhakar
Prepared by

11/16/95
Date

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 Gross Alpha Beta

The gross alpha beta analysis was performed using standard operating procedure (SOP), LAL-91-SOP-0060. The samples were analyzed in workgroup 29082. The instrument calibration verification met criteria. The method blank was within QC criteria. The laboratory control sample (LCS) recovery for alpha was slightly above QC criteria; however, since the beta LCS recovery and both matrix spike (MS) recoveries were within QC criteria, the data is not believed to be adversely affected. The duplicate (DUP) recoveries were within QC criteria. The minimum detectable activity (MDA) exceeded the reporting detection limit (RDL) due to residue weight limitations forcing a volume reduction. The affected samples are flagged with a "C" qualifier. No re-anlayses were performed.

Analytical Method Strontium-90

The strontium-90 analysis was performed using SOP, LAL-91-SOP-0196. The samples were analyzed in workgroup 29083. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The DUP recoveries were within QC criteria. No re-analyses were performed.

Liquid Scintillation Counter

Analytical Method Carbon-14

The carbon-14 analysis was performed using SOP, LAL-91-SOP-0209. The samples were analyzed in workgroup 29087. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The MS recovery was within QC criteria. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No re-analyses were performed.

Analytical Method Technetium-99

The technetium-99 analysis was performed using SOP, LAL-91-SOP-0169. The samples were analyzed in workgroups 29084 and 30338. Workgroup 29084 had low LCS and chemical recoveries and a DUP that was out of limits. The samples were re-prepared and re-analyzed in workgroup 30338. No data from workgroup 29084 is reported. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No other re-analyses were performed.

Analytical Method Tritium

The tritium analysis was performed using SOP, LAL-91-SOP-0066. The samples were analyzed in workgroup 29086. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The MS recovery was slightly above QC criteria; however, since all other QC analyses were within limits, the data is not believed to be adversely affected. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No re-analyses were performed.

Yvonne M. Jacoby
Prepared By

November 29, 1995
Date

Lockheed Analytical Services
DATA QUALIFIERS FOR INORGANIC ANALYSES
[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
B	***For CLP Analyses Only*** -- Reported value is less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL).
C	***For Routine, Non-CLP Analyses Only*** -- 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	***For CLP Analyses Only*** -- 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	***For CLP Reporting Only*** -- Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture).
W	***For AAS Only*** -- 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	
a[1]	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[1]	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.

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	***For Alpha Spectrometry Only***-- 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.
a[1]	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[1]	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.

9613420.0384

LOCKHEED ANALYTICAL SERVICES
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Oct 18 1995, 12:20 pm

Login Number: L5628
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	PR	Due Date
L5628-1	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S SCREENING		Hold:13-APR-96			
L5628-2	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S CLP FURNACE		Hold:13-APR-96			
Water 1 S CLP ICP		Hold:13-APR-96			
L5628-3	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S CLP MERCURY		Hold:13-NOV-95			
L5628-4	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S 300.0 FLUORIDE		Hold:13-NOV-95			
Water 1 S 300.0 SULFATE		Hold:13-NOV-95			
Water 1 S 9040 PH		Hold:23-OCT-95			
L5628-5	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S 9050 CONDUCTIVITY		Hold:13-NOV-95			
L5628-6	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S GR ALP/BETA LAL-0060		Hold:13-APR-96			
Water 1 S SR-90 LAL-0196		Hold:13-APR-96			
L5628-7	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
L5628-8	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					

1018596

9613420.0385

LOCKHEED ANALYTICAL SERVICES
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Oct 18 1995, 12:20 pm

Login Number: L5628
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	PR	Due Date
L5628-9	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
L5628-10	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
L5628-11	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S TC-99 LAL-0169		Hold:13-APR-96			
L5628-12	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
L5628-13	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
L5628-14	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
L5628-15	BOGNW7	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Water 1 S C-14 LAL-0209		Hold:13-APR-96			
Water 1 S TRITIUM(H3) LAL-0066		Hold:13-APR-96			
L5628-16	BOGNW8	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Filt H20 15 S CLP FURNACE		Hold:13-APR-96			
Filt H20 15 S CLP ICP		Hold:13-APR-96			
L5628-17	BOGNW8	16-OCT-95	18-OCT-95		22-NOV-95
TEMP 2					
Location: 157					
Filt H20 15 S CLP MERCURY		Hold:13-NOV-95			
L5628-18	REPORT TYPE	18-OCT-95	18-OCT-95		22-NOV-95
Location:					
Water 1 S EDD - DISK DEL.					

013

1018596

9613420.0386

LOCKHEED ANALYTICAL SERVICES
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Oct 18 1995, 12:20 pm

Login Number: L5628
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number		Client Sample Number	Collect Date	Receive Date	PR	Due Date
Water	1	S INORG TYPE 2 RPT +				
Water	1	S RAD RPT TYPE 2				

Signature: Paul C Davis

Date: 10-18-95

014

1C 1859C

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST L5628

Page 1 of 1

Data Turnaround
☐ Priority
■ Normal

Collector: A. Rizzo	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: ER-9	Field Logbook No.: EFR-1037	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W95-0-0640-04	Bill of Lading/Air Bill No.: 2904643892

Possible Sample Hazards/Remarks

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS												
			Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
			Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
			No. of Container(s)	1	1	1	1	5	4	1	1	1	1
			Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
				ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW7	W	10/16/95	1335	X	X	X	X	X	X	X	X		
B0GNW8	W	10/16/95	1335									X	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: AGRizzo (SRC)	Date/Time: 10-17-95 0740	Received By: B. Whitten	Date/Time: 10-17-95 0740
Relinquished By: B. Whitten	Date/Time: 10-17-95 0830	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

SPECIAL INSTRUCTIONS

Matrix*
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	Title	Date/Time
	Paul C. Davis	Sample Custodian	10-18-95 / 8:00 am

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

9612210.0097

9613420.0388

Environmental Restoration Contractor **ERC Team**

Interoffice Memorandum

Job No. 22192
Written Response Required: NO
CCN: N/A
OU: 100-BC-5
TSD: N/A
ERA: N/A
Subject Code: 5850, 8640

TO: W. S. Thompson N1-28
K. F. Trapp N1-28

DATE: October 9, 1995

COPIES: K. A. Mathews X0-23

FROM: S. K. De Mers
Radiological Controls
T7-05/373-1913

SUBJECT: **100-BC-5 EXEMPTION FROM TOTAL ACTIVITIES**

There is no need to perform total activities prior to offsite shipment to NRC licensed labs of samples taken from the attached list of wells.

After reviewing GEODAT data dating from 1955 to the present it is evident that none of the wells have ever had contaminants above the fifty picocuries per gram detection limit of a 222-S total activity analysis. The highest gross beta occurred in a 4/22/69 sample from well# 199-B4-4, the value was 7.4 picocuries per milliliter/gram gross beta. Since 1992 the highest value for gross beta has been less than one picocurie per milliliter and less than 10 picocuries per milliliter tritium. All processes which release radioactive materials to the soil column in the 100 BC Area been stopped. Wells which are closer to cribs and the tritium plume under 100-K are also below the detection limit. This information coupled with the total activities performed on these wells over the past three years provides sufficient process knowledge to conclude that activity levels in the water are not likely to increase above the detection limit of a total activity analysis in any given sample interval.

The radioactive screening data from the previous sampling round should always be checked to confirm levels have not increased over time. If the levels should double in any sample interval preshipment screening of samples from the affected wells should be resumed. If any of these the wells should not be sampled for radioactive contaminants in the next three years and there are no wells nearby which will provide representative data (ie. closer to known plumes of radioactive contaminants), a preshipment screen should also be performed.

Radiological monitoring during sampling will only be required if the wells are located in contamination or radiation areas or if the wells themselves are labeled with radiological stickers. Monitoring requirements for down hole work such as pump removal will be determined based on the history of each well on a case by case basis.

101859

Thompson

WELLS EVALUATED FOR EXEMPTION FROM TOTAL ACTIVITIES

199-B2-12
199-B2-13
199-B3-1
199-B3-46
199-B3-47
199-B4-1
199-B4-4
199-B4-5
199-B4-7
199-B4-8
199-B4-9
199-B5-1
199-B5-2
199-B8-6
199-B9-1
199-B9-2
199-B9-3
699-63-90
699-65-72
699-65-83
699-66-64
699-71-77
699-72-73
699-72-92

SAMPLE CHECK-IN LIST

Date/Time Received: 10-18-95/9:00am SDG#: n/a

Work Order Number: n/a SAF #: B95-103

Shipping Container ID: ER-9 Chain of Custody # n/a

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

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

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

9. Is the information on the COC and Sample bottles in agreement?

   Yes[X] No [ ]

Notes: _____

Sample Custodian/Laboratory: Paula Davis/LAS Date: 10-18-95

~~Telephoned~~ Faxed To: Kathleen Hall On 10-18-95 By Paula Davis
Rec'd 10-18-95

9613420.0391

LOCKHEED MARTIN

Sample Login
Login Review Checklist

Lot Number L5628

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 form 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	YES	NO	N/A	Comment
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	YES	NO	N/A	Comment
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	YES	NO	N/A	Comment
1. Are all discrepancies between the COC and the login noted (if applicable)?			X	

019

Paul C Davis 10-8-95
primary review signature date

[illegible] 10-18-95
secondary review signature date

1018596

Lockheed Analytical Services
Sample Receiving Checklist

Client Name: WHC Job No. L5628 Cooler ID: 1114

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: 2°C

temperature of temp. blank upon receipt: —

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

SAMPLE CONDITION UPON RECEIPT

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

MISCELLANEOUS ITEMS

	Yes	No	* Comments/Discrepancies
samples with short holding times		X	
samples to subcontract		N/A	

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: Paul C Davis 10-18-95

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 facsimille to the appropriate CSR (702) 361-8146*

version 2.0 (11/11/94)

9613420.0392

1018554

020

9613420.0393

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

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
BOGNW7	L5628-1		Water	SCREENING
	L5628-2		Water	CLP FURNACE
	L5628-2		Water	CLP ICP
	L5628-3		Water	CLP MERCURY
	L5628-4		Water	300.0 FLUORIDE
	L5628-4		Water	300.0 SULFATE
	L5628-4		Water	9040 PH
	L5628-5		Water	9050 CONDUCTIVITY
	L5628-6		Water	GR ALP/BETA LAL-C
	L5628-6		Water	SR-90 LAL-0196
	L5628-11		Water	TC-99 LAL-0169
	L5628-15		Water	C-14 LAL-0209
	L5628-15		Water	TRITIUM(H3) LAL-C
BOCNW8	L5628-16		Filt H20	CLP FURNACE
	L5628-16		Filt H20	CLP ICP
	L5628-17		Filt H20	CLP MERCURY
REPORT TYPE	L5628-18		Water	EDD - DISK DEL.
	L5628-18		Water	INORG TYPE 2 RPT
	L5628-18		Water	RAD RPT TYPE 2

101859

9613420.0394

LOCKHEED ANALYTICAL SERVICES
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Oct 19 1995, 12:27 pm

Login Number: L5644
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	PR	Due Date
L5644-9	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
L5644-10	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
L5644-11	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
Water 1 S TC-99 LAL-0169		Hold:14-APR-96			
L5644-12	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
L5644-13	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
L5644-14	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
L5644-15	BOGNW9	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
Water 1 S C-14 LAL-0209		Hold:14-APR-96			
Water 1 S TRITIUM(H3) LAL-0066		Hold:14-APR-96			
L5644-16	BOGNX0	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
Filt H20 15 S CLP FURNACE		Hold:14-APR-96			
Filt H20 15 S CLP ICP		Hold:14-APR-96			
L5644-17	BOGNX0	17-OCT-95	19-OCT-95		23-NOV-95
TEMP 4					
Location: 157					
Filt H20 15 S CLP MERCURY		Hold:14-NOV-95			
L5644-18	REPORT TYPE	19-OCT-95	19-OCT-95		23-NOV-95
Location:					
Water 1 S EDD - DISK DEL.					

022

1019596

9613420.0395

LOCKHEED ANALYTICAL SERVICES
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Oct 19 1995, 12:27 pm

Login Number: L5644
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	PR	Due Date
Water	1 S INORG TYPE 2 RPT +				
Water	1 S RAD RPT TYPE 2				

023

Signature: Paul C Davis

Date: 10-19-95

1019596

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

L5644

Page 1 of 1

Data Turnaround
☐ Priority
■ Normal

Collector: A. Rice	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: RM-136	Field Logbook No.: SFZ-1637	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W90-0-0640-05	Bill of Lading/Air Bill No.: 2904644041

Possible Sample Hazards/Remarks	Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
	Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
	No. of Container(s)	1	1	1	1	5	4	1	1	1	1
Special Handling and/or Storage: Maintain samples between 2°C and 6°C.	Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
SAMPLE ANALYSIS		ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)

Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW9	W	10-17-95	1150	X	X	X	X	X	X	X	X		
B0GNX0	W	10-17-95	1150									X	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: AGRice (ERW)	Date/Time: 1545 10-17-95	Received By: ERW B Whitten	Date/Time: 1545 10-17-95
Relinquished By: ERW B Whitten	Date/Time: 0830 10-18-95	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

SPECIAL INSTRUCTIONS

Matrix*
- 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	Title	Date/Time
	[illegible]	Sample Custodian	10-19-95 / 0900

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

9513140.0294

9613420.0397

Environmental Restoration Contractor **ERC Team**

Interoffice Memorandum

Job No. 22192
Written Response Required: NO
CCN: N/A
OU: 100-BC-5
TSD: N/A
ERA: N/A
Subject Code: 5850, 8640

TO: W. S. Thompson N1-28
K. F. Trapp N1-28

DATE: October 9, 1995

COPIES: K. A. Mathews X0-23

FROM: S. K. De Mers
Radiological Controls
T7-05/373-1913

SUBJECT: **100-BC-5 EXEMPTION FROM TOTAL ACTIVITIES**

There is no need to perform total activities prior to offsite shipment to NRC licensed labs of samples taken from the attached list of wells.

After reviewing GEODAT data dating from 1955 to the present it is evident that none of the wells have ever had contaminants above the fifty picocuries per gram detection limit of a 222-S total activity analysis. The highest gross beta occurred in a 4/22/69 sample from well# 199-B4-4, the value was 7.4 picocuries per milliliter/gram gross beta. Since 1992 the highest value for gross beta has been less than one picocurie per milliliter and less than 10 picocuries per milliliter tritium. All processes which release radioactive materials to the soil column in the 100 BC Area been stopped. Wells which are closer to cribs and the tritium plume under 100-K are also below the detection limit. This information coupled with the total activities performed on these wells over the past three years provides sufficient process knowledge to conclude that activity levels in the water are not likely to increase above the detection limit of a total activity analysis in any given sample interval.

The radioactive screening data from the previous sampling round should always be checked to confirm levels have not increased over time. If the levels should double in any sample interval preshipment screening of samples from the affected wells should be resumed. If any of these the wells should not be sampled for radioactive contaminants in the next three years and there are no wells nearby which will provide representative data (ie. closer to known plumes of radioactive contaminants), a preshipment screen should also be performed.

Radiological monitoring during sampling will only be required if the wells are located in contamination or radiation areas or if the wells themselves are labeled with radiological stickers. Monitoring requirements for down hole work such as pump removal will be determined based on the history of each well on a case by case basis.

025

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Thompson

WELLS EVALUATED FOR EXEMPTION FROM TOTAL ACTIVITIES

199-B2-12
199-B2-13
199-B3-1
199-B3-46
199-B3-47
199-B4-1
199-B4-4
199-B4-5
199-B4-7
199-B4-8
199-B4-9
199-B5-1
199-B5-2
199-B8-6
199-B9-1
199-B9-2
199-B9-3
699-63-90
699-65-72
699-65-83
699-66-64
699-71-77
699-72-73
699-72-92

SAMPLE CHECK-IN LIST

Date/Time Received: 10-19-95 / 0900 SDG#: N/A

Work Order Number: N/A SAF #: B95-103.

Shipping Container ID: RM-136 Chain of Custody # N/A

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

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

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

9. Is the information on the COC and Sample bottles in agreement?

   Yes [X] No [ ]

Notes: _____

Sample Custodian/Laboratory: Paula Davis/LAS Date: 10-19-95

~~Telephoned~~ Faxed To: Kathleen Hall On 10-19-95 By Paula Davis

027

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9613420.0400

LOCKHEED MARTIN

Sample Login
Login Review Checklist

Lot Number L5644

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 form 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	YES	NO	N/A	Comment
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	YES	NO	N/A	Comment
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	YES	NO	N/A	Comment
1. Are all discrepancies between the COC and the login noted (if applicable)?			X	

028

Paul C. Davis 10-19-95
primary review signature — date

secondary review signature — 10-19-95
date

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9613420.0401

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

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
BOGNW9	L5644-1		Water	SCREENING
	L5644-2		Water	CLP FURNACE
	L5644-2		Water	CLP ICP
	L5644-3		Water	CLP MERCURY
	L5644-4		Water	300.0 FLUORIDE
	L5644-4		Water	300.0 SULFATE
	L5644-4		Water	9040 PH
	L5644-5		Water	9050 CONDUCTIVITY
	L5644-6		Water	GR ALP/BETA LAL-0
	L5644-6		Water	SR-90 LAL-0196
	L5644-11		Water	TC-99 LAL-0169
	L5644-15		Water	C-14 LAL-0209
	L5644-15		Water	TRITIUM(H3) LAL-0
BOGNX0	L5644-16		Filt H20	CLP FURNACE
	L5644-16		Filt H20	CLP ICP
	L5644-17		Filt H20	CLP MERCURY
REPORT TYPE	L5644-18		Water	EDD - DISK DEL.
	L5644-18		Water	INORG TYPE 2 RPT
	L5644-18		Water	RAD RPT .TYPE 2

K19596

9613420.0402

LOCKHEED ANALYTICAL SERVICES

Sample Results

Client Sample ID: BOGNW7	Date Collected: 16-OCT-95
Matrix: Water	Date Received: 18-OCT-95
Percent Solids: N/A	

Constituent	Units	Method	Result	Project Reporting Limit	Data Qualifier(s)	Date Analyzed	LAS Batch ID	LAS Sample ID
Fluoride	mg/L	300.0	0.42	0.10		23-OCT-95	28989	L5628-4
Sulfate	mg/L	300.0	11.	0.10		20-OCT-95	28990	L5628-4
pH	pH Units	9040	8.1	0.10		23-OCT-95	28953	L5628-4
Conductivity	uS/cm	9050	260	1.0		06-NOV-95	28991	L5628-5

LOCKHEED ANALYTICAL SERVICES

Sample Results

Client Sample ID: BOGNW9	Date Collected: 17-OCT-95
Matrix: Water	Date Received: 19-OCT-95
Percent Solids: N/A	

Constituent	Units	Method	Result	Project Reporting Limit	Data Qualifier(s)	Date Analyzed	LAS Batch|ID	LAS Sample|ID
Fluoride	mg/L	300.0	0.24	0.10		23-OCT-95	28989	L5644-4
Sulfate	mg/L	300.0	39.	0.10		20-OCT-95	28990	L5644-4
pH	pH Units	9040	7.6	0.10		23-OCT-95	28953	L5644-4
Conductivity	uS/cm	9050	350	1.0		06-NOV-95	28991	L5644-5

9613420.0404

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW7

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5628-2

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	21.0	U		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	4.6	B		P
7440-39-3	Barium	63.2	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	27500			P
7440-47-3	Chromium	8.8	B		P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	43.8	B		P
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	10100			P
7439-96-5	Manganese	7.0	B		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	4740	B		P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	13800			P
7440-28-0	Thallium	4.9	B		P
7440-62-2	Vanadium	40.9	B		P
7440-66-6	Zinc	4.3	B		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

9613420.0405

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW7

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5628-3

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

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CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW9

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5644-2

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	23.8	B		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	4.6	B		P
7440-39-3	Barium	31.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	46600			P
7440-47-3	Chromium	80.7			P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	98.4	B		P
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	8900			P
7439-96-5	Manganese	2.0	U		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	5080			P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	10300			P
7440-28-0	Thallium	5.9	B		P
7440-62-2	Vanadium	7.7	B		P
7440-66-6	Zinc	8.3	B		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

9613420.0407

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW9

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5644-3

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

9613420.0408

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW8

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5628-16

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	21.0	U		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	10.3			P
7440-39-3	Barium	66.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	30600			P
7440-47-3	Chromium	4.0	U		P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	9.0	U		P
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	10900			P
7439-96-5	Manganese	7.4	B		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	5020			P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	14600			P
7440-28-0	Thallium	4.6	B		P
7440-62-2	Vanadium	41.9	B		P
7440-66-6	Zinc	3.0	U		P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

9613420.0409

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW8

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5628-17

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

9613420.0410

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNX0

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5644-16

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	21.0	U		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	5.5	B		P
7440-39-3	Barium	33.8	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	52800			P
7440-47-3	Chromium	88.6			P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	9.0	U		P
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	9960			P
7439-96-5	Manganese	2.0	U		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	4890	B		P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	11400			P
7440-28-0	Thallium	3.0	U		P
7440-62-2	Vanadium	5.1	B		P
7440-66-6	Zinc	3.0	U		P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

9613420.0411

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNX0

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5644-17

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW7 | LAL Sample ID: L5628-6

Date Collected: 16-OCT-95 | Date Received: 18-OCT-95

Matrix: Water | Login Number: L5628

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	02-NOV-95	GR ALP/BETA LAL-0060_29082	1.1	1.3	2.1	C	pCi/L
Gross Beta	02-NOV-95	GR ALP/BETA LAL-0060_29082	3.8	1.5	2.2		pCi/L
Total radio-strontium	13-NOV-95	SR-90 LAL-0196_29083	0.02	0.57	0.99		pCi/L

075

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW7 | LAL Sample ID: L5628-11

Date Collected: 16-OCT-95 | Date Received: 18-OCT-95

Matrix: Water | Login Number: L5628

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Tc-99	17-NOV-95	TC-99 LAL-0169_30338	-3.9	4.3	7.8		pCi/L

076

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW7 | LAL Sample ID: L5628-15

Date Collected: 16-OCT-95 | Date Received: 18-OCT-95

Matrix: Water | Login Number: L5628

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
C-14	27-OCT-95	C-14 LAL-0209_29087	-31.	82.	110		pCi/L
H-3	21-NOV-95	TRITIUM(H3) LAL-0066_29086	-120	210	280		pCi/L

077

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW9 | LAL Sample ID: L5644-6

Date Collected: 17-OCT-95 | Date Received: 19-OCT-95

Matrix: Water | Login Number: L5644

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	02-NOV-95	GR ALP/BETA LAL-0060_29082	1.2	1.5	2.5	C	pCi/L
Gross Beta	02-NOV-95	GR ALP/BETA LAL-0060_29082	34.5	3.2	2.2		pCi/L
Total radio-strontium	13-NOV-95	SR-90 LAL-0196_29083	1.44	0.67	1.0		pCi/L

078

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW9 | LAL Sample ID: L5644-11

Date Collected: 17-OCT-95 | Date Received: 19-OCT-95

Matrix: Water | Login Number: L5644

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Tc-99	17-NOV-95	TC-99 LAL-0169_30338	38.7	7.1	8.3		pCi/L

079

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW9 | LAL Sample ID: L5644-15

Date Collected: 17-OCT-95 | Date Received: 19-OCT-95

Matrix: Water | Login Number: L5644

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
C-14	27-OCT-95	C-14 LAL-0209_29087	34.	87.	110		pCi/L
H-3	21-NOV-95	TRITIUM(H3) LAL-0066_29086	2210	400	280		pCi/L

080

S7d. [illegible] to make 91-0225-60-1 AA0036

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide	Am-241	Customer:	LOCKHEED ENGINEERING & SCIENCES C
Half Life:	432.7 ± 0.5 years	P.O.No.:	06LAB1245
Catalog No.:	7241	Reference Date:	November 1 1991 12:00 PST.
Source No.:	388-100-1	Contained Radioactivity:	0.997 µCi.

Description of Solution

a. Mass of solution: 5.0007 grams.

b. Chemical form: AmCl3 in 0.5N HCl

c. Carrier content: None added

d. Density: 1.0077 gram/ml @ 20°C.

Radioimpurities

None detected

Radioactive Daughters

None detected

Radionuclide Concentration

0.1994 µCi/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: ±2.0%

b. Random uncertainty in assay: ±0.7%

c. Random uncertainty in weighing(s): ±0.0%

d. Total uncertainty at the 99% confidence level: ±2.7%

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)

Gary A. Gilmore
QUALITY CONTROL

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone Street.,
Burbank, California 91504
(818) 843 - 7000

PROJECT Am-241 / 1.6" dia. filter & LCS

Continued From Page

ISOTOPE DILUTION RECORD

Agnes Wo. 4-9-93

Isotope: Am-241

Secondary/Working Level Dilution

Date: 4-9-93 Preparer's Name: A. Wong

Pipet Check / Balance Wt. Check Done (✓)

Diluted Source ID (log#): 91-225-60-1

Diluent used: 0.5 N HCl

A: Source activity: 21700 dpm/g (9774.8 pCi/g)

B: Amount of source transferred: 10.3235 g

C: Total amount of dilution: 100.1029 g

D: Activity of dilution (A*B/C): 2237.90 dpm/g

E: Density of Diluent: 1.0010 g/ml

★ F: Activity by volume (D*E): 2240.14 dpm/ml

Dilution Log Book ID: ~~92-335~~ RW 92-353-81-1

Reviewed by: EJ Date: 4/9/93

1.6" diameter filter LCS for Gamma Spec. (in petri dish and sealed) JSS 5/18/93

Prepared by Nee Van Nuyen 5/10/93 — Cut Whatman Glass Microfiber filter paper (originally 3" dia) to 1.6" dia — Pipetted on filter

^{137}Cs LAC-0199- 0.200 ml * 975.13 pCi/ml = 195.0 pCi (≡ 197.8 pCi 4-2-91)

^{60}Co LAC-0225-80-1 0.200 ml * 990.3 (998.11 pCi/ml) = 199.6 pCi (≡ 259.1 pCi 4-2-91)

(same pipette amounts as p.80R)

Continued on Page N/A

Read and Understood By

096

Agnes Wong — Signed — 4-9-93 — Date

Jack M. Schuett — Signed — 5-18-93 — Date

96/3420.0420

Rcvd 5/31/94
ACS 851
RKS

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.

097

CST 36

9613420.0421

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 ± 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

098

Date Certificate Prepared April 26, 1994

Approval Signature Paul B. Hahn

PROJECT Sr-90

Notebook No. 0474

Continued From Page

INITIAL STANDARD DILUTION RECORD

Standard Information:

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

Primary Dilution

Balance Verification?:	yes
Diluent Used:	0.1M HCl
a: Decay Corrected Standard Activity (pCi/g):	5.4×10^3 pCi/g
b: Weight of the Source Transferred (g):	4.9670 g
c: Total diluted weight (g):	49.91 g
d: Total Diluted Volume (mL)	50 mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	537.4 pCi/g
f: Calculated Density of Solution (g/ml) [c / d]:	0.9982 g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	536.44 pCi/mL
h. Dilution Logbook I.D. #:	~~93-474-81-1~~ 93-474-82-1 CP 4/7/95

Prepared By: Agnes Wong Preparation Date: 6-15-94

Reviewed By: Joe Hutchison Review Date: 6/30/94

Purity/Cross Check Performed By: Check Date:

099

Signed Date Signed Date

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information

Isotope: Am-241 and Sr-90

Parent Barcode Number: AA0030 AA0046

Vendor or Certificate I.D. # of Parent Standard: Am-241 IPL 388-100-1; Sr-90 NIST SRM 4219G

Diluted Source Logbook I.D. #: Am-241 91-0225-60-1; Sr-90 91-0225-30-2

Balance Verification?: Yes

Diluent Used: 0.1 N HNO_3

Dilution

*Diluent: 0.1 N HNO_3 + 42 mg $Sr(NO_3)_2$/mL

*Density of diluent (g/ml): NA

a: Parent Specific Activity: Am-241 981 pCi/mL; Sr-90 600 pCi/mL on 8/1/90

b: Amount of Source Transferred: Am-241 0.5 mL; Sr-90 0.5 ~~g~~ mL

c: Total amount of Dilution: 500 ~~g~~ mL

d: Total Volume of Dilution: 500 mL

e: Activity of Dilution [a * b / c]: NA

f: Activity of Dilution (a * b / d): Am-241 9.81 pCi/mL; Sr-90 12 pCi/mL on 8/1/90

Dilution Logbook I.D. #: 95-721-13-1

Prepared By: Joe Hutchinson Preparation Date: 8/23/95

Reviewed By: [illegible] Review Date: 8/24/95

*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.

Read and Understood By

Signed Date Signed Date

S7d. [illegible] and to make 91-0225-60-1 AA0030.

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOLUTION

Radionuclide	Am-241	Customer:	LOCKHEED ENGINEERING & SCIENCES Co.
Half Life:	432.7 ± 0.5 years	P.O.No.:	06LAB1245
Catalog No.:	7241	Reference Date:	November 1 1991 12:00 PST.
Source No.:	388-100-1	Contained Radioactivity:	0.997 µCi.

Description of Solution

a. Mass of solution:	5.0007	grams.
b. Chemical form:	AmCl3 in 0.5N HCl	
c. Carrier content:	None added	
d. Density:	1.0077	gram/ml @ 20°C.

Radioimpurities

None detected

Radioactive Daughters

None detected

Radionuclide Concentration

0.1994 µCi/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:	±2.0%
b. Random uncertainty in assay:	±0.7%
c. Random uncertainty in weighing(s):	±0.0%
d. Total uncertainty at the 99% confidence level:	±2.7%

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)

Gary A Gilmore
QUALITY CONTROL

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone Street.,
Burbank, California 91504
(818) 843 - 7000

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AA004

THIS IS A PHOTOCOPY OF THE CERTIFICATE
WHICH IS BEING MAILED TO YOU UNDER
SEPARATE COVER.

National Institute of Standards & Technology

Certificate

Standard Reference Material 4919-G
Radioactivity Standard

Radionuclide	Strontium-90
Source identification	4919-G
Source description	Solution in NIST borosilicate-glass ampoule [1]*
Solution composition	Strontium-90 plus yttrium-90 plus approximately 95 μg each of non-radioactive strontium and yttrium per gram of 1-molar hydrochloric acid [2]
Mass	Approximately 5.0 grams
Radioactivity concentration	4.514×10^5 Bq g^{-1}
Reference time	1200 EST August 1, 1990
Overall uncertainty	1.05 percent [3]
Photon-emitting impurities	None observed [4]
Alpha-particle-emitting impurities	None observed [5]
Half life	28.5 ± 0.2 years [6]
Measuring instrument	$4\pi\beta$ liquid-scintillation counter

This standard reference material was prepared in the Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899
[illegible]uary, 1991

William P. Reed, Acting Chief
Office of Standard Reference Materials

*Notes on back

9613420.0426

HA0046

THIS IS A PHOTOCOPY OF THE CERTIFICATE WHICH IS BEING MAILED TO YOU UNDER SEPARATE COVER.

National Institute of Standards & Technology

Certificate

Standard Reference Material 4919-G
Radioactivity Standard

Radionuclide	Strontium-90
Source identification	4919-G
Source description	Solution in NIST borosilicate-glass ampoule [1]*
Solution composition	Strontium-90 plus yttrium-90 plus approximately 95 μg each of non-radioactive strontium and yttrium per gram of 1-molar hydrochloric acid [2]
Mass	Approximately 5.0 grams
Radioactivity concentration	4.514×10^3 Bq g^{-1}
Reference time	1200 EST August 1, 1990
Overall uncertainty	1.05 percent [3]
Photon-emitting impurities	None observed [4]
Alpha-particle-emitting impurities	None observed [5]
Half life	28.5 ± 0.2 years [6]
Measuring instrument	$4\pi\beta$ liquid-scintillation counter

This standard reference material was prepared in the Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899
[illegible]uary, 1991

William P. Reed, Acting Chief
Office of Standard Reference Materials

*Notes on back

NOTES

(1) Approximately five milliliters of solution. Ampoule specifications:

body diameter	16.5 ± 0.5 mm
wall thickness	0.60 ± 0.04 mm
barium content	less than 2.5 percent
lead oxide content	less than 0.02 percent
other heavy elements	trace quantities

(2) Solution density is 1.014 ± 0.002 g/mL at 21.5 °C.

(3) The overall uncertainty was formed by taking three times the quadratic combination of standard deviations of the mean, or approximations thereof, for the following:

a) liquid-scintillation measurements	0.01 percent
b) gravimetric measurements	0.05 percent
c) dead time	0.10 percent
d) background	0.01 percent
e) detection efficiency	0.30 percent
f) decay-scheme data	0.10 percent
g) half life	0.01 percent
h) radionuclidic impurities	0.10 percent

(4) The limit of detection for photon-emitting impurities is:

$$0.01\ \gamma\ s^{-1}g^{-1} \text{ between 50 and 1900 keV.}$$

(5) The limit of detection for alpha-particle-emitting impurities is:

$$0.05\ \alpha\ s^{-1}g^{-1}.$$

(6) NCRP Report No. 58, 2nd Edition, February 1985, p. 365.

For further information please contact Dr. Larry Lucas at (301) 975-5546.

4919-G

9613420.0428

NOTES ON THE USE OF STANDARD REFERENCE MATERIAL 4919G, STRONTIUM-90

The activity of the strontium-90 in the ampoule is given per gram of solution. If transfers are made by volume, the density given on the certificate can be used to compute the activity per unit volume. The activity given is the strontium-90 activity only. Because the strontium-90 is in equilibrium with its yttrium-90 daughter, which is also a beta-particle emitter, the activity given should be doubled to get the corresponding total beta-particle-emission rate.

If the solution is to be used for making quantitative sources, it should be kept tightly sealed so that evaporation, and the consequent change in the radioactivity concentration, is minimized. Glass containers are best for storage.

Dilute solutions of strontium-90 are often assayed by liquid-scintillation counting. We recommend that carrier solution containing approximately 1 mg of non-radioactive strontium be added first to the liquid-scintillation cocktail. We typically use a carrier solution containing 4 mg of strontium per mL of 0.5- molar hydrochloric acid. When 0.25 mL of this solution is added to 10 mL of emulsion-type liquid-scintillation cocktail, the resulting 1 mg of strontium per vial is generally sufficient to prevent the radioactive strontium-90 from plating out on the vial walls. A set of liquid-scintillation vials that cover a range of sample-solution masses should be prepared and monitored over several days to ensure that the efficiency is constant.

The beta-particle counting efficiency will be somewhat less than unity. A correction for the loss of low-energy beta particles can be computed using the integral-discriminator-extrapolation technique (G. Goldstein, Nucleonics 23 (1965) 67) or using the liquid-scintillation efficiency-tracing technique with tritium (B.M. Coursey et al, Int. J. Radiat. Isotopes 37 (1986) 403).

The activity concentration given on the certificate is as of 1200 hours Eastern Standard Time, August 9, 1990. To convert from EST to your local time, the table given below can be used.

TO CONVERT FROM EST TO:

EDT	Add	1 hour
CDT	Same as EST	
CST	Subtract	1 hour
MDT	Subtract	1 hour
MST	Subtract	2 hours
PDT	Subtract	2 hours
PST	Subtract	3 hours
UTC	Add	5 hours

9613420.0429

AAP046

ISOTOPE VOLUME DILUTION RECORD

Isotope: Sr-90 Vendor: NIST Reference Date: 1200 EST 8-1-199

Total Activity: NA Vendor ID: SRM 4919-G Receive Date: 10-30-1991

Total wt.(g) ~5.0 g NIST traceable Y/N Cert # 4919-G t½ 28.5 ± 0.2 years

Activity UNITS/g 4.514×10^3 Bq---converted to dpm/g 2.708×10^5 Receiver's Name Jimmy Morale

---

PRIMARY DILUTION: Prepared by volume

Date: 11/19/91 Preparer's Name. Nee Van Nuyen

a: Decay corrected activity: 2.708×10^5 dpm/g (* if <100yr decay correct to preparation date)

b: Wt. of Volumetric: 60.2814 g Balance wt check done (✓)

c: Wt. Volumetric + source: 65.2000 g Diluent: 1M HCl

d: Wt. of source transfered (c-b): 4.9186 g e: Wt. of diluent + source: N/A g

f: Vol. of diluent + source: 100 mL g: Activity of dilution (a*d/e): N/A dpm/g

h: Density (e/f): N/A g/mL i: Activity by volume (g*h): 13321.54 dpm/mL

Dilution Log Book ID: 91-225-30-1 (SRM 4919 G-A) 6000.69 pCi/ml

---

Working Level Dilution: Prepared by volume

Date: 5-6-92 Preparer's Name. Joe Hutchinson

A: Decay corrected activity: 6000.69 pCi/ml ⇒ corrected activity 5757.65 ~~dpm/ml~~ (* if <100yr decay correct to preparation date)

B: Wt. of Volumetric: N/A g Balance wt check done (✓)

C: Wt. Volumetric + source: N/A g Diluent: 0.1N HNO_3

D: Wt. of source transfered: N/A g E: Wt. of diluent + source : N/A g

F: Vol. of source transferred: 1 mL G: Vol. of diluent + source : 250 mL

H: Activity of dilution (A*F/E): N/A dpm/g I: Density (E/G): N/A g/mL

I: Activity by volume (A*F/G),(H*I) or (A*D/E): ~~23.0~~ 46.0 pCi ~~dpm/mL~~

Dilution Log Book ID: 91-225-63

Log Book Transfer

Reviewed by: [signature] Date: 4/7/93

23.0 pCi/ml Sr-90
23.0 pCi/ml Y-90

9613420.0430

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	Sr-90
Parent Barcode Number	~~Yes NA~~ AA0046
Vendor or Certificate I.D. # of Parent Standard:	SRM 4919-G
Diluted Source Logbook I.D. #:	91-225-30-1
Balance Verification?:	Yes
Diluent Used:	1 M HCl

Ref Date 8/1/90

Dilution		
*Diluent:	1 M HCl	
*Density of diluent (g/ml):	NA	g/ml
a: Parent Specific Activity:	6000.65	~~pCi/g~~ pCi/ml on 8/1/90
b: Amount of Source Transferred:	0.5033	g
c: Total amount of Dilution:	124.4545	g
d: Total Volume of Dilution:	NA	ml
e: Activity of Dilution [a * b / c]:	24.27	~~pCi/g~~ pCi/mL
f: Activity of Dilution (a * b / d):	24.27	pCi/ml
Dilution Logbook I.D. #:	94-0677-20-1	

Prepared By: Joe Hutchison Preparation Date: 12/5/94

Reviewed By: Agnes Wong Review Date: 12-5-94

*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.

9613420.0431

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.

CSC 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 ± 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. Hahn

Revised 1/84

PROJECT Sr-90 9613420.0433

Notebook No. 0474

Continued From Page _____

INITIAL STANDARD DILUTION RECORD

Standard Information:

Isotope:	Sr-90	Vendor:	EPA
Activity of Standard Received:	2.7×10^4 uCi	Vendor I.D. #	94003-1
Weight of Standard Received (g):	50 g	LAL I.D. #:	AC5281
Standard Activity (pCi/g):	5.4×10^3 pCi/g	NIST Traceable ?	yes
Halflife in Years or Days:	28.6 yrs	Certificate #:	94003-1
Reference Date:	4-1-1994	Receiver's Name:	K. Free
		Date Received:	5-3-94

Primary Dilution

Balance Verification?:	yes
Diluent Used:	0.1M HCl
a: Decay Corrected Standard Activity (pCi/g):	5.4×10^3 pCi/g
b: Weight of the Source Transferred (g):	4.9670 g
c: Total diluted weight (g):	49.91 g
d: Total Diluted Volume (mL)	50 mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	537.4 pCi/g
f: Calculated Density of Solution (g/ml) [c / d]:	0.9982 g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	536.44 pCi/mL
h. Dilution Logbook I.D. #:	~~93-494-81-1~~ 93-474-82-1 CP 4/7/95

Prepared By: Agnes Wong Preparation Date: 6-15-94

Reviewed By: Joe Hutchison Review Date: 6/30/94

Purity/Cross Check Performed By: _____ Check Date: _____

8/18/94

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Signed Date Signed Date

9613420.0434

PROJECT Sr-90

Notebook No. _____

Continued From Page _____

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

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

Dilution	
*Diluent:	0.1 M HCl
*Density of diluent (g/ml):	N/A
a: Parent Specific Activity:	536.44 pCi/ml
b: Amount of Source Transferred:	5.0018 g
c: Total amount of Dilution:	100.20 g
d: Total Volume of Dilution:	N/A
e: Activity of Dilution (a * b / c):	N/A
f: Activity of Dilution (a * b / d):	26.78 pCi/ml
Dilution Logbook I.D. #:	94-677-44-1

Prepared By: Agnes Wong Preparation Date: 3-2-95

Reviewed By: Joe Hitt Review Date: 3/3/95

*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.

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Signed _____ Date _____ Signed Agnes Wong Date 3-3-95

Rec'd 11/18/92

CERTIFICATE OF CALIBRATION
BETA STANDARD SOLUTION

AA0114

Radionuclide	C-14	Customer:	LOCKHEED ENVIRONMENTAL	
Half Life:	5730 ± 40 years	P.O.No.:	06LAB2959	
Catalog No.:	7014	Reference Date:	November 15 1992	12:00 PST.
Source No.:	407-124-2	Contained Radioactivity:	1.093	µCi.
		Contained Radioactivity:	40.4	kBq

Description of Solution

a. Mass of solution: 5.0242 grams.

b. Chemical form: Benzoic Acid Carboxy-C-14 in 0.1N NaOH

c. Carrier content: None added

d. Density: 1.002 g/ml @ 20°C.

Radioimpurities None detected

Radioactive Daughters None

Radionuclide Concentration 0.218 µCi/g

Method of Calibration

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

Uncertainty of Measurement

a. Systematic uncertainty in instrument calibration: ± 1.8%

b. Random uncertainty in assay: ± 0.5%

c. Random uncertainty in weighing(s): ± 1.0%

d. Total uncertainty at the 99% confidence level: ± 2.2%

NIST Traceability

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

Notes

1. Nuclear data were taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.
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).

Anna U. Uma

QUALITY CONTROL

Nov. 17, 1992

Date Signed

ISOTOPE PRODUCTS LABORATORIES
1800 North Keystone Street
Burbank, California 91504
(818) 843 - 7000

Notebook No. 474

AA 114

ISOTOPE WEIGHT DILUTION RECORD

Isotope: C-14

Vendor: IPL

Total Received Activity: 1.093 µci

Vendor ID: 407-124-2

Wt. Received: 5.024 g

NIST Traceable (Y) / N Cert. # Implicitly

Activity in Units/g: .2175 µci/g

Reference Date: 11-15-92

Activity converted (dpm/g): 482,954 dpm/g

Receive Date: 11/18/92

Halflife (Yrs or days) t½ = 5730 ± 40 years

Receiver's Name: Jimmy Morales

PRIMARY DILUTION:

Balance wt. check done (✓)

a: Source activity: 482,954 dpm/g * (if t½ = <100yr decay to prep. date)

b: Wt. of Source transfered: 4.90951 g

Diluent used: 0.1 N NaOH

c: Total diluted weight: 116.53 g

d: Activity of dilution (a*b/c): 20,347 dpm/g ± 2.2%

e: Calculated density of solution: 1.002 g/mL (4M HNO_3 = 1.1294 ± .0007 g/mL)

f: Activity by volume = (d*e): 20,388 dpm/mL

Dilution Log Book ID: LAL-93-474-23-1 ✓

Preparation Date: 10/27/93 Preparer's Name. M

SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done (✓)

Log Book ID of source being diluted:

a: Source activity: dpm/g * (if t½ = <100yr decay to prep. date)

b: Wt. of Source transfered: g

Diluent used:

c: Total diluted weight: g

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

e: Calculated density of solution: g/mL (4M HNO_3 = 1.1294 ± .0007 g/mL)

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

Dilution Log Book ID:

N/A

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Signed	Date	Reviewed by Signed	Date
RGS	10/27/93		

9613420.0437

INITIAL STANDARD DILUTION RECORD

Standard Information:			
Isotope:	C-14	Vendor:	Isotope Product
Activity of Standard Received:	1.09 uCi	Vendor I.D. #	
Weight of Standard Received (g):	5.0242 g	LAL I.D. #:	AA0114
Standard Activity (pCi/g):	2.17E+05 pCi/g	NIST Traceable ?	Yes
Halflife in Years or Days:	5730 yrs	Certificate #:	407-124-2
Reference Date:	11/15/92	Preparer's Name:	Mark Young
		Date Received:	11/18/92

Primary Dilution	
Balance Verification?:	Yes
Diluent Used:	0.1 N NaOH
a: Decay Corrected Standard Activity (pCi/g):	2.17E+05 pCi/g
b: Weight of the Source Transferred (g):	4.90951 g
c: Total diluted weight (g):	116.53 g
d: Total Diluted Volume (mL)	116.3 mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	9.139E+03 pCi/g
f: Calculated Density of Solution (g/ml) [c / d]:	1.0020 g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	9.157E+03 pCi/mL
h. Dilution Logbook I.D. #:	LAL-93-0474-23-1

Prepared By: _____ Preparation Date: 10/27/93

Reviewed By: _____ Review Date: _____

Purity/Cross Check Performed By: _____ Check Date: _____

9613420.0438

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	C-14
Parent Barcode Number	AA0114
Vendor or Certificate I.D. # of Parent Standard:	407-124-2
Diluted Source Logbook I.D. #:	LAL-93-0474-23-1
Balance Verification?:	Yes
Diluent Used:	0.1 N NaOH

Dilution		
*Diluent:	Nanopure w/ 1 mg/ml formaldehyde	
*Density of diluent (g/ml):	1.0006	g/ml
a: Parent Specific Activity:	9.14E+03	pCi/g
b: Amount of Source Transferred:	0.70	g
c: Total amount of Dilution:	250.14	g
d: Total Volume of Dilution:	250	ml
e: Activity of Dilution [a * b / c]:	2.57E+01	pCi/g
f: Activity of Dilution (a * b / d):	2.58E+01	pCi/ml
Dilution Logbook I.D. #:	LAL-94-0677-18-1	

Prepared By: Agnes Wong Preparation Date: 11/19/94

Preparer Signature: _____

Reviewed By: _____ Review Date: _____

Reviewer Signature: _____

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*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.

9613420.0439

AA0114

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	C-14
Parent Barcode Number	AA0114
Vendor or Certificate I.D. # of Parent Standard:	
Diluted Source Logbook I.D. #:	93-474-23-1
Balance Verification?:	yes
Diluent Used:	DDI water in 1mg/ml formaldehyde

Dilution		
*Diluent:	Nanopure water with 1mg/ml formaldehyde	
*Density of diluent (g/ml):	N/A	g/ml
a: Parent Specific Activity: 9267.27	~~20,338~~	~~pCi/g~~ the 11-19-94 pCi/ml
b: Amount of Source Transferred:	0.7046	g
c: Total amount of Dilution:	250.14	g
d: Total Volume of Dilution:	N/A	ml
e: Activity of Dilution (a * b / c):	N/A	pCi/g
f: Activity of Dilution (a * b / d):	26.10	pCi/ml
Dilution Logbook I.D. #:	94-677-18-1 ✓	

Prepared By: Agnes Wong Preparation Date: 11-19-94

Reviewed By: Joe Hutchinson Review Date: 12/12/94

*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.

9613420.0440

U. S. Department of Commerce
Malcolm Baldrige
Secretary
National Bureau of Standards
Ernest Ambler, Director

AA00128
THIS IS A PHOTOCOPY OF THE CERTIFICATE
REC'D 3/29/9
WHICH IS BEING MAILED TO YOU UNDER
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 μg of Tc(VII) as potassium pertechnetate per gram of approximately 0.001 molar KOH (1)*
Mass	4.910 grams
Radioactivity concentration	3.759×10^4 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	$(2.111 \pm 0.036) \times 10^5$ years (6)

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

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Washington, D.C. 20234
November, 1982

George A. Uriano, Chief
Office of Standard Reference Materials

*Notes on back

FOOTNOTES

(1) The $KTcO_4$ was prepared by M.W. Heitzmann of the U.S. Food and Drug Administration from NH_4TcO_4 obtained from Oak Ridge National Laboratory. The solution density is 0.998 g cm^{-3} at 21.8°C, and the $KTcO_4$ concentration is 0.00060 molar. The UV spectrum of this material exhibited only the characteristic doublets at 243 and 287 nm [A].≠

(2) Two liquid-scintillation counters were calibrated using the method of J.A.B. Gibson [B,C,D]. Three different radionuclides were used as the standard: ^3H, ^{14}C, and ^{60}Co. The results obtained using the three radionuclides agreed to within 0.32 percent. The ^{14}C result was used for confirmation only. The value given here is the unweighted mean of the ^3H and ^{60}Co results.

(3) Half the 99-percent confidence interval for the average of the ^3H result and the ^{60}Co result. The standard deviation of the mean of the ^3H result is 0.15 percent based on 6 degrees of freedom, and the standard deviation of the mean of the ^{60}Co result is 0.09 percent based on 9 degrees of freedom.

(4) The systematic uncertainty is the average of that for the ^3H result, 1.20 percent, and that for the ^{60}Co result, 1.49 percent. These values are linear sums of estimated upper limits of uncertainties due to the following:

	^3H	^{60}Co
a) reference material for standard radionuclide	0.63	0.68
b) source preparation	0.07	0.17
c) theoretical model	0.30	0.20
d) gamma-ray contribution to beta-particle detector		0.24
e) quenching	0.10	0.10
f) interpolation from calibration curve	0.10	0.10
	1.20	1.49

(5) The master solution from which these standards were prepared was examined with germanium gamma-ray spectrometers and no impurity was found. Limits of detection as a ratio of gamma-ray-emission rate to technetium-99 activity are

1×10^{-6} between 90 and 300 keV
1×10^{-7} between 300 and 1900 keV.

(6) NBS-measured half life based on the formula $T_{\frac{1}{2}} = N \ln(2)/A$, where N is the number of atoms, computed using an atomic mass for technetium-99 of 98.906254 ± 0.000002 grams and the gravimetrically determined mass of technetium-99, and A is the activity determined by liquid-scintillation counting. The value recommended by the Oak Ridge Nuclear Data Project is $(2.13 \pm 0.05) \times 10^5$ years. [E]

≠ References on last page

The following individuals and organizations contributed to the characterization of this Standard Reference Material.

J.A.B. Gibson
Atomic Energy Research Establishment
Environmental and Medical Sciences Division
Harwell
United Kingdom

M.W. Heitzmann
U.S. Food and Drug Administration
Division of Drug Chemistry
Washington, D.C.

J.C. Leak
U.S. Food and Drug Administration
Division of Oncology and
Radiopharmaceutical Drug Products
Rockville, MD

For further information please contact Dr. Bert M. Coursey at (301) 921-2383.

REFERENCES

A. Boyd, G.E., J. Chem. Ed., 36, 3 (1959).

B. Gale, H.J. and Gibson, J.A.B., Atomic Energy Research Establishment Report AERE-R5067 (1965), Harwell, United Kingdom.

C. Gibson, J.A.B. and Marshall, M., Int. J. Appl. Radiat. Isotopes, 23, 321 (1972).

D. Gibson, J.A.B., Computed counting efficiencies as a function of merit figure for 14 beta-particle-emitting radionuclides (July, 1980). Unpublished data.

E. Kocher, D.C., Radioactive Decay Data Tables DOC/TIC-11026, p. 108 (1981). Available from NTIS, Springfield, VA.

9613420.0443

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PROJE

Notebook No. Ø355

ISOTOPE WEIGHT DILUTION RECORD

Isotope: Tc-99 Vendor: NIST

Total Received Activity: 1.85E5 Bq Vendor ID: SRM 4288.

Wt. Received: 4.91 (in 0.001 M KOH) NIST Traceable Y / N Source Cert. # 4288-83

Activity in Units/g: 3.759 X10^4 Bq/g Reference Date: NOV 1982

x 60/2.22 = 1.016 E6 pci/g

Activity converted (dpm/g): 4.988 X10^6 pci/g ~~dpm/g~~ Total Receive Date: ~~3-29-92~~ AW 1-23-93 3-30-1992

Halflife (Yrs or days) t½ = 2.111 E5 yrs Receiver's Name: J. Morales

PRIMARY DILUTION: Balance wt. check done (✓)

a: Source activity: 1.016 E6 pci/g ~~dpm/g~~ rgs (if t½ = <100yr decay to prep. date)

b: Wt. of Source transfered: 4.8698 g

Barcode AA0128 Diluted

Diluent used: 0.1 m NH4OH

c: Total diluted weight: 146.81 g

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

100mL = 99.56g

e: Calculated density of solution: .9956 g/mL (4M HNO3 = 1.1294 ± .0007 g/mL)

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

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

Preparation Date: 6/16/93 Preparer's Name: RG Swoboda

U.S. Department of Commerce
National Institute of Standards and Technology AA0128
^{99}Tc Radioactivity Standard
Amount 3.759 x 10^4 Bq g^{-1}
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 pci/mL ~~dpm/g~~ rgs (if t½ = <100yr decay to prep. date)

b: Wt. of Source transfered: 2.3211 g

Diluent used: 0.1 m NH4OH

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 HNO3 = 1.1294 ± .0007 g/mL)

f: Activity by volume = (d*e): 1083 pci/mL ~~dpm/mL~~ rgs

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

Preparer's Name: RG Swoboda Preparation Date: 6/16/93

Reviewed By: Raymond Wong Review Date: 6/16/93

RG Swoboda 6/16/93

Signed Date Signed Date

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9613420.0444

PROJECT Tc-99

Notebook No. _____

Continued From Page _____

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	Tc-99
Parent Barcode Number	AA0128
Vendor or Certificate I.D. # of Parent Standard:	SRM 4288
Diluted Source Logbook I.D. #:	92-353-100-1
Balance Verification?:	yes
Diluent Used:	0.1M NH4OH

Dilution	
*Diluent:	0.1M NH4OH
*Density of diluent (g/ml):	N/A
a: Parent Specific Activity:	3.355E +4 pCi/ml
b: Amount of Source Transferred:	38.2586 g
c: Total amount of Dilution:	128.41 g
d: Total Volume of Dilution:	N/A
e: Activity of Dilution (a * b / c):	N/A
f: Activity of Dilution (a * b / d):	9995.92 pCi/ml
Dilution Logbook I.D. #:	94-677-78-1

Prepared By: Agnes Wong Preparation Date: 9-12-95

Reviewed By: [illegible] Review Date: 9/14/95

*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.

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Signed _____ Date _____ Signed Agnes Wong 9-17-95 Date _____

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	Tc-99
Parent Barcode Number	AA0128
Vendor or Certificate I.D. # of Parent Standard:	SRM 4288
Diluted Source Logbook I.D. #:	94-677-78-1
Balance Verification?:	yes
Diluent Used:	0.1 M NH4OH

Dilution	
*Diluent:	0.1M NH4OH
*Density of diluent (g/ml):	N/A
a: Parent Specific Activity:	9995.92 pCi/ml
b: Amount of Source Transferred:	2.9838 g
c: Total amount of Dilution:	254.05 g
d: Total Volume of Dilution:	N/A
e: Activity of Dilution (a * b / c):	N/A
f: Activity of Dilution (a * b / d):	117.40 pCi/ml as of 11-1982
Dilution Logbook I.D. #:	94-677-79-1

Prepared By: Agnes Wong Preparation Date: 9-12-95

Reviewed By: [illegible] Review Date: 9/14/95

*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.

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Agnes Wong 9-17-95

Signed	Date	Signed	Date

9613420.0446

ACS244

RECEIVED 11/25/95 RKS

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

Calibration Certificate

Description

Principal radionuclide: Tritium (H-3) Half-life: 12.43 years

Nominal activity: 110 nano curies

Nominal volume: 5 ml in ampoule/bottle number: 2606-1

Measurement Activity of principal radionuclide

Activity per gram of this solution

21.9 nano curies of Tritium

at 0400 hours PST on June 3, 1992

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

curies Per gram

of the daughter nuclide

Total mass of this solution

APPROX. 5.0 grams

Method of measurement

The activity of the primary solution and this dilution were measured by liquid scintillation counting.

Counting efficiencies for both standardizations were determined by counting solutions directly traceable to the National Institute of Standards & Technology (NIST).

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 December 1999

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) none	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 ± 0.4 %

(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

+2.9 % or -2.9 %

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 +4.3 %, -4.3 % 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).

Tritium decays 100 percent by beta emission. The maximum energy is 18.6 Kev, the average is 5.68 Kev.

Chemical Composition of Solution

Carrier content per gram of solution:

100 percent H_2O

Other components:

Barium less than 0.004 perc
Lead less than $3x10^{-5}$ perce

Preservative:

Remarks

Date Certificate Prepared June 17, 1992

Approval Signature George Dilleck

9613420.0448

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

REPORT OF TRACEABILITY

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

Radionuclide	Hydrogen-3
Source identification	2606-1, prepared by EMSL
Source description	Liquid in 5-mL flame-sealed glass ampoule
Source mass	Approximately 5.0 grams
Source composition	Hydrogen-3 in water
Reference time	0700 EST June 3, 1992

	NIST DATA	EMSL DATA
Radioactivity concentration	810.5 Bq g^{-1}	810.3 Bq g^{-1}
Expanded uncertainty	0.64 percent [1,2]*	4.3 percent [3]
Photon-emitting impurities	None observed [4]	None observed
Measuring instrument	$4\pi\beta$ liquid-scintillation counters calibrated with SRM 4926D	Liquid-scintillation counting
Half life	12.43 ± 0.05 years [5]	
Difference from NIST		-0.05 percent [6]

For the Director,

J.M. Robin Hutchinson, Acting Group Leader
Radioactivity Group
Physics Laboratory

Gaithersburg, MD 20899
January 1994

*Notes on next page

NOTES

(1) The uncertainty analysis methodology and nomenclature used for the reported uncertainties are based on uniform NIST guidelines and are compatible with those adopted by the principal international metrology standardization bodies [cf., B.N. Taylor and C.E. Kuyatt, *NIST Technical Note 1129* (1993)].

(2) The combined standard uncertainty, u_c = 0.32 percent, is the quadratic combination of the standard deviation (or standard deviation of the mean where appropriate), or approximations thereof, for the following component uncertainties:

a)	11 liquid-scintillation measurements on each of 4 vials	0.11 percent
b)	gravimetric	0.05 percent
c)	calibration of SRM 4926D	0.29 percent
d)	background	0.00 percent
e)	half life	0.03 percent

The expanded uncertainty, U = 0.64 percent, is obtained by multiplying u_c by a coverage factor of k = 2 and is assumed to provide an uncertainty interval of at least 95% confidence.

(3) Overall uncertainty reported by EMSL.

(4) The limit of detection for photon-emitting impurities is:

$0.08\ \gamma\ s^{-1}g^{-1}$ for energies between 90 and 2700 keV.

(5) Unterweger, M.P., Coursey, B.M., Schima, F.J., and Mann, W.B., Int. J. Appl. Radiat. Isot., 31, 611 (1980).

(6) This result demonstrates the traceability of EMSL to NIST, for this measurement, to within five percent as specified in the appendix, Traceability Studies, of the EPA-NIST interagency agreement of April 1976, as amended.

For further information call Larry Lucas at 301-975-5546 or Jeffrey Cessna at 301-975-5539.

9613420.0450

PROJECT H-3

Notebook No. 0721

Continued From Page NA

INITIAL STANDARD DILUTION RECORD

Standard Information:

Isotope:	H-3	Vendor:	EPA
Activity of Standard Received:	.11 uCi	~~Vendor I.D. #~~ 2/7/95	
Weight of Standard Received (g):	5 g	LAL I.D. #:	AC5299
Standard Activity (pCi/g):	21.9 ~~pCi/g~~ nCi/g 2/7/95	NIST Traceable ?	Yes
Halflife in Years or Days:	12.43 yrs	Certificate #:	2606-1
Reference Date:	0400, 6/3/92	Receiver's Name:	Kevin Free
		Date Received:	1/25/95

Primary Dilution

Balance Verification?:	Yes	
Diluent Used:	EPA Distilled ASTM Type II Water (Deed Water)	
a: Decay Corrected Standard Activity (pCi/g):	~~4.939~~ 21.9 nCi/g 2/7/95 pCi/g on 6/3/92	
b: Weight of the Source Transferred (g):	4.939	g
c: Total diluted weight (g):	49.377	g
d: Total Diluted Volume (mL)	~~50~~ 49.5 2/7/95	mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	2190	pCi/g
f: ~~Calculated~~ Known Density of Solution (g/ml) [c / d]:	0.99777	g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	2190	pCi/mL on 6/3/92
h. Dilution Logbook I.D. #:	LAL-95-0721-1	

Carry Pinewoy

Prepared By: C. Pinewoy J. Hutchinson / J. Morales / C. Poniewaz Preparation Date: 2/7/95

Reviewed By: Joe Hutchinson Review Date: 2/7/95

Purity/Cross Check Performed By: _____ Check Date: _____

159

Signed _____ Date _____ CP 5/8/95 Signed _____ Date _____

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information

Isotope:	H-3 ~~LES~~ MS
Parent Barcode Number	AC5299
Vendor or Certificate I.D. # of Parent Standard:	
Diluted Source Logbook I.D. #:	95-0721-1
Balance Verification?:	Yes
Diluent Used:	Dead Water

Dilution

*Diluent:	Low Bkg Water	
*Density of diluent (g/ml):	1	g/ml
a: Parent Specific Activity:	2190	pCi/g
b: Amount of Source Transferred:	10.0	g
c: Total amount of Dilution:	100	g
d: Total Volume of Dilution:	100	ml
e: Activity of Dilution (a * b / c):		pCi/g
f: Activity of Dilution (a * b / d):	219	pCi/ml on 6/13/92
Dilution Logbook I.D. #:	94-0677-70	

Prepared By: Joe Hutchison Preparation Date: 6/23/95

Reviewed By: [illegible] Review Date: 6/23/95

*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.

Read and Understood By

Signed	Date	Signed	Date

9613420.0452

ACS 271

RECEIVED 11/25/95 RKC

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

Calibration Certificate

Description

Principal radionuclide: Tritium (H-3) Half-life: 12.43 years

Nominal activity: 110 nano curies

Nominal volume: 5 ml in ampoule/bottle number: 2606-1

Measurement Activity of principal radionuclide

Activity per gram of this solution

21.9 nano curies of Tritium

at 0400 hours PST on June 3, 1992

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

curies Per gram

of the daughter nuclide

Total mass of this solution

APPROX. 5.0 grams

Method of measurement

The activity of the primary solution and this dilution were measured by liquid scintillation counting.

Counting efficiencies for both standardizations were determined by counting solutions directly traceable to the National Institute of Standards & Technology (NIST).

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 December 1999

9613420.0453

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

REPORT OF TRACEABILITY

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

Radionuclide	Hydrogen-3
Source identification	2606-1, prepared by EMSL
Source description	Liquid in 5-mL flame-sealed glass ampoule
Source mass	Approximately 5.0 grams
Source composition	Hydrogen-3 in water
Reference time	0700 EST June 3, 1992

	NIST DATA	EMSL DATA
Radioactivity concentration	810.5 Bq g^{-1}	810.3 Bq g^{-1}
Expanded uncertainty	0.64 percent [1,2]*	4.3 percent [3]
Photon-emitting impurities	None observed [4]	None observed
Measuring instrument	$4\pi\beta$ liquid-scintillation counters calibrated with SRM 4926D	Liquid-scintillation counting
Half life	12.43 ± 0.05 years [5]	
Difference from NIST		-0.05 percent [6]

For the Director,

J.M. Robin Hutchinson, Acting Group Leader
Radioactivity Group
Physics Laboratory

Gaithersburg, MD 20899
January 1994

*Notes on next page

PROJECT H-3 9613420.0454

Notebook No. 0721

Continued From Page NA

INITIAL STANDARD DILUTION RECORD

Standard Information:

Isotope:	H-3	Vendor:	EPA
Activity of Standard Received:	.11 uCi	~~Vendor I.D. #~~ 2/7/95	—
Weight of Standard Received (g):	5 g	LAL I.D. #:	AC 5299
Standard Activity (pCi/g):	21.9 ~~pCi/g~~ nCi/g 2/7/95	NIST Traceable ?	Yes
Halflife in Years or Days:	12.43 yrs	Certificate #:	2606-1
Reference Date:	0400, 6/3/92	Receiver's Name:	Kevin Free
		Date Received:	1/25/95

Primary Dilution

Balance Verification?:	Yes	
Diluent Used:	EPA Distilled ASTM Type II Water (Deed Water)	
a: Decay Corrected Standard Activity (pCi/g):	~~4.939~~ 21.9 nCi/g 2/7/95	pCi/g on 6/3/92
b: Weight of the Source Transferred (g):	4.939	g
c: Total diluted weight (g):	49.377	g
d: Total Diluted Volume (mL)	~~50~~ 49.5 2/7/95	mL
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	2190	pCi/g
f: ~~Calculated~~ Known Density of Solution (g/ml) [c / d]:	0.99777	g/mL
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	2190	pCi/mL on 6/3/92
h. Dilution Logbook I.D. #:	LAL-95-0721-1	

Prepared By: ~~Joe Hutchinson~~ J. Morales / C. Ponieweg Preparation Date: 2/7/95

Reviewed By: Joe Hutchinson Review Date: 2/7/95

Purity/Cross Check Performed By: _____ Check Date: _____

163

Signed _____ Date _____ CP 5/8/95 Signed _____ Date _____

9613420.0455

Notebook No. 0721

•PROJECT H-3 LCS

Continued From Page

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information

Isotope:	H-3 LCS
Parent Barcode Number	AC 5299
Vendor or Certificate I.D. # of Parent Standard:	2606-1
Diluted Source Logbook I.D. #:	LAL-95-721-1
Balance Verification?:	Yes
Diluent Used:	Deionized

Dilution

*Diluent:	Deep Well Water	
*Density of diluent (g/ml):	0.9977	g/ml
a: Parent Specific Activity:	2190	pCi/~~g~~ mL
b: Amount of Source Transferred:	5.0	~~g~~ mL
c: Total amount of Dilution:	~~4000 g~~ 3995 mL 11/1/95	
d: Total Volume of Dilution:	4000	ml
e: Activity of Dilution (a * b / c):	2.74	pCi/~~g~~ mL on 6/3/92
f: Activity of Dilution (a * b / d):	2.74	pCi/ml on 6/3/92
Dilution Logbook I.D. #:	95-721-16-1	

Prepared By: Joe Hutchison Preparation Date: 11/1/95

Reviewed By: _____ Review Date: _____

*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.

Read and Understood By

Signed	Date	Signed	Date

9613420.0456

Kearney/Centaur Division
A.T. Kearney, Inc.
2952 George Washington Way
Richland, Washington 99352
509 375 5667
Facsimile 509 375 5151

Management Consultants

AT KEARNEY

JAN 1996 RECEIVED Validation Log In

5 January 1996

Ms. Joan Kessner
Bechtel Hanford Incorporated
Post Office Box 969 MSIN H4-23
Richland, Washington 99352

Dear Ms. Kessner:

Enclosed are the Radiochemistry, Wet Chemistry, and Inorganic reports for SDGs No. W0769-QES and LK5628-LAS.

Sincerely,

R. Bruce Christian
Consultant

cc: J. Duncan - CH2
J. Goode - ATK

9613420.0457

JAN 1996
RECEIVED
Validation
Log In

Date: January 5, 1995
To: Bechtel Hanford, Inc. (technical representative)
From: A.T. Kearney, Inc.
Project: 100-BC-5 Groundwater Sampling - Round 9
Subject: Radiochemistry - Data Package No. LK5628-LAS (SDG No. LK5628)

INTRODUCTION

This memo presents the results of data validation on Summary Data Package No. LK5628-LAS prepared by Lockheed Analytical Services (LAS). A list of samples validated along with the analyses reported and the method of analysis is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analysis
B0GNW7	10/16/95	Water	C	See Note 1
B0GNW9	10/17/95	Water	C	See Note 1

Note 1. Gross alpha/beta, strontium-90, technetium-99, carbon-14 and tritium.

Data validation was conducted in accordance with the WHC statement of work (WHC 1994) and validation procedures (WHC 1992b). Appendices 1 through 5 provide the following information as indicated below:

Appendix 1. Glossary of Data Reporting Qualifiers
Appendix 2. Summary of Data Qualification
Appendix 3. Qualified Data Summary and Annotated Laboratory Reports
Appendix 4. Laboratory Narrative and Chain-of-Custody Documentation
Appendix 5. Data Validation Supporting Documentation

DATA QUALITY OBJECTIVES

- **Holding Times**

  Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The maximum holding time for radiochemical analyses is six months.

  All holding times were acceptable.

- **Instrument Calibration and Performance**

Instrument calibration is performed to establish that the counters used to determine radionuclide activities are capable of producing acceptable and reliable analytical data. Each counting system must be factory calibrated at installation and after any maintenance or repair. Calibration consists of an instrument efficiency determination for each applicable radionuclide. Continuing calibration checks are performed to verify that instrument performance is stable and reproducible.

Initial and continuing calibrations are not reviewed under Level C validation.

- **Blanks**

Laboratory Blanks

Blank samples are analyzed to determine if positive results are due to laboratory reagent, sample container, or detector contamination. If blank analysis results indicate the presence of an analyte above the MDA, the following qualifiers are applied: All positive sample results less than five times the highest blank concentration are qualified as estimates and flagged "J"; sample results below the MDA are elevated to the MDA and qualified as undetected and flagged "U"; sample results above the MDA and greater than five times the highest blank concentration are not qualified.

All blank results were acceptable.

- **Accuracy**

Accuracy is evaluated by analyzing distilled water samples spiked with known quantities of radionuclides. The sample activity as determined by analysis is compared to the known activity to assess accuracy. The acceptable laboratory control sample recovery range is 70 to 130 percent, and 60 to 140 percent for matrix spike samples. Spike sample results outside the above ranges resulted in associated sample results being qualified as estimates, rejected, or not qualified, depending on the activity of the individual sample.

Due to the lack of a matrix spike analysis, all technetium-99 results have been qualified as estimates and flagged "J/UJ".

All accuracy results were acceptable.

- **Precision**

Duplicate Analysis

Analytical precision is expressed by the RPD between the recoveries of duplicate matrix spike analyses performed on a sample. Precision may also be assessed using unspiked duplicate sample analyses. If both sample and replicate activities are greater than five times the CRDL and the RPD is less than 35 percent for soil samples and 20 percent for water samples, the results are acceptable. If either activities are less than five times the CRDL, a control limit of less than or equal to two times the CRDL is used for soil samples and less than or equal to the CRDL for water samples. If either the original or replicate value is below the CRDL, the applicable control limits are less than or equal to the CRDL for water samples and less than or equal to two times the CRDL for soil samples. If the RPD is outside the applicable control limit, associated results are qualified as estimates and flagged "J".

All precision results were acceptable.

Field Split Samples

Two split samples were submitted to LAS as shown below:

Sample Number	Split Sample Number	Well Location
B0GNQ1	B0GNW7	199-B2-12
B0GNS3	B0GNW9	199-B5-1

Samples B0GNQ1 and B0GNS3 were analyzed by Quanterra Environmental Services and reported with SDG W0769-QES. The split sample results were compared using the validation guidelines for determining the RPD between a sample and its duplicate. All results fell within the required control limits.

- **Completeness**

Data Package No. LK5628-LAS (SDG No. LK5628) was submitted for validation and verified for completeness. The completion rate was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES.

Due to the lack of a matrix spike analysis, all technetium-99 results have been qualified as estimates and flagged "J/UJ". Data flagged "J/UJ" indicates that the associated concentration is an estimate, but under WHC guidelines, the data may be usable for decision-making purposes.

REFERENCES

EPA, 1987, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, Environmental Protection Agency, Washington, D.C.

EPA, 1988a, *EPA Contract Laboratory Program Statement of Work for Organics Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988c, *EPA Contract Laboratory Program Statement of Work for Inorganics Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988d, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990, *EPA Contract Laboratory Program Statement of Work for Inorganic Analyses, Multi-media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991, *EPA Contract Laboratory Program Statement of Work for Organics Analyses, Multi-Media, Multi-Concentration*, Environmental Protection Agency, Washington, D.C.

WHC, 1992a, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, October 1993.

WHC, 1992b, *Data Validation Procedure for Radiological Analyses*, WHC-SD-EN-SPP-001, Rev. 2, Westinghouse Hanford Company, 1993.

9613420.0461

EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, U.S. Environmental Protection Agency, Washington, D.C.

9613420.0462

Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers which may be applied by data validators in compliance with WHC procedures are as follows:

U - Indicates the compound or analyte was analyzed for and not detected above the minimum detectable activity (MDA) in the sample. The value reported is the sample result corrected for sample dilution and moisture content by the laboratory. The data is usable for decision making purposes.

UJ - Indicates the compound or analyte was analyzed for and not detected at concentrations above the minimum detectable activity (MDA) in the sample. Due to a QC deficiency identified during the data validation, the associated quantitation limit is an estimate, but is usable for decision making purposes.

J - Indicates the compound or analyte was analyzed for and detected. Due to a QC deficiency identified during the data validation, the associated concentration is an estimate, but the data are usable for decision-making purposes.

R - Indicates the compound or analyte was analyzed for, detected, and due to an identified QC deficiency, the data are unusable.

UR - Indicates the compound or analyte was analyzed for and not detected in the sample. Additionally, the data is unusable due to an identified QC deficiency.

9613420.0464

Appendix 2

Summary of Data Qualification

DATA QUALIFICATION SUMMARY

SDG: LK5628-LAS	REVIEWER: RBC	DATE: 01/05/96	PAGE 1 OF 1
COMMENTS:			
COMPOUND	QUALIFIER	SAMPLES AFFECTED	REASON
Technetium-99	UJ	B0GNW7	No matrix spike analysis
Technetium-99	J	B0GNW9	No matrix spike analysis

9613420.0466

Appendix 3

Qualified Data Summary and Annotated Laboratory Reports

RADIOCHEMISTRY ANALYSIS, WATER MATRIX (pCi/l)

Project: BECHTEL-HANFORD																						
Laboratory: Lockheed																						
Case	SDG: LK5268																					
Sample Number		B0GNW7		B0GNW9																		
Location		199-B2-12		199-B5-1																		
Remarks		Split		Split																		
Sample Date		10/16/95		10/17/95																		
Radiochemistry Analysis	CRDL	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Gross Alpha	3	1.1	U	1.2	U																
Gross Beta	4	3.8		34.5																	
Strontium-90	2	0.02	U	1.44																	
Technetium-99	15	-3.9	UJ	38.7	J																
Carbon-14	200	-31.	U	34.	U																
Tritium	400	-120	U	2210																	

RBC 1/4/96

000011

96134200467

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW7 | LAL Sample ID: L5628-6

Date Collected: 16-OCT-95 | Date Received: 18-OCT-95

Matrix: Water | Login Number: L5628

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	02-NOV-95	GR ALP/BETA LAL-0060_29082	1.1	1.3	2.1	U	pCi/L
Gross Beta	02-NOV-95	GR ALP/BETA LAL-0060_29082	3.8	1.5	2.2		pCi/L
Total radio-strontium	13-NOV-95	SR-90 LAL-0196_29083	0.02	0.57	0.99	U	pCi/L

JRM
1/4/96

075/96

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW7 | LAL Sample ID: L5628-11

Date Collected: 16-OCT-95 | Date Received: 18-OCT-95

Matrix: Water | Login Number: L5628

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Tc-99	17-NOV-95	TC-99 LAL-0169_30338	-3.9	4.3	7.8	UJ	pCi/L

RKC
1/4/96

~~076~~

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW7 | LAL Sample ID: L5628-15

Date Collected: 16-OCT-95 | Date Received: 18-OCT-95

Matrix: Water | Login Number: L5628

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
C-14	27-OCT-95	C-14 LAL-0209_29087	-31.	82.	110	U	pCi/L
H-3	21-NOV-95	TRITIUM(H3) LAL-0066_29086	-120	210	280	U	pCi/L

JRK
1/4/96

~~077~~

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW9 | LAL Sample ID: L5644-6

Date Collected: 17-OCT-95 | Date Received: 19-OCT-95

Matrix: Water | Login Number: L5644

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	02-NOV-95	GR ALP/BETA LAL-0060_29082	1.2	1.5	2.5	e U	pCi/L
Gross Beta	02-NOV-95	GR ALP/BETA LAL-0060_29082	34.5	3.2	2.2		pCi/L
Total radio-strontium	13-NOV-95	SR-90 LAL-0196_29083	1.44	0.67	1.0		pCi/L

1/4/95
PRC

078 PRC

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW9 | LAL Sample ID: L5644-11

Date Collected: 17-OCT-95 | Date Received: 19-OCT-95

Matrix: Water | Login Number: L5644

SDG: LK5628

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Tc-99	17-NOV-95	TC-99 LAL-0169_30338	38.7	7.1	8.3	J	pCi/L

NKC
1/4/96

~~079~~

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: BOGNW9 | LAL Sample ID: L5644-15

Date Collected: 17-OCT-95 | Date Received: 19-OCT-95

Matrix: Water | Login Number: L5644

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
C-14	27-OCT-95	C-14 LAL-0209_29087	34.	87.	110	U	pCi/L
H-3	21-NOV-95	TRITIUM(H3) LAL-0066_29086	2210	400	280		pCi/L

RBC
1/4/96

9613420.0474

Appendix 4

Laboratory Narrative and Chain-of-Custody Documentation

9613420.0475

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

November 29, 1995

DEC 1995
RECEIVED
Data
Log In

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

RE:	Log-in No.:	L5628/L5644
	Quotation No.:	Q400000-B
	SAF:	B95-103
	Document File No.:	1018596/1019596
	BHI Document File No.:	286/287
	SDG No.:	LK5628

L5628- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 18 October 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.

L5644- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 19 October 1995. The temperature of the cooler upon receipt was 4°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) 375-4741.

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 1

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,

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 Gross Alpha Beta

The gross alpha beta analysis was performed using standard operating procedure (SOP), LAL-91-SOP-0060. The samples were analyzed in workgroup 29082. The instrument calibration verification met criteria. The method blank was within QC criteria. The laboratory control sample (LCS) recovery for alpha was slightly above QC criteria; however, since the beta LCS recovery and both matrix spike (MS) recoveries were within QC criteria, the data is not believed to be adversely affected. The duplicate (DUP) recoveries were within QC criteria. The minimum detectable activity (MDA) exceeded the reporting detection limit (RDL) due to residue weight limitations forcing a volume reduction. The affected samples are flagged with a "C" qualifier. No re-anlayses were performed.

Analytical Method Strontium-90

The strontium-90 analysis was performed using SOP, LAL-91-SOP-0196. The samples were analyzed in workgroup 29083. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The DUP recoveries were within QC criteria. No re-analyses were performed.

Liquid Scintillation Counter

Analytical Method Carbon-14

The carbon-14 analysis was performed using SOP, LAL-91-SOP-0209. The samples were analyzed in workgroup 29087. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The MS recovery was within QC criteria. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No re-analyses were performed.

Analytical Method Technetium-99

The technetium-99 analysis was performed using SOP, LAL-91-SOP-0169. The samples were analyzed in workgroups 29084 and 30338. Workgroup 29084 had low LCS and chemical recoveries and a DUP that was out of limits. The samples were re-prepared and re-analyzed in workgroup 30338. No data from workgroup 29084 is reported. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No other re-analyses were performed.

Analytical Method Tritium

The tritium analysis was performed using SOP, LAL-91-SOP-0066. The samples were analyzed in workgroup 29086. The instrument calibration verification met criteria. The method blank was within QC criteria. The LCS recovery was within QC criteria. The MS recovery was slightly above QC criteria; however, since all other QC analyses were within limits, the data is not believed to be adversely affected. The DUP recoveries were within QC criteria. The quench value was within curve limitations. No re-analyses were performed.

Yvonne M. Jacoby
Prepared By

November 29, 1995
Date

Bechtel Hanford, Inc.	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST L5644	Page 1 of 1
		Data Turnaround: ☐ Priority ■ Normal

Collector: A. Rice	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: RM-136	Field Logbook No.: SFZ-1637	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W90-0-0640-05	Bill of Lading/Air Bill No.: 2904644041
Possible Sample Hazards/Remarks		

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS													
			Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
			Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
			No. of Container(s)	1	1	1	1	5	4	1	1	1	1
			Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
				ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW9	W	10-17-95	1150	X	X	X	X	X	X	X	X		
B0GNX0	W	10-17-95	1150									X	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: A. Rice (ERC)	Date/Time: 10-17-95 1545	Received By: B. Whitten	Date/Time: 10-17-95 1545
Relinquished By: B. Whitten	Date/Time: 10-18-95 0830	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

SPECIAL INSTRUCTIONS

Matrix*
- 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	Title	Date/Time
	[illegible]	Sample Custodian	10-19-95 1040

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

9601342.1179

0000023

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST L5628

Page 1 of 1

Data Turnaround
☐ Priority
■ Normal

Collector: A. Rizzo	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: ER-9	Field Logbook No.: EFZ-1037	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W95-0-0640-04	Bill of Lading/Air Bill No.: 2904643892

Possible Sample Hazards/Remarks

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS												
			Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
			Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
			No. of Container(s)	1	1	1	1	5	4	1	1	1	1
			Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
				ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW7	W	10/16/95	1335	X	X	X	X	X	X	X	X		
B0GNW8	W	10/16/95	1335									X	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: AGRizzo (ERS)	Date/Time: 10-17-95 0740	Received By: ERC B. Whitten	Date/Time: 10-17-95 0740
Relinquished By: ERC B. Whitten	Date/Time: 10-17-95 0830	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

SPECIAL INSTRUCTIONS

Matrix*
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	Title	Date/Time
	Paul C. Davis	Sample Custodian	10-18-95 / 8:50 am

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

9613270.1080

9613420.0481

Appendix 5

Data Validation Supporting Documentation

RADIOCHEMICAL DATA VALIDATION CHECKLIST

VALIDATION LEVEL:	A	B	C	D	E
PROJECT: 100-BC-5 rnd 9			DATA PACKAGE: LK5628		
VALIDATOR: RBC		LAB: LAS		DATE: 12/28/95	
CASE:			SDG: LK5628-LAS		

ANALYSES PERFORMED

☐ Gross Alpha/Beta	☐ Strontium-90	☐ Technetium-99	☐ Alpha Spectroscopy	☐ Gamma Spectroscopy	
☐ Total Uranium	☐ Radium-22	☐ Tritium	☐		

SAMPLES/MATRIX		
	BOGNW7	BOGNW9
water		

1. Completeness . . . . . ☐ N/A

Technical verification forms present? . . . . . Yes No N/A

Comments:

2. Initial Calibration . . . . . ☒ N/A

Instruments/detectors calibrated within one year of sample analysis? . . . . . Yes No N/A

Initial calibration acceptable? . . . . . Yes No N/A

Standards NIST traceable? . . . . . Yes No N/A

Standards Expired? . . . . . Yes No N/A

Comments:

3. Continuing Calibration . . . . . ☒ N/A

Calibration checked within one week of sample analysis? . . . Yes No N/A
Calibration check acceptable? . . . . . Yes No N/A
Calibration check standards NIST traceable? . . . . . Yes No N/A
Calibration check standards expired? . . . . . Yes No N/A

Comments:

4. Blanks . . . . . ☐ N/A

Method blank analyzed? . . . . . Yes No N/A
Method blank results acceptable? . . . . . Yes No N/A
Analytes detected in method blank? . . . . . Yes No N/A
Field blank(s) analyzed? . . . . . Yes No N/A
Field blank results acceptable? . . . . . Yes No N/A
Analytes detected in field blank(s)? . . . . . Yes No N/A
Transcription/Calculation Errors? . . . . . Yes No N/A

Comments:

5. Matrix Spikes . . . . . ☐ N/A

Matrix spike analyzed? . . . . . Yes No N/A
Spike recoveries acceptable? . . . . . Yes No N/A
Spike source traceable? . . . . . Yes No N/A
Spike source expired? . . . . . Yes No N/A
Transcription/Calculation Errors? . . . . . Yes No N/A

Comments: 3H + C14 ok - Tc-99 - no MS - J/UJ all

6. Laboratory Control Samples . . . . . ☐ N/A

LCS analyzed? . . . . . Yes No N/A
LCS recoveries acceptable? . . . . . Yes No N/A
LCS traceable? . . . . . Yes No N/A
Transcription/Calculation Errors? . . . . . Yes No N/A

Comments: gross alpha 131% recovery - both non-detects thus no qualifier

7. Chemical Recovery . . . . . ☐ N/A

Chemical carrier added? . . . . . Yes No N/A
Chemical recovery acceptable? . . . . . Yes No N/A
Chemical carrier traceable? . . . . . Yes No N/A
Chemical carrier expired? . . . . . Yes No N/A
Transcription/Calculation errors? . . . . . Yes No N/A

Comments: Sr-90 + TC-99 chem recovery acceptable 3H + C-14 per BHI instruction, used US recovery in place of yield.

8. Duplicates . . . . . ☐ N/A

Duplicates Analyzed? . . . . . Yes No N/A
RPD Values Acceptable? . . . . . Yes No N/A
Transcription/Calculation Errors? . . . . . Yes No N/A

Comments:

~~A3~~ PKR

9. Field QC Samples . . . . . ☐ N/A

Field duplicate sample(s) analyzed? . . . . . Yes (No) N/A
Field duplicate RPD values acceptable? . . . . . Yes No (N/A)
Field split sample(s) analyzed? . . . . . (Yes) No N/A
Field split RPD values acceptable? . . . . . Yes No N/A
Performance audit sample(s) analyzed? . . . . . Yes (No) N/A
Performance audit sample results acceptable? . . . . . Yes No (N/A)

Comments: _____

10. Holding Times

Are sample holding times acceptable? . . . . . (Yes) No N/A

Comments: _____

11. Results and Detection Limits (Levels D & E) . . . . . ☐ N/A

Results reported for all required sample analyses? . . . . (Yes) No N/A
Results supported in raw data? . . . . . Yes No (N/A)
Results Acceptable? . . . . . Yes No (N/A)
Transcription/Calculation errors? . . . . . Yes No (N/A)
MDA's meet required detection limits? . . . . . (Yes) No N/A
Transcription/calculation errors? . . . . . Yes No (N/A)

Comments: _____

9613420.0486

JAN 1996
RECEIVED
Validation
Log In

Date: January 5, 1996
To: Bechtel Hanford Inc. (technical representative)
From: A.T. Kearney, Inc.
Project: 100-BC-5 Groundwater Sampling - Round 9
Subject: Wet Chemistry - Data Package No. LK5628-LAS (SDG No. LK5628)

INTRODUCTION

This memo presents the results of data validation on Summary Data Package No. LK5628-LAS prepared by Lockheed Analytical Services (LAS). A list of the samples validated along with the analyses reported and the method of analysis is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analysis
B0GNW7	10/16/95	Water	C	See Note 1
B0GNW9	10/17/95	Water	C	See Note 1

Note 1. Fluoride, sulfate, pH and specific conductance.

Data validation was conducted in accordance with the WHC statement of work (WHC 1994) and validation procedures (WHC 1992). Appendices 1 through 5 provide the following information as indicated below:

Appendix 1. Glossary of Data Reporting Qualifiers
Appendix 2. Summary of Data Qualification
Appendix 3. Qualified Data Summary and Annotated Laboratory Reports
Appendix 4. Laboratory Narrative and Chain-of-Custody Documentation
Appendix 5. Data Validation Supporting Documentation

DATA QUALITY OBJECTIVES

- **Holding Times**

  Analytical holding times are assessed to ascertain whether the holding time requirements have been met by the laboratory. The holding time requirement is 28 days for fluoride, sulfate and specific conductanc and immediately for pH.

  If holding times are exceeded, but not by greater than two times the limit, all associated sample results are qualified as estimates and flagged "J" for detects and "UJ" for non-detects. If holding times are exceeded by greater than two

times the limit, all associated detectable sample results are qualified as estimates and flagged "J" and all non-detects are rejected and flagged "UR".

All pH results were qualified as estimates and flagged "J" due to exceeded holding times. Holding times were met for all other analytes.

- **Instrument Calibration**

Instrument calibration is performed to establish that the instrument is capable of producing acceptable and reliable analytical data over a range of concentrations. The initial and continuing calibrations are performed according to the associated EPA Methods and all results must meet validation requirements set by Westinghouse Hanford Company (WHC 1992a). At least one blank and three standards are used to establish the instrument calibrations prior to sample analysis and the correlation must be greater than or equal to 0.995. Continuing calibration checks are performed to verify that instrument performance is stable and reproducible on a day-to-day basis.

Instrument calibration is not evaluated under Level C validation.

- **Blanks**

Method blank analyses are performed to determine the extent of laboratory contamination introduced through sampling, sample preparation and analysis. At least one acceptable method blank analysis must be conducted for every 20 samples. No contaminants should be present in the method blank. All blank results must fall below the CRQL.

All method blank results were acceptable.

- **Accuracy**

Matrix Spike

Matrix spike analyses are used to assess the analytical accuracy of the reported data and the effect of the matrix on the ability to accurately quantify sample concentrations. Matrix spike recoveries must fall within the range of 75% to 125%. Samples with a spike recovery of less than 30% and a sample value below the IDL are rejected and flagged "UR". Samples with a spike recovery of 30% to 74% and a sample result less than the IDL are qualified "UJ". Samples with a spike recovery of greater than 125% or less than 75% and a sample result greater than the IDL are qualified "J". Finally, for samples with a spike

recovery greater than 125% and a sample result less than the IDL, no qualification is required.

All matrix spike recovery results were acceptable.

Laboratory Control Sample

The LCS monitors the overall performance of the analysis, including the sample preparation. An LCS should be prepared (e.g., digested or distilled) and analyzed with every group of samples which have been prepared together.

The performance criteria for solid LCS samples are established through interlaboratory studies coordinated by a certifying agency (e.g., EPA or an independent commercial supplier). If the LCS recoveries are outside the control limit and the sample result is greater that the IDL, all sample results must be qualified as estimates and flagged "J". If the LCS recoveries are less than the control limit and the sample result is less than the IDL, all sample results must be flagged "UJ". If the LCS recoveries are greater than the control limits and the sample result is less than the IDL, then no qualification is necessary.

The performance criteria for aqueous LCS samples are percent recoveries between 80% and 120%. Samples with LCS recoveries of less than 50% are rejected and flagged "UR/R". Samples with LCS recoveries between 50% and 79% and a sample value below the IDL are qualified as estimates and flagged "UJ". If the LCS recovery is greater than 120% or between 50% and 79% and the sample value above the IDL, the result is qualified as an estimate and flagged "J". For LCS recoveries greater than 120% and a sample value below IDL, no qualification is necessary.

LCS results are not evaluated under Level C validation.

- **Precision**

Laboratory Duplicate Samples

Laboratory duplicate sample analyses are used to measure laboratory precision and sample homogeneity. For solid samples, results must be within RPD limits of plus or minus 35%. If RPD values are out of specification and the sample concentration is greater than five times the CRDL, all associated sample results are qualified as estimated "J" for detects, "UJ" for non-detects. If RPD values are plus or minus two times the CRDL and the sample concentration is less than five times the CRDL, all associated sample results are qualified as estimated and flagged "J" for detects and "UJ" for non-detects.

The performance criteria for aqueous laboratory duplicates are an RPD less than 20% for positive sample results greater than five times the CRDL and plus or minus the CRDL for positive sample results less than five times the CRDL. Sample results outside the criteria are qualified as estimates and flagged "J".

All laboratory duplicate results were acceptable.

Field Split Samples

Two split samples were submitted to LAS as shown below:

Sample Number	Split Sample Number	Well Location
B0GNQ1	B0GNW7	199-B2-12
B0GNS3	B0GNW9	199-B5-1

Samples B0GNQ1 and B0GNS3 were analyzed by Quanterra Environmental Services and reported with SDG W0769-QES. The split sample results were compared using the validation guidelines for determining the RPD between a sample and its duplicate. All results fell within the required control limits.

- **Completeness**

Data Package No. LK5628-LAS (SDG No. LK5628) was submitted for validation and verified for completeness. The completion rate was 100%.

MAJOR DEFICIENCIES

None found

MINOR DEFICIENCIES

All pH results were qualified as estimates and flagged "J" due to exceeded holding times. Data flagged "J" indicate the associated result is an estimate, but the data may be usable for decision making purposes. All other validated results are considered accurate within the standard error associated with the methods.

REFERENCES

EPA, 1987, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, Environmental Protection Agency, Washington, D.C.

EPA, 1988a, *EPA Contract Laboratory Program Statement of Work for Organics Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988c, *EPA Contract Laboratory Program Statement of Work for Inorganics Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988d, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990, *EPA Contract Laboratory Program Statement of Work for Inorganic Analyses, Multi-media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991, *EPA Contract Laboratory Program Statement of Work for Organics Analyses, Multi-Media, Multi-Concentration*, Environmental Protection Agency, Washington, D.C.

WHC, 1992a, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, October 1993.

WHC, 1992b, *Data Validation Procedure for Radiological Analyses*, WHC-SD-EN-SPP-001, Rev. 2, Westinghouse Hanford Company, 1993.

EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, U.S. Environmental Protection Agency, Washington, D.C.

9613420.0491

Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers which may be applied by data validators in compliance with WHC procedures are as follows:

U - Indicates the compound or analyte was analyzed for and not detected in the sample. The value reported is the sample quantitation limit corrected for sample dilution and moisture content by the laboratory.

UJ - Indicates the compound or analyte was analyzed for and not detected in the sample. Due to a QC deficiency identified during the data validation, the associated quantitation limit is an estimate.

J - Indicates the compound or analyte was analyzed for and detected. The associated concentration is an estimate, but the data are usable for decision-making purposes.

R - Indicates the compound or analyte was analyzed for, detected, and due to an identified QC deficiency, the data are unusable.

UR - Indicates the compound or analyte was analyzed for and not detected in the sample. Additionally, the data is unusable due to an identified QC deficiency.

NJ - Indicates presumptive evidence of a compound at an estimated value. The data may not be valid for some specific applications (i.e., usable for decision-making purposes).

N - Indicates presumptive evidence of a compound. The data may not be valid for some specific applications (i.e., usable for decision-making purposes).

9613420.0493

Appendix 2

Summary of Data Qualification

DATA QUALIFICATION SUMMARY

SDG: LK5628-LAS	REVIEWER: RBC	DATE: 01/05/96	PAGE 1 OF 1
COMMENTS:			
COMPOUND	QUALIFIER	SAMPLES AFFECTED	REASON
pH	J	B0GNW7, B0GNW9	Holding time exceeded

9613420.0495

Appendix 3

Qualified Data Summary and Annotated Laboratory Reports

GENERAL CHEMISTRY ANALYSIS, WATER MATRIX, (mg/l)

Project: BECHTEL-HANFORD																					
Laboratory: Lockheed																					
Case	SDG: LK5628																				
Sample Number		B0GNW7		B0GNW9																	
Location		199-B2-12		199-B5-1																	
Remarks		Split		Split																	
Sample Date		10/16/95		10/17/95																	
General Chemistry	CRQL	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Fluoride	0.1	0.42		0.24																	
Sulfate	0.1	11		39.																	
pH	+/-0.05	8.1	J	7.6	J																
Spec. Conductance	5	260		350																	

RBC 1/4/96

Specific Conductivity (umhos/cm), pH (pH units)

000011

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9613420.0497

LOCKHEED ANALYTICAL SERVICES

Sample Results

Client Sample ID: BOGNW7	Date Collected: 16-OCT-95
Matrix: Water	Date Received: 18-OCT-95
Percent Solids: N/A	

Constituent	Units	Method	Result	Project Reporting Limit	Data Qualifier(s)	Date Analyzed	LAS Batch|ID	LAS Sample|ID
Fluoride	mg/L	300.0	0.42	0.10		23-OCT-95	28989	L5628-4
Sulfate	mg/L	300.0	11.	0.10		20-OCT-95	28990	L5628-4
pH	pH Units	9040	8.1	0.10	J	23-OCT-95	28953	L5628-4
Conductivity	uS/cm	9050	260	1.0		06-NOV-95	28991	L5628-5

BJK
12/28/95

~~031~~ RK

9613420.0498

LOCKHEED ANALYTICAL SERVICES

Sample Results

Client Sample ID: BOGNW9	Date Collected: 17-OCT-95
Matrix: Water	Date Received: 19-OCT-95
Percent Solids: N/A	

Constituent	Units	Method	Result	Project Reporting Limit	Data Qualifier(s)	Date Analyzed	LAS Batch|ID	LAS Sample|ID
Fluoride	mg/L	300.0	0.24	0.10		23-OCT-95	28989	L5644-4
Sulfate	mg/L	300.0	39.	0.10		20-OCT-95	28990	L5644-4
pH	pH Units	9040	7.6	0.10	J	23-OCT-95	28953	L5644-4
Conductivity	uS/cm	9050	350	1.0		06-NOV-95	28991	L5644-5

RVC
12/28/95

032

9613420.0499

Appendix 4

Laboratory Narrative and Chain-of-Custody Documentation

9613420.0500

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

November 29, 1995

DEC 1995
RECEIVED
Data
Log In

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

RE:	Log-in No.:	L5628/L5644
	Quotation No.:	Q400000-B
	SAF:	B95-103
	Document File No.:	1018596/1019596
	BHI Document File No.:	286/287
	SDG No.:	LK5628

L5628- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 18 October 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.

L5644- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 19 October 1995. The temperature of the cooler upon receipt was 4°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) 375-4741.

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 1

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,

Karen Hermann for

Kathleen M. Hall
Client Services Representative

cc: Client Services
Document Control

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 2

CASE NARRATIVE
INORGANIC NON METALS ANALYSES
WATER

The routine calibration and quality control analyses performed for this batch include as applicable: initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), matrix spike sample(s), and duplicate sample(s).

Preparation and Analysis Requirements

- Two water samples were received for LK5628 and analyzed in batch 1018 bh for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following samples:

Client ID	LAL #		Method
BOGNW7	L5628-5	DUP	9050 Conductivity
	L5628-4	MS, DUP	300.0 Fluoride and Sulfate
	L5628-4	DUP	9040 pH

Holding Time Requirements

- All samples were analyzed within the 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

November 10, 1995
Date

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST L5628

Page 1 of 1

Data Turnaround
☐ Priority
■ Normal

Collector: A. Rizzo	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: ER-9	Field Logbook No.: EFZ-1037	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W95 0-0640-04	Bill of Lading/Air Bill No.: 2904643892

Possible Sample Hazards/Remarks

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS													
			Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
			Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
			No. of Container(s)	1	1	1	1	5	4	1	1	1	1
			Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
				ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW7	W	10/16/95	1335	X	X	X	X	X	X	X	X		
B0GNW8	W	10/16/95	1335									X	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: AGRizzo (ERC)	Date/Time: 10-17-95 0740	Received By: ERC / B. Whitten	Date/Time: 10-17-95 0740
Relinquished By: ERC / B. Whitten	Date/Time: 10-17-95 0830	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

SPECIAL INSTRUCTIONS

Matrix*
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	Title	Date/Time
	Paul C. Lewis	Sample Custodian	10-18-95 / 8:50 am

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

L5644

Page 1 of 1

Data Turnaround: ☐ Priority ■ Normal

Collector: A. Rice	Company Contact: R. L. Biggersteff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: RM-136	Field Logbook No.: SFC-1637	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W98-0-0640-05	Bill of Lading/Air Bill No.: 2904644041

Possible Sample Hazards/Remarks

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS													
			Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
			Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
			No. of Container(s)	1	1	1	1	5	4	1	1	1	1
			Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
				ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW9	W	10-17-95	1150	X	X	X	X	X	X	X	X		
B0GNX0	W	10-17-95	1150									X	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: A. Rice (EPI)	Date/Time: 10-17-95 1545	Received By: B. Whitten	Date/Time: 10-17-95 1545
Relinquished By: B. Whitten	Date/Time: 10-18-95 0830	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

SPECIAL INSTRUCTIONS

Matrix*
- 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	Title	Date/Time
	[illegible]	Sample Custodian	10-19-95 0940

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

Appendix 5

Data Validation Supporting Documentation

GENERAL CHEMISTRY DATA VALIDATION CHECKLIST

VALIDATION LEVEL:	A	B	C	D	E

PROJECT: 100-BC-5	DATA PACKAGE: LK5628	
VALIDATOR: RBC	LAB: LAS	DATE: 12/28/95
CASE:	SDG: LK5628-LAS	

ANALYSES PERFORMED

☐ Anions/IC	☐ TOC	☐ TOX	☐ TPH-418.1	Oil and Grease	Alkalinity
☐ Ammonia	☐ BOD/COD	☐ Chloride	☐ Chromium-VI	☒ pH	☐ NO_3/NO_2
☒ Sulfate	☐ TDS	☐ TKN	☐ Phosphate	☒ conduct.	☒ Fluoride
☐	☐	☐	☐	☐	☐

SAMPLES/MATRIX	BOG NW7	BOG NW9
Water		

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Is technical verification documentation present? . . . . . (Yes) No N/A

Is a case narrative present? . . . . . (Yes) No N/A

Comments:

2. HOLDING TIMES

Are sample holding times acceptable? . . . . . Yes (No) N/A

Comments: pH - 3days J all

GENERAL CHEMISTRY DATA VALIDATION CHECKLIST

3. INSTRUMENT CALIBRATION

Was initial calibration performed for all applicable analyses? Yes No N/A
Are initial calibration results acceptable? . . . . . Yes No N/A
Was a calibration check performed for all applicable analyses? Yes No N/A
Are calibration check results acceptable? . . . . . Yes No N/A
Comments:

4. BLANKS

Were laboratory blanks analyzed? . . . . . Yes No N/A
Are laboratory blank results acceptable? . . . . . Yes No N/A
Were field/trip blanks analyzed? . . . . . Yes No N/A
Are field/trip blank results acceptable? . . . . . Yes No N/A
Comments: FL ✓ SUV ✓

5. ACCURACY

Were spike samples analyzed at the required frequency? . . . . Yes No N/A
Are spike recoveries acceptable? . . . . . Yes No N/A
Were LCS analyses performed at the required frequency? . . . . Yes No N/A
Are LCS recoveries acceptable? . . . . . Yes No N/A
Comments: FL ✓ SUV ✓

6. PRECISION

Were laboratory duplicate samples analyzed at the required frequency? . . . . . Yes No N/A
Are laboratory duplicate sample RPD values acceptable? . . . . Yes No N/A
Are field duplicate RPD values acceptable? . . . . . Yes No N/A
Are field split RPD values acceptable? . . . . . Yes No N/A

GENERAL CHEMISTRY DATA VALIDATION CHECKLIST

Comments: FL ✓ SUV ✓ SCV ✓ PRV ✓

7. ANALYTE QUANTITATION

Was analyte quantitation performed properly? . . . . . Yes No N/A

Comments:

8. REPORTED RESULTS AND DETECTION LIMITS

Are results reported for all requested analyses? . . . . . Yes No N/A

Are results supported in the raw data? . . . . . Yes No N/A

Are results calculated properly? . . . . . Yes No N/A

Do results meet the CRDLs? . . . . . Yes No N/A

Comments:

A-25

HOLDING TIME SUMMARY

SDG: LK5628	VALIDATOR: RBC	DATE: 1/5/96	PAGE 1 OF 1
COMMENTS:			

FIELD SAMPLE ID	ANALYSIS TYPE	DATE SAMPLED	DATE PREPARED	DATE ANALYZED	PREP. HOLDING TIME, DAYS	ANALYSIS HOLDING TIME, DAYS	QUALIFIER
BOGNW7	pH	10/16/95		10/23/95		immediate	J
BOGNW9	pH	10/17/95		10/23/95		immediate	J

B-4/5

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JAN 1996
RECEIVED
Validation
Log In

Date: January 5, 1996
To: Bechtel Hanford Company (technical representative)
From: A.T. Kearney, Inc.
Project: 100-BC-5 Groundwater Sampling - Round 9
Subject: Inorganics - Data Package No. LK5628-LAS (SDG No. LK5628)

INTRODUCTION

This memo presents the results of data validation on Data Package No. LK5628-LAS prepared by Lockheed Analytical Services (LAS). A list of samples validated along with the analyses reported and the method of analysis is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analysis
B0GNW7	10/16/95	Water	C	See Note 1
B0GNW8	10/16/95	Water	C	See Note 1
B0GNW9	10/17/95	Water	C	See Note 1
B0GNX0	10/17/95	Water	C	See Note 1

Note 1. Requested Method: ICP and AA Metals, and Mercury

Data validation was conducted in accordance with the WHC statement of work (WHC 1994) and validation procedures (WHC 1992a). Appendices 1 through 5 provide the following information as indicated below:

Appendix 1. Glossary of Data Reporting Qualifiers
Appendix 2. Summary of Data Qualification
Appendix 3. Qualified Data Summary and Annotated Laboratory Reports
Appendix 4. Laboratory Narrative and Chain-of-Custody Documentation
Appendix 5. Data Validation Supporting Documentation

DATA QUALITY OBJECTIVES

- **Holding Times**

Analytical holding times for ICP and AA metals and mercury were assessed to ascertain whether the holding time requirements were met by the laboratory. The holding time requirements are as follows: Samples must be analyzed within six months for all ICP and AA metals and within 28 days for mercury.

Holding time requirements for all analytes were met.

- **Blanks**

Calibration Blanks

A calibration blank must be analyzed immediately after every initial and continuing calibration verification. The blank must be analyzed at the beginning of the run and after the last analytical sample. In the case of positive blank results, samples with digestate concentrations (in ug/L) of less than five times the highest amount found in any of the associated blanks have had their associated values qualified as non-detected and flagged "U". Samples with concentrations of greater than five times the highest blank value do not require qualification.

In the case of negative calibration blank results, if the absolute value of any calibration blank exceeds the Instrument Detection Limit (IDL), all non-detects are qualified as estimates and flagged "UJ", and all positive results within two times the absolute value of the blank result are qualified as estimates and flagged "J". The qualification is applied only to results generated between the unacceptable calibration blank and the nearest acceptable blank.

Level C validation does not include the review of data based on calibration blanks.

Preparation Blanks

At least one preparation blank, consisting of deionized distilled water processed through each sample preparation and analysis procedure must be prepared and analyzed with every sample delivery group. In the case of positive blank results, samples with digestate concentrations (in ug/L) of less than five times the preparation blank value have had their associated values qualified as non-detected and flagged "U". Samples with concentrations of greater than five times the highest blank concentration do not require qualification.

In the case of negative blank results, if the absolute value exceeds the Contract Required Detection Limit (CRDL), all non-detects are rejected and flagged "UR" and all detects that are less than ten times the absolute value of the associated preparation blank result are qualified as estimates and flagged "J". If the absolute value of the negative preparation blank is greater than the IDL and less than or equal to the CRDL, all non-detects are qualified as estimates and flagged "UJ" and all detects less than ten times the absolute value of the blank are qualified as estimates and flagged "J". If the sample results are greater than ten times the absolute value of the preparation blank, no qualification is necessary.

Due to the presence of a positive preparation blank result, the aluminum result for sample number B0GNW9 has been flagged "U".

Due to the presence of a positive preparation blank result, the iron results for sample numbers B0GNW7 and B0GNW9 have been flagged "U".

All other preparation blanks results were acceptable.

- **Accuracy**

Matrix Spike

Matrix spike analyses are used to assess the analytical accuracy of the reported data and the effect of the matrix on the ability to accurately quantify sample concentrations. Matrix spike recoveries must fall within the range of 75% to 125%. Samples with a spike recovery of less than 30% and a sample value below the IDL are rejected and flagged "UR". Samples with a spike recovery of 30% to 74% and a sample result less than the IDL are qualified "UJ". Samples with a spike recovery of greater than 125% or less than 75% and a sample result greater than the IDL are qualified "J". Finally, for samples with a spike recovery greater than 125% and a sample result less than the IDL, no qualification is required.

All matrix spike recovery results were acceptable.

Laboratory Control Sample Recovery

The LCS monitors the overall performance of the analysis, including the sample preparation. An LCS should be digested or distilled and analyzed with every group of samples which have been prepared together. The performance criteria for solid LCS samples are established through interlaboratory studies coordinated by a certifying agency (e.g., EPA or an independent commercial supplier).

One liquid LCS should be digested and analyzed for each sample batch that contains water samples. The results are compared against the control limit of

80-120% as required in the WHC data validation guidelines (WHC 1992a).

Level C validation does not require the qualification of data based on laboratory control sample results.

- **Precision**

Laboratory Duplicate Samples

The laboratory duplicate result measures the precision of the method by measuring a second aliquot of the sample that is treated the same way as the original. Samples whose precision fell outside the quality control requirements were qualified as estimates and flagged "J".

All laboratory duplicate results were acceptable.

ICP Serial Dilution

The ICP serial dilution is used to determine whether significant physical or chemical interferences exist due to the sample matrix. If the sample concentration is greater than or equal to 50 times the IDL for an analyte and the %D is greater than 10%, the associated data is qualified as an estimate and flagged "J".

Level C validation does not require the qualification of data based on serial dilution results.

Field Split Samples

Four split samples were submitted to LAS as shown below:

Sample Number	Split Sample Number	Well Location
B0GNQ1	B0GNW7	199-B2-12
B0GNQ2	B0GNW8	199-B2-12
B0GNS3	B0GNW9	199-B5-1
B0GNS4	B0GNX0	199-B5-1

Sample numbers B0GNQ1, B0GNQ2, B0GNS3 and B0GNS4 were analyzed by Quanterra Environmental Servies and reported with SDG NO. W0769-QES. The split sample results were compared using the sample guidelines for determining the RPD between a sample and its duplicate. All results fell within the required control limits with the exception of calcium (20.1%) in sample pair B0GNQ2/B0GNW8.

- **Furnace AA Quality Control**

The post-digestion analytical spike is analyzed to determine the extent of interference in the digestate matrix. When the result of the analytical spike analyses exceeds the control window of 85% to 115% recovery and the absorbance of the sample is greater than fifty percent of the analytical spike absorbance, then the sample must be reanalyzed using the MSA. The duplicate injections and the analytical spike recoveries establish the precision and accuracy of the individual GFAA determinations.

Duplicate Injections

Each furnace analysis requires a minimum of two injections (burns), except for full MSA. For concentrations greater than the CRDL, the duplicate injection readings must agree within 20% RSD or CV. If these requirements are not met, the analytical sample must be rerun once (i.e., two additional burns). If the readings are then still outside the QC limits, the result is qualified as an estimate and flagged "J".

Level C validation does not require the qualification of data based on duplicate injections.

Analytical Spike Recoveries

For all samples whose analytical spike results are outside the 85% to 115% control limit, but whose absorbances are less than 50% of the analytical spike absorbance, the samples were qualified as estimates and flagged "J". In cases where the analytical spike recovery was less than 10 percent, non-detect results were rejected and flagged "UR".

Level C validation does not require the qualification of data based on analytical spike recoveries.

- **Completeness**

Data Package No. LK5628-LAS (SDG No. LK5628) was submitted for validation and verified for completeness. The completion percentage was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES

Minor positive preparation blank contamination was encountered for two analytes. All results were flagged accordingly. All other validated results are considered accurate within the standard error associated with the methods.

REFERENCES

EPA, 1987, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, Environmental Protection Agency, Washington, D.C.

EPA, 1988a, *EPA Contract Laboratory Program Statement of Work for Organics Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988c, *EPA Contract Laboratory Program Statement of Work for Inorganics Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988d, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990, *EPA Contract Laboratory Program Statement of Work for Inorganic Analyses, Multi-media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1991, *EPA Contract Laboratory Program Statement of Work for Organics Analyses, Multi-Media, Multi-Concentration*, Environmental Protection Agency, Washington, D.C.

WHC, 1992a, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, October 1993.

WHC, 1992b, *Data Validation Procedure for Radiological Analyses*, WHC-SD-EN-SPP-001, Rev. 2, Westinghouse Hanford Company, 1993.

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EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, U.S. Environmental Protection Agency, Washington, D.C.

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Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers which may be applied by data validators in compliance with WHC guidelines are as follows:

U - Indicates the compound or analyte was analyzed for and not detected in the sample. The value reported is the sample quantitation limit corrected for sample dilution and moisture content by the laboratory.

UJ - Indicates the compound or analyte was analyzed for and not detected in the sample. Due to a QC deficiency identified during the data validation, the associated quantitation limit is an estimate.

J - Indicates the compound or analyte was analyzed for and detected. Due to a QC deficiency identified during the data validation, the associated concentration is an estimate, but the data are usable for decision-making purposes.

BJ - Applied to inorganic analyses only. Indicates the analyte concentration was greater than the IDL but less than the CRDL and is considered an estimated value.

R - Indicates the compound or analyte was analyzed for, detected, and due to an identified QC deficiency, the data are unusable.

UR - Indicates the compound or analyte was analyzed for and not detected in the sample. Additionally, the data is unusable due to an identified QC deficiency.

NJ - Indicates presumptive evidence of a compound at an estimated value. The data may not be valid for some specific applications (i.e., usable for decision-making purposes).

N - Indicates presumptive evidence of a compound. The data may not be valid for some specific applications (i.e., usable for decision-making purposes).

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Appendix 2

Summary of Data Qualification

DATA QUALIFICATION SUMMARY

SDG: LK5628	REVIEWER: RJS	DATE: 01/05/96	PAGE 1 OF 1
COMMENTS:			
COMPOUND	QUALIFIER	SAMPLES AFFECTED	REASON
Aluminum	U	B0GNW9	Positive preparation blank result
Iron	U	B0GNW7, B0GNW9	Positive preparation blank result

9613420.0521

Appendix 3

Qualified Data Summary and Annotated Laboratory Reports

INORGANIC ANALYSIS, WATER MATRIX, (ug/L)

Project: BECHTEL-HANFORD																					
Laboratory: Lockheed																					
Case	SDG: LK5628																				
Sample Number		B0GNW7		B0GNW8		B0GNW9		B0GNX0													
Location		199-B2-12		199-B2-12		199-B5-1		199-B5-1													
Remarks		Split		Split		Split		Split													
Sample Date		10/16/95		10/16/95		10/17/95		10/17/95													
Inorganic Analytes	CRDL	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Aluminum	200	21.0	U	21.0	U	23.8	U	21.0	U												
Antimony	60	4.0	U	4.0	U	4.0	U	4.0	U												
Arsenic	10	4.6		10.3		4.6		5.5													
Barium	200	63.2		66.0		31.0		33.8													
Beryllium	5	1.0	U	1.0	U	1.0	U	1.0	U												
Cadmium	5	5.0	U	5.0	U	5.0	U	5.0	U												
Calcium	5000	27500		30600		46600		52800													
Chromium	10	8.8		4.0	U	80.7		88.6													
Cobalt	50	6.0	U	6.0	U	6.0	U	6.0	U												
Copper	25	3.0	U	3.0	U	3.0	U	3.0	U												
Iron	100	43.8	U	9.0	U	98.4	U	9.0	U												
Lead	3	2.0	U	2.0	U	2.0	U	2.0	U												
Magnesium	5000	10100		10900		8900		9960													
Manganese	15	7.0		7.4		2.0	U	2.0	U												
Mercury	0.2	0.20	U	0.20	U	0.20	U	0.20	U												
Nickel	40	14.0	U	14.0	U	14.0	U	14.0	U												
Potasssium	5000	4740		5020		5080		4890													
Selenium	5	4.0	U	4.0	U	4.0	U	4.0	U												
Silver	10	3.0	U	3.0	U	3.0	U	3.0	U												
Sodium	5000	13800		14600		10300		11400													
Thallium	10	4.9		4.6		5.9		3.0	U												
Vanadium	50	40.9		41.9		7.7		5.1													
Zinc	20	4.3		3.0	U	8.3		3.0	U												

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CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW7

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5628-2

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	21.0	U		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	4.6	B		P
7440-39-3	Barium	63.2	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	27500			P
7440-47-3	Chromium	8.8	B		P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	43.8	~~B~~		P 4
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	10100			P
7439-96-5	Manganese	7.0	B		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	4740	B		P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	13800			P
7440-28-0	Thallium	4.9	B		P
7440-62-2	Vanadium	40.9	B		P
7440-66-6	Zinc	4.3	B		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

~~053~~ 123

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CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW7

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5628-3

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

FORM I - IN

RJS 12/28/95

9613420.0525

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW8

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5628-16

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	21.0	U		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	10.3			P
7440-39-3	Barium	66.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	30600			P
7440-47-3	Chromium	4.0	U		P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	9.0	U		P
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	10900			P
7439-96-5	Manganese	7.4	B		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	5020			P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	14600			P
7440-28-0	Thallium	4.6	B		P
7440-62-2	Vanadium	41.9	B		P
7440-66-6	Zinc	3.0	U		P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

063 RS

9613420.0526

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW8

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5628-17

Level (low/med): LOW Date Received: 10/18/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

9613420.0527

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNX0

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5644-16

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	21.0	U		P
7440-36-0	Antimony	4.0	U		P
7440-38-2	Arsenic	5.5	B		P
7440-39-3	Barium	33.8	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	52800			P
7440-47-3	Chromium	88.6			P
7440-48-4	Cobalt	6.0	U		P
7440-50-8	Copper	3.0	U		P
7439-89-6	Iron	9.0	U		P
7439-92-1	Lead	2.0	U		P
7439-95-4	Magnesium	9960			P
7439-96-5	Manganese	2.0	U		P
7439-97-6	Mercury				NR
7440-02-0	Nickel	14.0	U		P
7440-09-7	Potassium	4890	B		P
7782-49-2	Selenium	4.0	U		P
7440-22-4	Silver	3.0	U		P
7440-23-5	Sodium	11400			P
7440-28-0	Thallium	3.0	U		P
7440-62-2	Vanadium	5.1	B		P
7440-66-6	Zinc	3.0	U		P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

065 RS

9613420.0528

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNX0

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: SAF#B9 SAS No.: SDG No.: L5628F

Matrix (soil/water): WATER Lab Sample ID: L5644-17

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

06685

9613420.0529

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW9

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5644-2

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	23.8	~~B~~		P	u
7440-36-0	Antimony	4.0	U		P	
7440-38-2	Arsenic	4.6	B		P	
7440-39-3	Barium	31.0	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	5.0	U		P	
7440-70-2	Calcium	46600			P	
7440-47-3	Chromium	80.7			P	
7440-48-4	Cobalt	6.0	U		P	
7440-50-8	Copper	3.0	U		P	
7439-89-6	Iron	98.4	~~B~~		P	u
7439-92-1	Lead	2.0	U		P	
7439-95-4	Magnesium	8900			P	
7439-96-5	Manganese	2.0	U		P	
7439-97-6	Mercury				NR	
7440-02-0	Nickel	14.0	U		P	
7440-09-7	Potassium	5080			P	
7782-49-2	Selenium	4.0	U		P	
7440-22-4	Silver	3.0	U		P	
7440-23-5	Sodium	10300			P	
7440-28-0	Thallium	5.9	B		P	
7440-62-2	Vanadium	7.7	B		P	
7440-66-6	Zinc	8.3	B		P	

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

054 RS

9613420.0530

CLP

1

INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

B0GNW9

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Matrix (soil/water): WATER Lab Sample ID: L5644-3

Level (low/med): LOW Date Received: 10/19/95

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic				NR
7440-39-3	Barium				NR
7440-41-7	Beryllium				NR
7440-43-9	Cadmium				NR
7440-70-2	Calcium				NR
7440-47-3	Chromium				NR
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead				NR
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

RJS 12/28/95

FORM I - IN

055

Appendix 4

Laboratory Narrative and Chain-of-Custody Documentation

9613420.0532

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

November 29, 1995

DEC 1995
RECEIVED
Data
Log In

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

RE:	Log-in No.:	L5628/L5644
	Quotation No.:	Q400000-B
	SAF:	B95-103
	Document File No.:	1018596/1019596
	BHI Document File No.:	286/287
	SDG No.:	LK5628

L5628- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 18 October 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.

L5644- The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 19 October 1995. The temperature of the cooler upon receipt was 4°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) 375-4741.

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 1

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,

Karen Hermann for

Kathleen M. Hall
Client Services Representative

cc: Client Services
Document Control

Lockheed Analytical Services

Log-in No.: L5628/L5644
Quotation No.: Q400000-B
SAF: B95-103
Document File No.: 1018596/1019596
WHC Document File No.: 286/287
SDG No.: LK5628
Page No.: 3

CASE NARRATIVE
INORGANIC METALS ANALYSES
WATER

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

- Two water samples were analyzed for total metals analysis. The samples were batched as LAS batch 1018BHT for total metals analysis. Sample B0GNW7 (L5628-2) and (L5628-3) were used for matrix spike, duplicate and serial dilution analyses. All data flags due to the performance of the above-mentioned QC samples are also associated with every sample analyzed with this batch.

Holding Time Requirements

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

Method Blanks

- The level of analytes in the method blanks were less than the reporting detection limits.

Internal Quality Control

All internal quality control were within acceptance limits.

Sample Results

- The following qualifiers are reported on the basis of the techniques employed to perform the analyses:
  "P" Trace ICP-AES
  "P" ICP-AES
  "AV" Cold Vapor AA

Nalini Prabhakar
Prepared by

11/16/95
Date

CASE NARRATIVE
INORGANIC METALS ANALYSES
FILTERED WATER

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

- Two filtered water samples were analyzed for dissolved metals analysis. As the measured turbidity of the samples was less than 1 NTU, they were batched as LAS batch 1018BHD for dissolved metals analysis. Sample B0GNW8 (L5628-16) and (L5628-17) were used for matrix spike, duplicate and serial dilution analyses. All data flags due to the performance of the above-mentioned QC samples are also associated with every sample analyzed with this batch.

Holding Time Requirements

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

Method Blanks

- The level of analytes in the method blanks were less than the reporting detection limits.

Internal Quality Control

All internal quality control were within acceptance limits.

Sample Results

- The following qualifiers are reported on the basis of the techniques employed to perform the analyses:
  "P" Trace ICP-AES
  "P" ICP-AES
  "AV" Cold Vapor AA

Nalini Prabhakar
Prepared by

000026

11/16/95
Date

9613420.0536

ERC LABORATORY MANAGEMENT
SAMPLING AUTHORIZATION FORM

9/18/95

SAF Number B95-103 Revision 0

PROGRAM TYPE	CERCLA	PROJECT ID	100-BC-5 LFI
PROJECT TYPE	Limited Field Investigation	OPERABLE UNIT	100-BC-5
TASK ID	6	ROUND NUMBER	9

SAMPLING EVENT TITLE 100-BC-5 GROUNDWATER SAMPLING — ROUND 9

TASK MANAGER	ORG. CODE	MSIN	TELEPHONE	FAX
R. L. Biggerstaff	BN222	H4-91	372-9572	972-9655

CHARGE CODES — ANALYTICAL SERVICES PB3AB SAMPLE MANAGEMENT PB3AC
SAMPLING SERVICES PB3AA TECHNICAL OVERSIGHT PB3AC

SAMPLE MANAGEMENT FUNCTION PROJECT COORDINATOR R. C. Smith

TELEPHONE 372-2537

ESTIMATED START DATE 10/09/95 ESTIMATED COMPLETION DATE 10/20/95

SAMPLING LOCATION 100-BC-5/100 Area ESTIMATED NUMBER OF SAMPLES 60

DATA TURNAROUND REQUIREMENTS __ PRIORITY ✓ REGULAR

DATA DELIVERABLE REQUIREMENTS __ STANDALONE ✓ SUMMARY

SAMPLE MATRIX __ SOIL ✓ WATER __ OTHER (See Comments)

ANALYTICAL PROTOCOL(S) CLP, SW-846, RADCHEM, and Field Screening

LABORATORY QUANTERRA (Main) LOCKHEED (Split)

COMMENTS:

▸▸ The Person in Charge is **Bob Raidl** 3050C/63; 372-9641.

▸▸ Take the split and duplicate at the sample sampling point (well). Twenty-four wells are to be sampled. Filtered and unfiltered samples are needed from each well.

▸▸ Wells to be sampled include 199-B2-12, 199-B2-13, 199-B3-1, 199-B3-46, 199-B3-47, 199-B4-1, 199-B4-4, 199-B4-5, 199-B4-7, 199-B4-8, 199-B4-9, 199-B5-1, 199-B5-2, 199-B8-6, 199-B9-1, 199-B9-2, 199-B9-3, 699-63-90, 699-65-72, 699-65-83, 699-66-64, 699-71-77, 699-72-73, and 699-72-92.

Date 09/19/95

BHI-EE-002 (12/94)

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST L5628

Page 1 of 1

Date Turnaround
☐ Priority
■ Normal

Collector: A. Rizzo	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: ER-9	Field Logbook No.: EFZ-1037	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W95 0-0640-04	Bill of Lading/Air Bill No.: 2904643892

Possible Sample Hazards/Remarks

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS												
			Preservation	HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
			Type of Container	P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
			No. of Container(s)	1	1	1	1	5	4	1	1	1	1
			Volume	1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
				ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Sample No.	Matrix*	Date Sampled	Time Sampled										
B0GNW7	W	10/16/95	1335	X	X	X	X	X	X	X	X		
B0GNW8	W	10/16/95	1335									X	X

000128

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By: BCH AGRiza (ERB)	Date/Time: 0740 10-17-95	Received By: ERB B. Whitten	Date/Time: 0740 10-17-95
Relinquished By: ERB B. Whitten	Date/Time: 0830 10-17-95	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:

SPECIAL INSTRUCTIONS

Matrix*
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	Title	Date/Time
	Paul C. Davis	Sample Custodian	10-18-95 / 8:00 am

FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

9413120.0647

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST L5644

Page 1 of 1

Data Turnaround: ☐ Priority ■ Normal

Collector: A. Rice	Company Contact: R. L. Biggerstaff	Telephone: (509) 372-9572
Project Designation: 100-BC-5 Groundwater Sampling - Round 9	Sampling Location: 100-BC-5	SAF No.: B95-103
Ice Chest No.: RM-136	Field Logbook No.: SFZ-1637	Method of Shipment: Federal Express
Shipped To: Lockheed	Offsite Property No.: W98-0-0640-05	Bill of Lading/Air Bill No.: 2904644041
Possible Sample Hazards/Remarks		

Sample No.	Matrix*	Date Sampled	Time Sampled	ICP Metals, AA Metals (Unfiltered)	Mercury (Unfiltered)	Anions - F, SO_4, pH	Conductivity	Gross Alpha, Gross Beta, Sr-90	Tc-99	Tritium, C-14	Activity Scan	ICP Metals, AA Metals (Filtered)	Mercury (Filtered)
Preservation				HNO_3	HNO_3	Cool 4°C	Cool 4°C	HNO_3	HCl	None	None	HNO_3	HNO_3
Type of Container				P/G	G	P	P	P/G	P/G	G	P/G	P/G	G
No. of Container(s)				1	1	1	1	5	4	1	1	1	1
Volume				1L	500mL	500mL	250mL	1L	1L	1L	20mL	1L	500mL
B0GNW9	W	10-17-95	1150	X	X	X	X	X	X	X	X		
B0GNX0	W	10-17-95	1150									X	X

Special Handling and/or Storage: Maintain samples between 2°C and 6°C.

SAMPLE ANALYSIS

CHAIN OF POSSESSION

Relinquished By	Date/Time	Received By	Date/Time
A. Rice (ERI)	10-17-95 1545	R. L. Biggerstaff (BWHHW)	10-17-95 1545
R. L. Biggerstaff (BWHHW)	10-18-95 0830		

Sign/Print Names

SPECIAL INSTRUCTIONS

Matrix*: 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	Title	Date/Time
	[illegible]	Sample Custodian	10-19-95 1040

FINAL SAMPLE	Disposal Method	Disposed By	Date/Time

0000029

0040

9613420.0539

Appendix 5

Data Validation Supporting Documentation

INORGANIC ANALYSIS DATA VALIDATION CHECKLIST

VALIDATION LEVEL:	A	B	C	D	E

PROJECT: WHC/BHI		DATA PACKAGE: LK5628-LAS
VALIDATOR: RJS	LAB: Lockheed	DATE: 12/28/95
CASE: 100-BC-5		SDG: LK5628

ANALYSES PERFORMED

☒ CLP/ICP	☐ CLP/GFAA	☒ CLP/Hg	☐ CLP/Cyanide	☐	☐
☐ SW-846/ICP	☐ SW-846/GFAA	☐ SW-846/Hg	☐ SW-846 Cyanide	☐	☐

SAMPLES/MATRIX

BOGNW7, BOGNW9
BOGNW8, BOGNX0

(4 water samples)

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Is technical verification documentation present? . . . . . (Yes) No N/A

Is a case narrative present? . . . . . (Yes) No N/A

Comments:

2. HOLDING TIMES

Are sample holding times acceptable? . . . . . (Yes) No N/A

Comments:

metals < 6 months ✓

Hg < 28 days ✓

INORGANIC ANALYSIS DATA VALIDATION CHECKLIST

3. INSTRUMENT PERFORMANCE AND CALIBRATIONS

Were initial calibrations performed on all instruments? . . . . Yes No N/A
Are initial calibrations acceptable? . . . . . Yes No N/A
Are ICP interference checks acceptable? . . . . . Yes No N/A
Were ICV and CCV checks performed on all instruments? . . . . . Yes No N/A
Are ICV and CCV checks acceptable? . . . . . Yes No N/A

Comments:

4. BLANKS

Were ICB and CCB checks performed for all applicable analyses? Yes No N/A
Are ICB and CCB results acceptable? . . . . . Yes No N/A
Were preparation blanks analyzed? . . . . . Yes No N/A
Are preparation blank results acceptable? . . . . . Yes No N/A
Were field/trip blanks analyzed? . . . . . Yes No N/A
Are field/trip blank results acceptable? . . . . . Yes No N/A

Comments: Prep blank' (Detects Al B06NW9 "U")
(Detects Fe B06NW7, B06NW9 "U")

5. ACCURACY

Were spike samples analyzed? . . . . . Yes No N/A
Are spike sample recoveries acceptable? . . . . . Yes No N/A
Were laboratory control samples (LCS) analyzed? . . . . . Yes No N/A
Are LCS recoveries acceptable? . . . . . Yes No N/A

Comments:

INORGANIC ANALYSIS DATA VALIDATION CHECKLIST

6. PRECISION

Were laboratory duplicates analyzed? . . . . . (Yes) No N/A
Are laboratory duplicate samples RPD values acceptable? . . . . (Yes) No N/A
Were ICP serial dilution samples analyzed? . . . . . Yes No (N/A)
Are ICP serial dilution %D values acceptable? . . . . . Yes No (N/A)
Are field duplicate RPD values acceptable? . . . . . Yes No (N/A)
Are field split RPD values acceptable? . . . . . Yes No N/A

Comments: Spit Samples

(1) BOGNW7 / BOGNQ1 ✓ (3) BOGNW9 / BOGNS3 ✓

(2) BOGNW8 / BOGNQ2 (Ca 20.1%)* (4) BOGNX0 / BOGNS4 (Ca 19%) ✓

7. FURNACE AA QUALITY CONTROL

Were duplicate injections performed as required? . . . . . Yes No (N/A)
Are duplicate injection %RSD values acceptable? . . . . . Yes No (N/A)
Were analytical spikes performed as required? . . . . . Yes No (N/A)
Are analytical spike recoveries acceptable? . . . . . Yes No (N/A)
Was MSA performed as required? . . . . . Yes No (N/A)
Are MSA results acceptable? . . . . . Yes No (N/A)

Comments:

8. REPORTED RESULTS AND DETECTION LIMITS

Are results reported for all requested analyses? . . . . . (Yes) No N/A
Are all results supported in the raw data? . . . . . Yes No (N/A)
Are results calculated properly? . . . . . Yes No (N/A)
Do results meet the CRDLs? . . . . . (Yes) No N/A

Comments:

BLANK AND SAMPLE DATA SUMMARY

SDG: LK5628	VALIDATOR: RJS	DATE: 12/28/95	PAGE 1 OF ___

COMMENTS:

SAMPLE ID	COMPOUND	RESULT	Q	RT	UNITS	5X RESULT	10X RESULT	SAMPLES AFFECTED	QUALIFIER
Prep 1	Aluminum	26.69			ug/L	133.45	—	B06NW9	U
Prep 1	Iron	32.34				161.7	—	B06NW9, W7	U

000031

96134020.0543

9613420.0544

CLP

3
BLANKS

Lab Name: L.A.S. Contract: HANFORD

Lab Code: LOCK Case No.: B95-10 SAS No.: SDG No.: L5628W

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Prepa-ration Blank	C	M
Aluminum	21.0	U	21.0	U	21.0	U	21.0	U	26.690	B	P
Antimony	4.0	U	4.0	U	4.0	U	4.0	U	4.000	U	P
Arsenic	3.0	U	3.0	U	3.0	U	3.0	U	3.000	U	P
Barium	14.0	U	14.0	U	14.0	U	14.0	U	14.000	U	P
Beryllium	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Cadmium	5.0	U	5.0	U	5.0	U	5.0	U	5.000	U	P
Calcium	26.0	U	26.0	U	26.0	U	26.0	U	26.000	U	P
Chromium	4.0	U	4.0	U	4.0	U	4.0	U	4.000	U	P
Cobalt	6.0	U	6.0	U	6.0	U	6.0	U	6.000	U	P
Copper	3.0	U	3.0	U	3.0	U	3.0	U	3.000	U	P
Iron	9.0	U	9.0	U	9.0	U	9.0	U	32.340	B	P
Lead	2.0	U	2.0	U	2.0	U	2.0	U	2.000	U	P
Magnesium	38.0	U	38.0	U	38.0	U	38.0	U	38.000	U	P
Manganese	2.0	U	2.0	U	2.0	U	2.0	U	2.000	U	P
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.200	U	AV
Nickel	14.0	U	14.0	U	14.0	U	14.0	U	14.000	U	P
Potassium	520.0	U	520.0	U	-622.3	B	520.0	U	520.000	U	P
Selenium	4.0	U	4.0	U	4.0	U	4.0	U	4.000	U	P
Silver	3.0	U	3.0	U	3.0	U	3.0	U	3.000	U	P
Sodium	46.0	U	46.0	U	46.0	U	46.0	U	175.740	B	P
Thallium	3.6	B	4.5	B	3.0	U	3.0	U	3.000	U	P
Vanadium	4.0	U	4.0	U	4.0	U	4.0	U	4.000	U	P
Zinc	3.0	U	3.0	U	3.0	U	3.0	U	3.000	U	P

FORM III - IN

ILM03.0

056 RS