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December 3, 1990

Ms. Joan Kessner, T6-08
Westinghouse Hanford Company
P.O. Box 1970
Richland, Washington 99352



Dear Joan:

TRANSMITTAL OF 200-BP-1 GROUNDWATER ANALYSIS PROJECT, PARAMETERS OF INTEREST DATA PACKAGE/REPORT NO. 1, REVISION 0, DECEMBER 3, 1990

Enclosed is one copy of the subject 200-BP-1 Parameters of Interest Data Package/Report No. 1 and two copies of the report. The other two copies of the appendices will be transmitted to you as soon as duplicating can get them copied.

If you have any questions after reviewing the data, please give me a call on 376-5802.

Sincerely,

B.M. Gillespie

B. M. Gillespie
Analytical Laboratory Operations
200-BP-1 PNL Project Manager

Enclosures

cc: J.M. Latkovich



INTRODUCTION

This data package contains the results obtained by Pacific Northwest Laboratory (PNL) staff in the characterization of samples for the 200-BP-1 Groundwater Analysis Project. The samples were submitted for analysis by Westinghouse Hanford Company (WHC) under the Technical Project Plan (TPP) 16772 and the Quality Assurance Project Plan (QAPjP) ALO-001. The analytical procedures required for analysis were defined in the Test Instructions (TI) prepared by the PNL 200-BP-1 Project Management Office in accordance with the TPP and the QAPjP ALO-001.

The samples (Table 1) were submitted with the appropriate WHC Chain of Custody (COC) and Sample Analysis Request Forms. The samples were delivered at refrigerated temperature to the 300 Area, 325 Building 200-BP-1 Sample Custodian.

The requested analysis for these samples were the parameters of interest in the WHC SOW. These parameters of interest are; nitrate, nitrite, phosphate, sulfate, cyanide, free cyanide, selenium, bismuth, total alpha, total beta, cesium-137, cobalt-60, ruthenium-106, plutonium-239/240, plutonium-238, strontium-90, technetium-99, uranium activity, and tritium. The quality control (QC) requirements for each sample are defined in the test instructions for each sample. The QC requirements outlined in the procedures and requested in the WHC SOW were followed. Sample duplicates, methods blank, matrix spikes and matrix spike duplicates were analyzed. All QC data that exist are included in this Data Package/Report.

The data in this package are reported in separate tables (Tables 2 through 15) for each analyte or method. Four appendices are provided; one for Test Instruction, one for Chain of Custody, Sample Analysis Request Forms and Sample Receipt Forms, one that contains the primary inorganic analytical data and one that contains the primary radiochemistry analytical data.

CERTIFICATION STATEMENT

I certify that this data package is in compliance with the terms and conditions of the TPP 16772 and QAPjP ALO-001 for completeness. Release of the data contained in this hard copy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Project Manager or the Project Manager's designee, as verified by the following signature.

B.M. Gillespie
B. M. Gillespie
200-BP-1 Project Manager

1-14-91
Date

Quality Control

I certify that I have reviewed all data in this report/package for completeness of the QC data and for compliance with project QC requirements as defined in the TPP 16772 and the QAPjP ALO-001.

J. L. Daniel
J. L. Daniel
PNL ACL Quality Representative

1/15/91
Date

Table 1: 200-BP-1 Sample Numbers

<u>WHC Sample Number</u>	<u>PNL ALO Sample Number</u>	<u>Sample Type</u>
699-55-55-001	90-5335	Soil
699-52-57-001	90-5336	Soil
699-52-57-027	90-5343	Soil
699-55-55-025	90-5344	Soil
699-52-57-050	90-5345	Soil
699-52-57-049	90-5346	Water
699-52-57-050A	90-5347	Water
699-52-57-077	90-5350	Soil
699-52-57-077B	90-5351	Soil
699-52-57-074	90-5352	Water
699-52-57-077A	90-5353	Water

TABLE 2:
WEIGHT PERCENT SOLIDS SUMMARY SHEET

SAMPLE ID#	PNL LOG#	SAMPLE WT %	DUPLICATE WT %	AVERAGE SOLIDS WT %
699-52-57-001	90-5335	94.88	95.33	95.11
699-55-55-001	90-5336	96.41	95.70	96.06
699-52-57-027	90-5343	97.00	96.30	96.65
699-55-55-025	90-5344	96.08	96.04	96.06
699-52-57-050	90-5345	96.88	97.19	97.04
699-52-57-077	90-5350	94.49	94.97	94.73
699-52-57-077-B	90-5351	94.43	94.38	94.41

* Weight Percent Solids were determined following the method outlined in PNL-ALO-504.

ANION ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-108, Aqueous Leach of Sludges, Soils, and Other Solid Samples for Anion Analysis. The sample solution was then analyzed by Ion Chromatography (IC) according to procedure PNL-ALO-212, Determination of Inorganic Anions by Ion Chromatography. This method is comparable to EPA method 300.0. The total analysis was performed in building 325 in the 300 area.

The data are listed in Table 3. Analyses are listed on four separate tables, a table for each analyte. The data are reported this way to allow review of sample data, duplicates, blanks, matrix spikes, RPD and % recoveries for samples of each analyte.

The mean % spike recoveries and their standard deviations (SD) are as follows:

	<u>SAMPLE + SPIKE</u>				<u>BLANK + SPIKE</u>	
	<u>SOILS</u>		<u>WATER</u>		<u>SOIL AND WATER</u>	
	<u>(% REC)</u>	<u>SD (%)</u>	<u>(% REC)</u>	<u>SD (%)</u>	<u>(% REC)</u>	<u>SD (%)</u>
N02-N	94.7	7.1	116.7	5.4	95.0	16.4
N03-N	100.5	2.6	104.0	2.2	98.9	1.8
P04-P	90.0	7.0	99.2	2.0	92.3	4.9
S04	99.1	3.7	103.3	2.8	100.5	0.5

Upon review of the nitrate and sulfate soil analysis of duplicates a mean and standard deviation of the RPD's of the duplicate values are:

	<u>Mean (%)</u>	<u>Std dev (%)</u>
N03-N	7.8	10.8
S04	2.9	3.2

The values varied due to heterogeneity of sample matrix. The concentration of the other soil analytes and all analytes for water samples, was below the detection limits, therefore a relative percent difference is not calculated.

The hold times for water analysis of anions is 48 hours from sampling to the time of analysis. Hold times on water samples were met on two water samples and missed on the other two due to facilities maintenance. Since the hold times were only missed by 4.3 hours and 3.5 hours, there is no impact on the results. There are no hold times associated with the analysis of soils except that the analysis of anions be performed within 48 hours of the aqueous leach of the soils. All leaches of soils were analyzed within the requested hold time.

TABLE 3: ANION IC ANALYSIS DATA

NITRITE (NO2-N)

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1	C2	RPD	C5	C3		C6		C3	% RECOVERIES	
		SAMPLE (mg/Kg)	SAMPLE DUP (mg/Kg)		BLANK (ug)	SPIKE+SAMPLE (mg/Kg)	SPIKE (mg/Kg)	DUP+SPIKE (mg/Kg)	SPIKE (mg/Kg)	SAMPLE + SPIKE	C6 DUP+SPIKE	C4 LCS SAMPLE
699-52-57-001	90-5335	<DL	<DL	NA	<DL	60.9	61.8	57.3	58.1	98.5	98.6	99.3
	90-5335R	<DL	<DL	NA	<DL	21.4	21.7			98.6		102.6
699-55-55-001	90-5336	<DL	<DL	NA	<DL	78.1	80.5	72.9	71.6	80.5	71.6	99.3
	90-5336R	<DL	<DL	NA	<DL	22.5	23.4			96.2		98.0
699-52-57-027	90-5343	<DL	<DL	NA	<DL	23.1	24.9			92.8		97.4
699-55-55-025	90-5344	<DL	<DL	NA	<DL	27.5	29.3			93.6		100.7
699-52-57-050	90-5345	<DL										103.9
699-52-57-077	90-5350	<DL										101.3
699-52-57-077-B	90-5351	<DL	<DL	NA	<DL	24.0	23.4	23.7	23.7	102.6	100.0	101.3
										mean	94.7	
										std. dev.	7.1	

*DL = detection limit of 0.5 mg/Kg (theoretical)

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1	C2	RPD	C5	C3		C6		C3	% RECOVERIES	
		SAMPLE (ug/L)	SAMPLE DUP (ug/L)		BLANK (ug)	SPIKE+SAMPLE (ug/L)	SPIKE (ug/L)	DUP+SPIKE (ug/L)	SPIKE (ug/L)	SAMPLE + SPIKE	C6 DUP+SPIKE	C4 LCS SAMPLE
699-52-57-049	90-5346	<DL	<DL	NA								
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	1680.0	1520.0	1670.0	1520.0	110.5	109.9	102.6
699-52-57-074	90-5352 (a)	<DL	<DL	NA		1810.0	1520.0			119.1		
699-52-57-077A	90-5353 (b)	<DL	<DL	NA		1830.0	1520.0			120.4		
										mean	116.7	100.3
										std. dev.	5.4	2.1

*DL = detection limit of 5 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

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TABLE 3: ANION IC ANALYSIS DATA

NITRATE (NO3-N)

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1		RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES			
		SAMPLE (mg/Kg)	SAMPLE DUP (mg/Kg)			SPIKE+SAMPLE (mg/Kg)	SPIKE (mg/Kg)	DUP+SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SAMPLE + SPIKE	C6 DUP+ SPIKE	C4 LCS SAMPLE	
699-52-57-001	90-5335	2.9	2.3	26.2	1.7	46.4	45.9	44.5	43.1	95.4	97.2	99.1	
	90-5335R	1.6	1.6	0	<DL	18.0	16.1			102.0		100.9	
699-55-55-001	90-5336	<DL	<DL	NA	<DL	60.2	59.8	53	53.1	100.7	99.8	100.0	
	90-5336R	0.4	0.5	8.7	<DL	17.9	17.3			100.8		100.9	
699-52-57-027	90-5343	1.6	1.6	1.2	<DL	20.3	18.5			100.9		102.7	
699-55-55-025	90-5344	1.2	1.2	1.6	<DL	23.8	21.7			104.0		100.0	
699-52-57-050	90-5345	1.2										100.9	
699-52-57-077	90-5350	1.0										101.8	
699-52-57-077-B	90-5351	0.9	0.9	1.1	<DL	18.3	17.4	18.1	17.6	99.9	97.6	99.1	
										mean			
										std. dev.	100.5		
											2.6		

*DL = detection limit of 0.5 mg/Kg (theoretical)

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1		RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES			
		SAMPLE (ug/L)	SAMPLE DUP (ug/L)			SPIKE+SAMPLE (ug/L)	SPIKE (ug/L)	SUP+SPIKE (ug/L)	SPIKE (ug/L)	C3 SAMPLE + SPIKE	C6 DUP+ SPIKE	C4 LCS SAMPLE	
699-52-57-049	90-5346	<DL	<DL	NA									
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	1140.0	1120.0	1140.0	1130.0	101.8	100.9	100.0	
699-52-57-074	90-5352 (a)	56.2	56.2	0		1230.0	1130.0			103.9			
699-52-57-077A	90-5353 (b)	<DL	<DL	NA		1200.0	1130.0			106.2			
										mean	104.0	98.9	100.6
										std. dev.	2.2	1.8	1.1

*DL = detection limit of 5 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

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TABLE 3: ANION IC ANALYSIS DATA

PHOSPHATE (PO4-P)

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (mg/Kg)	C2 SAMPLE DUP (mg/Kg)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES		
						SPIKE+SAMPLE (mg/Kg)	SPIKE (mg/Kg)	DUP+SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SAMPLE + SPIKE	C6 DUP+ SPIKE	C4 LCS SAMPLE
699-52-57-001	90-5335	<DL	<DL	NA	<DL	59.8	66.2	57	62.2	90.3	91.6	88.3
	90-5335R	<DL	<DL	NA	<DL	23.2	23.2			100.0		96.9
699-55-55-001	90-5336	<DL	<DL	NA	<DL	78.1	86.3	71.5	76.7	90.5	93.2	90.8
	90-5336R	1.2	<DL	NA	<DL	25.1	25.0			98.0		93.9
699-52-57-027	90-5343	<DL	<DL	NA	<DL	23.0	26.7			86.1		95.1
699-55-55-025	90-5344	<DL	<DL	NA	<DL	25.6	31.4			81.5		93.9
699-52-57-050	90-5345	<DL										92.6
699-52-57-077	90-5350	<DL										93.9
699-52-57-077-B	90-5351	<DL	<DL	NA	<DL	20.9	25.1	21.8	25.3	83.3	86.2	92.6
										mean	90.0	
										std. dev.	7.0	

*DL = detection limit of 3 mg/Kg (theoretical)

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (ug/L)	C2 SAMPLE DUP (ug/L)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES			
						SPIKE+SAMPLE (ug/L)	SPIKE (ug/L)	SUP+SPIKE (ug/L)	SPIKE (ug/L)	C3 SAMPLE + SPIKE	C6 DUP+ SPIKE	C4 LCS SAMPLE	
699-52-57-049	90-5346	<DL	<DL	NA									
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	1570.0	1620.0	1600.0	1630.0	96.9	98.2	98.2	
699-52-57-074	90-5352 (a)	<DL	<DL	NA		1640.0	1630.0			100.6			
699-52-57-077A	90-5353 (b)	<DL	<DL	NA		1630.0	1630.0			100.0			
										mean	99.2	92.3	93.5
										std. dev.	2.0	4.9	2.6

*DL = detection limit of 31 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

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TABLE 3: ANION IC ANALYSIS DATA

SULFATE

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (mg/Kg)	C2 SAMPLE DUP (mg/Kg)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES		
						SPIKE+SAMPLE (mg/Kg)	SPIKE (mg/Kg)	DUP+SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SAMPLE + SPIKE	C6 DUP+ SPIKE	C4 LCS SAMPLE
699-52-57-001	90-5335	<DL	<DL	NA	<DL	203.0	203.0	191.0	191.0	100.0	100.0	98.8
	90-5335R	<DL	<DL	NA	<DL	72.9	71.3			102.2		99.8
699-55-55-001	90-5336	<DL	<DL	NA	<DL	265.0	265.0	236.0	235.0	100.0	100.4	99.2
	90-5336R	3.7	<DL	NA	<DL	78.5	76.8			99.8		99.6
699-52-57-027	90-5343	22.7	21.3	6.4	<DL	97.5	81.9			92.2		99.6
699-55-55-025	90-5344	17.2	16.8	2.4	<DL	116.0	96.2			102.9		98.8
699-52-57-050	90-5345	19.7										99.2
699-52-57-077	90-5350	15										99.2
699-52-57-077-B	90-5351	13.3	13.3	0	<DL	87.5	76.9			96.5		99.2
										mean	99.1	
										std. dev.	3.7	

*DL = detection limit of 6 mg/Kg (theoretical)

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (ug/L)	C2 SAMPLE DUP (ug/L)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES			
						SPIKE+SAMPLE (ug/L)	SPIKE (ug/L)	DUP+SPIKE (ug/L)	SPIKE (ug/L)	C3 SAMPLE + SPIKE	C6 DUP+ SPIKE	C4 LCS SAMPLE	
699-52-57-049	90-5346	<DL	<DL	NA									
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	4980.0	4980.0	5040.0	4990.0	100.0	101.0	100.0	
699-52-57-074	90-5352 (a)	<DL	<DL	NA		5250.0	5000.0			105.0			
699-52-57-077A	90-5353 (b)	<DL	<DL	NA		5220.0	4980.0			104.8			
										mean	103.3	100.5	99.6
										std. dev.	2.8	0.5	0.7

*DL = detection limit of 55 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

CYANIDE ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-270, Total Cyanide in Waters, Solids or Sludges. The methodology is comparable to CLP SOW 788 Method 335.2 distillation and colorimetric technique for the analysis of cyanide. The analysis was performed in building 3720 in the 300 area.

The procedure, PNL-ALO-270, did not reflect the correct CLP standard preparation guidelines (Section 7.3.2.1 and 7.4.2.1). The analysts made a deviation to the procedure and used the client requested method, CLP SOW (788), Method 335.2, for the standard preparation (page D-76). An Interim Change Notice (ICN) or revision to the procedure will be written.

One set of samples was inadvertently spiked with a level above the CLP required spike level. The resulting % recovery was above 95%. During the analysis of the other samples, the KCN spike solution was found to be 80% of the specified CLP procedure requirements by titration with AgNO_3 . New KCN solution was prepared for subsequent batches.

The sample results were below the client required detection limits of 10 $\mu\text{g/L}$ and 1 mg/Kg. Sample results are all below 2 ppm therefore, free cyanide analysis was not required.

Upon review of the sample spiked data results, for soils results, the mean recovery is 103.3% with a standard deviation of 8% and for water results the mean recovery is 103.7% with a standard deviation of 2.2%. The spiked blank results mean recovery is 103.4% with a standard deviation of 9.7%. The overall spike recovery had a precision of $\pm 7\%$ and a bias (accuracy) of + 3.5% on the average.

The general Environmental Protection Agency (EPA) hold time for total cyanide is 12 days. In many cases the hold time was not met. The delay in work is attributed to the above mentioned method/procedure problems and internal logistics problems with Radiation Protection Technology (RPT). Attention was spent on analyzing the soil samples to meet (or come as close to) the hold times as they are more important and more critical to the investigation of the task. Note that the soils greatest "miss" on hold times is three days (Table 4, footnotes d and e). The water samples were field

blanks. When it was determined that hold times may not be met, priority was given to soil samples. There is no impact from the hold time not being met on the results of the soil sample analyses as they are below detection limits and the analysis was performed only 1 to 3 days late. There is no impact on the results of the late analysis dates of the water samples as they are below the detection limits as expected of field blanks.

GRAPHITE FURNACE ATOMIC ABSORPTION ANALYSIS RESULTS

Samples and their accompanying QC samples were prepared following acid digestion by procedure PNL-ALO-101, Acid Digestion for Metal Analysis. The methodology is consistent with the CLP procedure for the acid digestion of waters and sediments. Digestions were conducted in 125 mL narrow mouth bottles. Digestates were then analyzed by graphite furnace atomic absorption (GFAAS) following procedure PNL-ALO-215, Selenium (Atomic Absorption, Furnace Method), for selenium and PNL-ALO-216, Bismuth (Atomic Absorption, Furnace Technique), for bismuth. Se and Bi analysis methodologies are consistent with CLP SOW 788 Method 270.2. Digestion of samples was performed in building 325 and analysis by GFAAS was conducted in building 3720.

Analysis for Se and Bi was conducted on a Perkin-Elmer 5000, as a Zeeman equipped unit was not available. The quarterly instrument detection limit (IDL) for Se was found to be 1.5 $\mu\text{g/L}$. The corresponding IDL for Bi was found to be 2.9 $\mu\text{g/L}$.

A preliminary analysis of the samples was performed to determine the dilution factor necessary to bring the concentration to mid-range in the calibration curve. All samples were determined to have Se and Bi levels below the respective detection limits 3.75 $\mu\text{g/L}$ and 7.25 $\mu\text{g/L}$. Detection limit was defined as 2.5 times the IDL.

Upon review of the data tables for selenium (Table 5A and 5B) and bismuth (Table 6A and 6B), the average recovery of selenium spike in waters is 98.2% with a standard deviation of 11.5%, the average recovery of selenium spike in soils is 65.3% with a standard deviation of 17.3%, the average recovery of bismuth spike in waters is 101.7% with a standard deviation of 6.1% and the average recovery of bismuth spike in soils is 90.5% with a standard deviation of 8.4%. A precision determined from the duplicate sample analysis is not possible since the results are below detection limits. Therefore, the precision and bias based on spike recovery information associated with this set of data are as follows:

	<u>Precision</u>	<u>Bias (Accuracy)</u>
Selenium in water	±12%	-2%
Selenium in soil	±17%	-35%
Bismuth in water	± 6%	+ 2%
Bismuth in soil	± 8%	- 9%

The large bias associated with the analysis of selenium in soil samples is attributed to the low concentrations of selenium and spike standard in the samples and matrix interference (of iron) in the samples. The matrix interference of iron interferes in the background determination in selenium analysis. A Zeeman background correction attachment (not available in this laboratory) is necessary for this matrix correction. The data in Tables 5A, 5B, 6A, and 6B are flagged with appropriate CLP (as defined in CLP SOW 7/88, pages B-19 and 20) flags where necessary. ICB, CCB, ICV, CRA, etc. are as defined in the CLP SOW 7/88, Section E.

The CLP SOW 788 specified hold time of 180 days was met as well as the contract required hold time of 120 days.

TABLE 5A: SELENIUM ANALYSIS DATA
ACID EXTRACTABLE SELENIUM IN WATER SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (ug/L)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	0.5						
ICV (a)	26.0					98	
CCB	0.5						
CRA	5.1					102	
CCB	-0.1						
90-5346-B5	-0.1						
90-5346-B5-AS	11.5			10	115		
90-5346-B1	-0.4	<DL					U
90-5346-B1AS	10.0			10	100		
90-5346-B3	19.7	19.7		25	79		
90-5346-B2	0.5	<DL	N/A				B
90-5346-B2-AS	9.4			10	94		
90-5346-B4	21.9	21.9		25		88	
90-5346-B4-AS	33.5			10	116		
90-5346-B6	21.8	21.8		25	87		
90-5347-B1	0.3	<DL					B
90-5347-B1-AS	10.6			10	103		
CCV	25.5					97	
CCB	0.0						
90-5352-B1	-0.2	<DL					U
90-5352-B1-AS	9.9			10	99		
90-5353-B1	0.1	<DL					B
90-5353-B1-AS	10.0			10	100		
(d) 90-5357-B1	0.1	<DL					B
(d) 90-5357-B1-AS	10.2			10	102		
(d) 90-5358-B1	0.5	<DL					B
(d) 90-5358-B1-AS	9.0			10	85		
CCV	25.7					97	
CCB	0.6						

Notes:

(a) Used a dilution of ICF/ICV-2= 26.4 ug/L
 (b) Analytical spike (AS) = 10 ug/L.
 (c) Pre-digest spike = 25 ug/L. for B3, B4 and B6.
 (d) Samples not part of Data Package #1
 (e) RPD only calculated if both sample and duplicate are greater than detection limit.

B1 = SAMPLE
 B2 = SAMPLE DUPLICATE
 B3 = SAMPLE + Se SPIKE
 B4 = LAB. CONTROL STANDARD
 B5 = PROCEDURAL BLANK
 B6 = SAMPLE + Se SPIKE DUPLICATE

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-049	90-5346	10/04/90	10/21/90	11/05/90
699-52-57-050A	90-5347	10/04/90	10/21/90	11/05/90
699-52-57-074	90-5352	10/09/90	10/21/90	11/05/90
699-52-57-077A	90-5353	10/09/90	10/21/90	11/05/90

CRDL*: 5 ug/L
 DL (IDL x 2.5): 3.75 ug/L

*CRDL = Contract required detection limit

TABLE 5B: SELENIUM ANALYSIS DATA
ACID EXTRACTABLE SELENIUM IN SOIL SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (mg/Kg)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	0.2						
ICV (a)	25.6					97	
CCB	-0.1						
CRA	4.8					96	
CCB	-0.1						
90-5335-B5	-0.1						
90-5335-B5-AS	9.5			10	95		
90-5335-B1	-3.6	<DL					W,U
90-5335-B1-AS	5.3			10	53		
90-5335-B3	-1.3	0		25	0		
90-5335-B3-AS	7.5			10	75		
90-5335-B2	-2.4	<DL	N/A				U
90-5335-B2-AS	5.9			10	59		
90-5335-B4 (d)	10.7	34.2				87	W
90-5335-B4-AS	18.1			10	74		
90-5335-B6	-0.8	0		25	0		
90-5335-B6-AS	7.8			10	78		
90-5335-B7	23.8			25	95		
90-5336-B1	-2.7	<DL					W,U
90-5336-B1-AS	5.9			10	59		
CCV	25.3					96	
CCB	0.5						
90-5343-B1	-3.8	<DL					W,U
90-5343-B1-AS	5.4			10	54		
90-5344-B1	-4.3	<DL					W,U
90-5344-B1-AS	5.0			10	50		
90-5345-B1	-5.3	<DL					W,U
90-5345-B1-AS	3.6			10	36		
90-5350-B1	3.3	<DL					W,U
90-5350-B1-AS	6.2			10	62		
90-5351-B1	-2.7	<DL					W,U
90-5351-B1-AS	5.9			10	59		
CCV	25.2					95	
CCB	0.3						

Notes:

(a) Used a dilution of ICF/ICV-2= 26.4 ug/L
 (b) Analytical spike (AS) = 10 ug/L.
 (c) Pre-digest spike = 25 ug/L. for B3, B6 and B7.
 (d) B4 = LCS-0287 containing 39.2 mg/Kg Se
 (e) RPD only calculated if both sample and duplicate are greater than detection limit.

B1 = SAMPLE
 B2 = SAMPLE DUPLICATE
 B3 = SAMPLE + Se SPIKE
 B4 = LAB. CONTROL STANDARD
 B5 = PROCEDURAL BLANK
 B6 = SAMPLE + Se SPIKE DUPLICATE
 B7 = SPIKED PROCEDURAL BLANK

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-001	90-5335	9/25/90	11/11/90	11/13/90
699-55-55-001	90-5336	9/25/90	11/11/90	11/13/90
699-52-57-027	90-5343	10/01/90	11/11/90	11/13/90
699-55-55-025	90-5344	10/01/90	11/11/90	11/13/90
699-52-57-050	90-5345	10/04/90	11/11/90	11/13/90
699-52-57-077	90-5350	10/09/90	11/11/90	11/13/90
699-52-57-077-B	90-5351	10/09/90	11/11/90	11/13/90

CRDL*: 0.5 mg/Kg
 DL (IDL x 2.5): 3.75 ug/L

*CRDL = Contract required detection limit

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TABLE 6A: BISMUTH ANALYSIS DATA
ACID EXTRACTABLE BISMUTH IN WATER SAMPLES

Lab Log #	Soln. Conc. (ug/L)	Results (ug/L)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	-0.6						
ICV (a)	33.5					98	
CCB	0.6						
CRA	9.8					98	
CCB	-0.8						
90-5346-B5	-0.1						
90-5346-B5-AS	19.1			20	95		
90-5346-B1	-0.2	<DL					U
90-5346-B1AS	19.9			20	99		
90-5346-B3	48.3	48.3		50	97		
90-5346-B2	1.7	<DL	N/A				
90-5346-B2-AS	21.8			20	100		
90-5346-B4	14.9	44.7		50		89	
90-5346-B4-AS	36.5			20	108		
90-5346-B6	48.3	48.3		50	97		
90-5347-B1	2.0	<DL					
90-5347-B1-AS	21.9			20	108		
CCV	36.7					110	
CCB	0.4						
90-5352-B1	-1.3	<DL					U
90-5352-B1-AS	23.1			20	115		
90-5353-B1	-1.1	<DL					U
90-5353-B1-AS	20.0			20	100		
(d) 90-5357-B1	-0.8						U
(d) 90-5357-B1-AS	20.4			20	102		
(d) 90-5358-B1	-0.6						U
(d) 90-5358-B1-AS	19.7			20	98		
CCV	32.6					98	
CCB	0.4						

Notes:

- (a) ICV & CCV = 33.33 ug/L
 - (b) Analytical spike (AS) = 20 ug/L.
 - (c) Pre-digest spike for B3, B4 and B6 = 50 ug/L.
 - (d) Samples not part of Data Package #1
 - (e) RPD only calculated if both sample and duplicate are greater than detection limit.
- B1 = SAMPLE
 - B2 = SAMPLE DUPLICATE
 - B3 = SAMPLE + Bi SPIKE
 - B4 = LAB. CONTROL STANDARD
 - B5 = PROCEDURAL BLANK
 - B6 = SAMPLE + Bi SPIKE DUPLICATE

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-049	90-5346	10/04/90	10/21/90	11/04/90
699-52-57-050A	90-5347	10/04/90	10/21/90	11/04/90
699-52-57-074	90-5352	10/09/90	10/21/90	11/04/90
699-52-57-077A	90-5353	10/09/90	10/21/90	11/04/90

CRDL* : 60 ug/L
DL (IDL x 2.5): 7.25 ug/L

*CRDL = Contract required detection limit

TABLE 6B: BISMUTH ANALYSIS DATA
ACID EXTRACTABLE BISMUTH IN SOIL SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (mg/Kg)	Duplicate RPD (e)	Spike -(ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	-0.1						
ICV (a)	24.5					98	
CCB	0.0						
CRA	9.4					94	
CCB	-0.1						
90-5335-B5	-0.3						
90-5335-B5-AS	18.2			20	91		
90-5335-B1	-0.6	<DL					U,N
90-5335-B1AS	18.0			20	90		
90-5335-B3	36.5	3.53		50	73		N
90-5335-B2	0.1	<DL	N/A				
90-5335-B2-AS	18.9			20	94		
90-5335-B4 (d)	17.8	32.5				89	
90-5335-B4-AS	35.6			20	89		
90-5335-B6	37.2	3.44		50	74		N
90-5335-B7	50.8			50	102		
90-5336-B1	0.3	<DL					
90-5336-B1-AS	19.6			20	96		
CCV	26.0					106	
CCB	0.6						
90-5343-B1	-2.5	<DL					U,N
90-5343-B1-AS	19.3			20	96		
90-5344-B1	-2.6	<DL					U,N
90-5344-B1-AS	18.3			20	91		
90-5345-B1	-2.4	<DL					U,N
90-5345-B1-AS	18.9			20	94		
90-5350-B1	-1.4	<DL					U,N
90-5350-B1-AS	19.5			20	97		
90-5351-B1	-1.8	<DL					U,N
90-5351-B1-AS	18.1			20	90		
CCV	26.8					107	
CCB	0.7						

Notes:

- (a) Used a dilution of ICV-2 = 26.4 ug/L
- (b) Analytical spike (AS) = 20 ug/L.
- (c) Pre-digest spike = 50 ug/L.
- (d) B4 = LCS-0287+ 40 ug Bi spike
- (e) RPD only calculated if both sample & duplicate are greater than detection limit.

- B1 = SAMPLE
- B2 = SAMPLE DUPLICATE
- B3 = SAMPLE + Bi SPIKE
- B4 = LAB. CONTROL STANDARD
- B5 = PROCEDURAL BLANK
- B6 = SAMPLE + Bi SPIKE DUPLICATE
- B7 = SPIKED PROCEDURAL BLANK

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-001	90-5335	9/25/90	11/11/90	11/13/90
699-55-55-001	90-5336	9/25/90	11/11/90	11/13/90
699-52-57-027	90-5343	10/01/90	11/11/90	11/13/90
699-55-55-025	90-5344	10/01/90	11/11/90	11/13/90
699-52-57-050	90-5345	10/04/90	11/11/90	11/13/90
699-52-57-077	90-5350	10/09/90	11/11/90	11/13/90
699-52-57-077-B	90-5351	10/09/90	11/11/90	11/13/90

CRDL* : 10 mg/Kg
DL (IDL x 2.5): 7.25 ug/L

*CRDL = Contract required detection limit

FREE CYANIDE ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-107, Leach Procedure for Preparing Sludges, Soils and Other Solid Samples for Free Cyanide Analysis. The sample solutions were then analyzed by direct injection into an ion chromatograph/amperometric detector instrument system according to procedure PNL-ALO-271, Procedure for Analysis of Free Cyanide in Water and Solid Sample Leachates. The analysis of free of cyanide in waters or soils was to be performed on samples that had results of greater than 2 ppm total cyanide. Free cyanide analysis was done for a few samples that were nearing the hold time for total cyanide so the free cyanide analysis would also meet the hold time for CLP total cyanide analysis.

Upon review of the data, the average recovery spike recovery was 58.8% with a standard deviation of 15% and the average recovery of the standards was 86% with a standard deviation of 11.7%. The conclusion is a precision of the method of $\pm 12\%$ and a bias (accuracy) of -14% on the average. The poor spike recovery is attributed to the sonicating (which caused excess heat and loss of CN) of the samples. Once the method was changed to magnetic stirring of the sample, spike recoveries were acceptable.

The quarterly detection limit found for the free cyanide analysis system used in Building 314 in the 300 area was $2 \mu\text{g/L}$. This detection limit determination was performed to CLP protocol.

The CLP SOW (No. 788) hold time was met. The defined hold time for cyanide is 12 days. The four samples analyzed for free cyanide were analyzed on October 8, 1990. The samples were sampled on September 26, 1990 and October 2, 1990.

TABLE 7: FREE CYANIDE ANALYSIS

Sample ID#	Sample mg/Kg	Sample Duplicate mg/Kg	Sample+ Spike mg/Kg	Spike Added mg/Kg	(20ppb) Control Std. ppb	Matrix Blank mg/Kg	Spike Duplicate mg/Kg	Spike Rec %	Control Std. % Rec.
90-5335-J-1	<0.2								
90-5335-J-4					19.9				99.5
90-5335-J-4					15.9				79.5
90-5335-J-4					14.7				73.5
90-5335-J-4					18.3				91.5
90-5335-J-5						<0.2			
90-5336-J-1	<0.2								
90-5336-J-3			0.44	1				44	
90-5336-J-6				1			<0.2		
90-5336-J-6				1			0.58 *	58	
90-5336-J-6				1			0.745 **	74.5	
90-5343-J-1	<0.2								
90-5343-J-2		<0.2							
90-5344-J-1	<0.2								
							mean	58.8	86
							std. dev.	15.3	11.7

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Note: Sample results reported based on undried sample weight.

* Freshly sonicated spiked sample - spike sonicated 10/8/90.

** Stirred (magnetically) spiked sample - not sonicated and hence no temperature rise during leaching.

Note: Based on control standard run before and immediately after this spiked sample, the spike recovery is within allowable limits. Detector response drift is obvious here in later portion of the analytical session.

- J1 = SAMPLE
- J2 = DUPLICATE SAMPLE
- J3 = SPIKE SAMPLE
- J4 = STANDARD
- J5 = METHODS BLANK
- J6 = SPIKE DUPLICATE

GAMMA ENERGY ANALYSIS RESULTS

Eleven samples were received for Gamma Energy Analysis (GEA). Seven samples were soils and 4 samples were liquids. For the soils, a duplicate soil and a matrix blank were analyzed per the Test Instructions received. Water spike and water spike duplicate samples were spiked with Co-90 and Cs-137 but not spiked with Ru-106 as a Ru-106 determination was to be performed by a different sample collection method. Since these water samples were field blanks for soil samples, the client decided not to perform the sample collection method for Ru-106 (the water samples were to be submitted on a resin as per the Ru-106 determination in waters sample collection method). A total of 17 analyses were performed by GEA. The sample preparation and counting were performed in 329 Building in the 300 Area.

The samples were prepared for counting by following PNL-ALO-105. This procedure covers the preparation of both the solids and the liquids. The geometry used for the solids was the "large tuna can." Two hundred twenty grams of dried material were sealed into a "large tuna can." The liquids were transferred into 500 ml polyethylene bottles. A total of 500 g of liquid was taken for each sample. Note that for the analysis of ^{106}Ru in waters, a special sample was supposed to be collected if the requested detection limit was to be met.

The samples were then analyzed by gamma-ray spectroscopy to determine the quantities of ^{60}Co , ^{106}Ru , and ^{137}Cs present. This work was performed following PNL-ALO-464 and PNL-ALO-470. The liquids were counted on Detector K in a horizontal configuration. The soils were counted on two different detectors. This served as both a cross check on the data and supplied detection limit information on each system. The first system was Detector L which is a lithium-drifted germanium [Ge(Li)] detector. The second system was Detector I which is a coincidence-noncoincidence Ge(Li)-NaI(Tl) detector. This system was designed for improved sensitivity of single gamma-ray emitting radionuclides such as ^{137}Cs .

Tables 7A and 7B present the measured values for ^{60}Co , ^{106}Ru , and ^{137}Cs in the soils and waters, respectively. The detection limits quoted are calculated as if the isotope was present at a level that is 2.5 times the

square root of twice the average background. The average relative standard deviation of analytical data for the two water spike samples for Co-60 and Cs-137 is <0.3%. The average % recovery for Co-60 and Cs-137 in the two water spike samples was 97.5% and 97.6%, respectively. The accuracy and precision shown are far better than the requested values of $\pm 25\%$ and $\pm 35\%$ for soils and $\pm 25\%$ and $\pm 25\%$ for waters, respectively.

Table 8A:

Gamma Energy Analysis of Soils -

Detector I

(Radionuclide activity in pCi/g)

Sample ID	LRB #	Date of Count	Weight g.	Co(60)	Ru(106)	Cs(137)
90-5335-L-1	53944-7-A	11-01-90	220.20	<0.015	<0.15	<0.0070
90-5335-L-2	53944-7-B	10-31-90	220.73	<0.014	<0.13	<0.0057
90-5336-L-1	53944-8-A	10-26-90	220.40	<0.008	<0.073	<0.0035
90-5343-L-1	53944-9-A	10-29-90	220.06	<0.011	<0.10	<0.0051
90-5344-L-1	53944-10-A	10-30-90	220.29	<0.012	<0.10	<0.0055
90-5345-L-1	53944-11-A	11-04-90	220.04	<0.015	<0.13	<0.0067
90-5350-L-1	53944-12-A	11-05-90	220.05	<0.0094	<0.084	<0.0045
90-5351-L-1	53944-13-A	11-07-90	220.18	0.015	<0.11	<0.0056
90-5335-L-5	53944-14-A	11-08-90		+/- 35% ** <1.1 *	<4.2*	<0.75*

Detector L

(Radionuclide activity in pCi/g)

Sample ID	LRB #	Date of Count	Weight g.	Co(60)	Ru(106)	Cs(137)
90-5335-L-1	53944-7-A	10-31-90	220.20	<0.019	<0.18	<0.015
90-5335-L-2	53944-7-B	11-01-90	220.73	<0.022	<0.20	<0.017
90-5336-L-1	53944-8-A	10-29-90	220.40	<0.018	<0.16	<0.014
90-5343-L-1	53944-9-A	10-30-90	220.06	<0.017	<0.16	<0.013
90-5344-L-1	53944-10-A	10-26-90	220.29	<0.010	<0.093	<0.0079
90-5345-L-1	53944-11-A	11-05-90	220.04	<0.020	<0.19	<0.015
90-5350-L-1	53944-12-A	11-04-90	220.05	<0.018	<0.16	<0.013
90-5351-L-1	53944-13-A	11-08-90	220.18	<0.017	<0.15	<0.013
90-5335-L-5	53944-14-A	11-07-90		<2.6*	<8.0*	<2.3*

* This is a blank value expressed as pCi/sample. If one assumes an average mass of 220 g, the values of Co(60), Ru(106), and Cs(137) for Detector I are <0.0050, <0.019, and <0.0034 pCi/g and for Detector L the blank values are <0.012, <0.036, and <0.010 pCi/g.

** The one sigma uncertainty is based on counting statistics.

- L1 = SAMPLE
- L2 = SAMPLE DUPLICATE
- L5 = BLANK

Detection Limit (theoretical as defined in the QAPJP ALO-001)
 Cs(137) - 0.01 pCi/g
 Co(60) - 0.01 pCi/g
 Ru(106) - 0.11 pCi/g

Note: All "<" values are detection limits associated with each "not detected" analysis.

Table 8B:
Gamma Energy Analysis of Waters

Detector K

Sample ID	LRB #	Date of Count	Weight L.	Co(60) (pCi/L)	Co(60) spike (pCi/L)	Co(60) spike Added (pCi/L)	Co(60) Spike % rec	Ru(106) (pCi/L)	Cs(137) (pCi/L)	Cs(137) spike (pCi/L)	Cs(137) spike Added (pCi/L)	Cs(137) Spike % rec
90-5346-L-1	53944-15-A	10-24-90	0.5	<10				<140	<8.1			
90-5346-L-2	53944-16-A	10-30-90	0.5	7.1 +/- 44%				<110	<6.4			
90-5347-L-1	53944-17-A	10-25-90	0.5	10.9 +/- 30%				<130	<6.6			
90-5347-L-3	53944-18-A	11-01-90	0.5		84740 +/- 0.72%	87030	97.4	<930		82970 +/- 1.0%	85190	97.4
90-5347-L-6	53944-19-A	11-05-90	0.5		85020 +/- 0.72%	87030	97.7	<950		83310 +/- 1.0%	85190	97.8
90-5352-L-1	53944-20-A	10-31-90	0.5	<7.5				<118	<6.7			
90-5353-L-1	53944-21-A	10-26-90	0.5	<4.0				<50	7.3 +/- 35%			
90-5347-L-5	53944-22-A	10-29-90	0.5	<8.4				<80	<6.4			

The one sigma uncertainties are based on counting statistics.

Density of water samples taken as 1 g/ml.

- L1 = SAMPLE
- L2 = SAMPLE DUPLICATE
- L3 = METHODS SPIKE
- L5 = BLANK
- L6 = METHODS DUPLICATE SPIKE

Detection Limit = Cs(137) - 3.2 pCi/L
 Co(60) - 3.6 pCi/L
 Ru(106) - 44 pCi/L

Note: All "<" values are detection limits associated with each "not detected" analysis.

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TOTAL ALPHA ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. The digested samples were then processed by procedure PNL-ALO-460, Source Preparation for Gross Alpha Analysis, and the sources were counted in accordance with procedure PNL-ALO-461, Alpha Counting Procedure. The sample results for solids are reported per received sample weight (i.e. not corrected for wt % solids). Total alpha activity was calculated using a counting efficiency factor for Pu-239. The digestion, source preparation and counting were performed in building 329 in the 300 area.

Water Samples

An Interlaboratory Control Sample (LCS) was analyzed with this sample delivery group. This LCS sample is from the Environmental Monitoring Systems Laboratory (EMSL).

Upon review of the sample data (Table 9A), the average recovery of the spike in water samples was 92.5% with a standard deviation of 3.8%. The conclusion is that the method achieved a precision of $\pm 4\%$ relative, with a bias of - 8% on the average in water sample analysis.

Soil Samples

A percent recovery (i.e. counting efficiency) versus total solids curve was prepared for the analysis of total alpha activity for soil samples. The PNL method in procedure, PNL-ALO-460, is consistent with that in SW 846, method 9310. This method requires the use of a counting efficiency versus total solids curve for the gross alpha analysis in water samples and also is an accepted method for gross alpha analysis of soil samples.

The blank from this analysis batch was very high for an unknown reason. It appears to be a high flier as it cannot be attributed to instrument or method errors, and is higher than sample results and not indicative of problems with the other sample determinations. The blank spike showed excellent recovery of 108%. The matrix spike and duplicate matrix spike resulted in recoveries of 50% and 71% after curve factor corrections. These recoveries are typical of gross alpha analysis of soil samples attributed to uneven distribution of solids on the counting disk. Upon review of the duplicate sample results (Table 9B), the relative percent difference (RPD)

is 74% and the RPD for the matrix spike and the matrix spike duplicate samples is 30%. The precision at the low end of total alpha is not within the $\pm 35\%$ required but the spike duplicates are within the precision limits.

There are no defined hold times for total alpha analysis.

TABLE 9A:

WATER SAMPLE ANALYSIS

TOTAL ALPHA ANALYSIS DATA

Total alpha results reported as Pu-239

Sample #	Sample Type	Total Alpha (pCi/L)	* +/- 1 sigma	RPD	Spike Conc. (pCi/L)	* +/- 1 sigma	Spike % Rec.
90-5346-A-1a	Sample	<1.3					
90-5347-A-1a	Sample	<1.3					
90-5347-A-2a	Duplicate	<1.3					
90-5352-A-1a	Sample	<1.3					
90-5353-A-1a	Sample	<1.3					
90-5353-A-3a	Matrix Spike	229	6	4.9	237	3	96.6
90-5353-A-6a	Dup. Matrix Spike	218	6		237	3	92.0
90-5347-A-5a	Blank	<1.3					
90-5347-A-4a	Blank Spike	211	6		237	3	89.0
						mean	92.5
						std. dev.	3.8

Interlaboratory Comparison Sample (90-6819**)

90-6819-A-4a		3.38	0.28				
90-6819-A-4a		3.59	0.28	15			
90-6819-A-4a		4.44	0.31				
	mean	3.80			10 (EPA)		38
	std. dev.	0.56			3.1 (std. dev.)		

A-1a = SAMPLE

A-2a = DUPLICATE

A-3a = SAMPLE SPIKE

A-4a = BLANK SPIKE

A-5a = BLANK

A-6a = SAMPLE SPIKE DUPLICATE

** EPA/EMSL sample - Gross Alpha-Beta in Water
September 21, 1990

Detection Limit = 1.3 pCi/L

* One sigma uncertainties are based on propagation of mass, volumetric and counting uncertainties.

TABLE 9B:
SOIL SAMPLE ANALYSIS
TOTAL ALPHA ANALYSIS DATA

Total alpha results reported as Pu-239

Sample #	Sample Type	Total Alpha (pCi/g)	+/- 1 sigma	RPD	Spike Conc. (pCi/g)	+/- 1 sigma	Spike % Rec.
90-5335-A-1a	Soil	4.1	0.6				
90-5336-A-1a	Soil	3.7	0.5				
90-5336-A-2a	Duplicate	1.7	0.4	74			
BL-5336-A-5A	Blank	11.4 *	0.6				
BS-5336-A-4a	Blank Spike	51.8 *	2.1		47.9	0.5	108.1 **
90-5343-A-1a	Soil	1.2	0.3				
90-5344-A-1a	Soil	1.5	0.3				
90-5344-A-3a	Matrix Spike	25.3	1.4		47.5	0.5	50.1
90-5344-A-6a	Dup. Mat. Spi	34.4	1.8	30	46.5	0.5	70.8
90-5345-A-1a	Soil	1.4	0.4				
90-5350-A-1a	Soil	1.4	0.3				
90-5351-A-1a	Soil	1.6	0.4				
						mean	76.3
						std. dev.	29.4

* Based on 1 g. sample size.

** Based on assumption that true blank value = 0 pCi/g.

Detection Limit = 0.1 pCi/g (theoretical)

One sigma uncertainties are based on propagation of mass, volumetric and counting uncertainties.

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TOTAL BETA ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. The digested samples were then processed by procedure PNL-ALO-462, Source Preparation for Gross Beta Analysis, and the sources were counted in accordance with procedure PNL-ALO-463, Beta Counting Procedure. The sample results for solids are reported per received sample weight (i.e. not corrected for wt % solids). Total beta activity was calculated using a Sr-90/Y-90 efficiency factor. The digestion, source preparation and counting were performed in building 329 in the 300 area.

Upon review of the sample data, the average recovery of the spike in water analysis was 97.4% with a standard deviation of 3.6% and in soil the average spike recovery was 67.8% with a standard deviation of 16.1%. Therefore, the method achieved a precision of $\pm 4\%$ relative, with a bias of - 3% on the average for water analysis and for soils a precision of $\pm 16\%$ relative, with a bias of -32%. The precision and accuracy of these analyses are within the required limits of the Technical Project Plan.

There are no defined hold times for total beta analysis.

TABLE 10A:
 WATER SAMPLE ANALYSIS
 TOTAL BETA ANALYSIS DATA

Total beta results are reported as Sr-90/Y-90

Sample #	Sample Type	Total Beta (pCi/L)	+/- 1 sigma	RPD	Spike Conc. (pCi/L)	+/- 1 sigma	Spike % Rec.	
90-5346-A-1a	Sample	<3.1						
90-5346-A-2a	Duplicate	<3.1						
90-5347-A-1a	Sample	8.8	2.2					
90-5352-A-1a	Sample	<3.1						
90-5353-A-1a	Sample	<3.1						
90-5357-A-3a	Matrix Spike	229	15	7.2	245	12	93.5	
90-5357-A-6a	Dup. Matrix Spike	246	15		245	12	100.4	
90-5346-A-5a	Blank	<3.1						
90-5347-A-4a	Blank Spike	241	15		245	12	98.4	

							mean	97.4
							std. dev.	3.6

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Interlaboratory Comparison Sample (90-6819**)

90-6819-A-4a		7.2	1.5				
90-6819-A-4a		5.6	1.5	14			
90-6819-A-4a		5.8	1.5				

		mean	6.2		10 (EPA)		62
		std. dev.	0.9		2.2 (std. dev.)		

- A-1a = SAMPLE
- A-2a = DUPLICATE
- A-3a = SAMPLE SPIKE
- A-4a = BLANK SPIKE OR LABORATORY CONTROL STANDARD
- A-5a = BLANK
- A-6a = SAMPLE SPIKE DUPLICATE

** EPA/EMSL sample - Gross Alpha-Beta in Water
 September 21, 1990

Matrix Detection Limit = 3.1 pCi/L

* One sigma uncertainties are based on propagation of mass, volumetric and counting uncertainties.

66377-200

TABLE 10B:
SOIL SAMPLE ANALYSIS
TOTAL BETA ANALYSIS DATA

Total beta results are reported as Sr-90/Y-90

Sample #	Sample Type	Total Beta (pCi/g)	+/- 1 sigma	RPD	Spike Conc. (pCi/g)	+/- 1 sigma	Spike % Rec.
90-5335-A-1a	Sample	1.84	0.16				
90-5336-A-1a	Sample	1.87	0.17	16.8			
90-5336-A-2a	Duplicate	1.58	0.16				
90-5336-A-5a	Blank	<0.17					
90-5336-A-4a	Blank Spike	1.37	0.19		2.45	0.122	55.9
90-5343-A-1a	Sample	0.74	0.16				
90-5344-A-1a	Sample	1.79	0.22				
90-5345-A-1a	Sample	1.05	0.19				
90-5350-A-1a	Sample	1.07	0.16				
90-5351-A-1a	Sample	1.21	0.16				
90-5351-A-3a	Matrix Spike	2.27	0.25	14.7	1.23	0.061	86.1
90-5351-A-6a	Dup. Matrix Spike	1.96	0.22		1.23	0.061	61.3
						mean	67.8
						std. dev.	16.1

- A-1a = SAMPLE
- A-2a = DUPLICATE
- A-3a = SAMPLE SPIKE
- A-4a = BLANK SPIKE OR LABORATORY CONTROL STANDARD
- A-5a = BLANK
- A-6a = SAMPLE SPIKE DUPLICATE

Detection Limit = 0.17 pCi/g (theoretical)

* One sigma uncertainties are based on propagation of mass, volumetric and counting uncertainties.

90-5335-A-1a

ICP-MS ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-101, Acid Digestion for Metal Analysis. The methodology is consistent with CLP Inorganic acid digestion for metals. The sample solutions (1:100 dilutions) were then analyzed by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) Analysis, procedure PNL-ALO-280. The technetium analysis was performed in accordance with procedure PNL-ALO-281, ICP/MS Determination of ^{99}Tc and the uranium was analyzed in accordance with procedure PNL-ALO-282, Determination of Uranium Concentration/Isotopic Composition Using ICP/MS. The digestion of the samples was performed in 325 building and the analysis of the digestate was performed in building 3708 in the 300 area.

Initially, there were a few sample preparation problems. Low level (~ 1 ppb) uranium contamination was discovered. The analyst performing the digestions used glassware used for inorganic metals analysis and was originally unaware of the uranium contamination problem. The problem was solved by using new plastic-ware. Inadvertent spiking of all samples with ^{99}Tc and U spike solutions was discovered upon analysis. It was determined the analyst was interrupted during analysis and there was miscommunication to the analyst completing the digestion. These problems were overcome and the ICP/MS determinations were found to be straightforward. In general, both ^{99}Tc and U concentrations were below or near the sample matrix detection limits in these samples. A small interfering peak at mass/charge 99 was observed in preparation blanks and reagent blanks, thus limiting the lower level detection to 0.01 ppb (leachate solution). Accurate uranium isotope ratios could not be calculated due to statistically insignificant count rates for the 234 and 236 isotopes. Consequently, at ^{238}U concentrations of < 200 ppb, a total uranium activity was computed from the ^{238}U concentration and the half-life of this isotope, also being applied (assuming that ^{238}U activity amounts to 48.1% of natural uranium activity).

Quality assurance measures included the analysis of blind standards, duplicate analyses and analysis of spiked samples. Results for blind standards are given in the ^{99}Tc and U data tables (Table 11 and Table 12) and are in excellent agreement with standard values. Precision estimates

based on duplicate analyses are difficult to determine due to the detection limit values given in most cases for these samples. An exception here is uranium in the soil samples, where duplicate values of 448 and 1357 ng/g were obtained for sample 90-5335, indicating sample heterogeneity (obvious in the samples received), preparation imprecision, or both. Spike recoveries for ^{99}Tc ranged from 79% to 114% (mean of 94%) in the soils. A precision of $\pm 18\%$ and bias of -6% relative are deduced by this data for spike recoveries. Water sample spike recoveries were consistent at 95% for a precision of $\pm 0\%$ and a bias of -5% relative. Uranium recoveries in the water samples were 92-95% (mean 93%) with a precision of $\pm 2\%$ and bias of -7% relative, but were indeterminable in the case of the soil samples since the inherent soil uranium contribution was well in excess of the spike amounts (3-5 times the instrument detection limits). Precision and accuracy will be determined when enough data is available for control charts.

No defined hold times were required for these analytes, although analyses were generally performed within 2-3 days of sample digestion.

TABLE 11: Tc-99 and Uranium Determinations (Soils)

200-BP-1 SOILS ANALYSIS: Data Package 1
Tc-99 and Uranium Determinations

November 19 1990

PNL sample I.D. Number (a)	VIAL ID NUMBER	DRY WEIGHT	DILUTION FACTOR (b)	ICP/MS Analysis No.	Tc-99, ng/ml leachate	Tc-99, ng/g soil (c,d)	Tc-99, ng/g spiked (d)	Tc-99, spike recovery, %	Tc-99, pCi/g, dry soil	U, ng/ml leachate	U, ng/g soil (c,d)	U, ng/g spiked (d)	U, spike recovery, % (e)	U, pCi/g (total), dry soil (f)
90-5335-B1	1	1.2949	72.55	0b10q22	0.01	0.76			13	5.86	448			0.3
90-5335-B2	2	1.2227	76.89	0b10q15	<0.01	<0.8			<20	16.77	1357			0.9
90-5335-B3	3	1.4756	63.56	0b10q14	0.06	3.81	3.35	114	N/A	5.67	380	3.37	N/A	N/A
90-5335-B4	4	1.2889	72.96	0b10q8	<0.01	<0.8			<20	148.00	11366			7.9
90-5335-B5	5	N/A	98.07	0b10q11	0.01	1.34			N/A	0.11	11			N/A
90-5335-B6	6	1.1494	81.91	0b10q19	0.06	4.83	6.09	79	N/A	6.21	535	4.32	N/A	N/A
90-5335-B7	29	N/A	96.02	0b10q5	0.04	4.45	4.94	90	N/A	0.14	14	4.97	N/A	N/A
90-5336-B1	7	1.1273	83.49	0b10q20	0.01	1.23			21	5.77	507			0.4
90-5343-B1	8	1.0127	93.09	0b10q6	0.01	1.08			18	5.55	543			0.4
90-5344-B1	9	1.1042	85.27	0b10q21	0.02	1.53			26	5.14	462			0.3
90-5345-B1	10	1.2151	77.40	0b10q36	0.01	0.98			17	5.72	466			0.3
90-5350-B1	11	1.1909	78.99	0b10q23	<0.01	<0.9			<20	5.57	463			0.3
90-5351-B1	12	1.1173	84.25	0b10q9	<0.01	<0.9			<20	5.84	518			0.4
Tc/U STD ppb	0.0494 / 0.497	N/A	N/A	0b10q7	0.05					0.52				
Tc/U STD ppb	0.0988 / 0.994	N/A	N/A	0b10q18	0.09					1.03				
Tc/U STD ppb	0.494 / 4.97	N/A	N/A	0b10q33	0.49					5.03				
Tc/U STD ppb	0.988 / 9.94	N/A	N/A	0b10q34	1.01					9.96				

(a) Sample types:

- B1 - sample
- B2 - sample, duplicate
- B3 - sample + Tc/U spike
- B4 - laboratory control sample (ICF LCS-0287, no Tc or U data available)
- B5 - procedural blank
- B6 - sample + Tc/U spike, duplicate
- B7 - blank + Tc/U spike

(b) units of mL/g dry soil except for -B5 and -B7 samples (blank/blank spike) units of mL

(c) leachate concentration corrected for internal standard dilution (x 5.00/4.75) and preparation dilution factor

(d) units of ng/g except -B5 and -B7 samples (blank/blank spike) units of ng

(e) not applicable - [U] in sample leachate >> [U] of added spike

(f) total uranium activity calculated using natural isotopic abundance for soil leachate [U] < 200 ppb: pCi = [U]*0.000336/0.481

90-5335-B1
 90-5335-B2
 90-5335-B3
 90-5335-B4
 90-5335-B5
 90-5335-B6
 90-5335-B7
 90-5336-B1
 90-5343-B1
 90-5344-B1
 90-5345-B1
 90-5350-B1
 90-5351-B1

TABLE 12: Tc-99 and Uranium Determinations (Water)

200-BP-1 WATER ANALYSIS: Data Package 1
Tc-99 and Uranium determinations

November 16, 1990

PNL Sample I.D. # (a)	ICP/MS Sample #	Sample Dil. Factor	Tc-99				Tc-99, pCi/L	U			U, pCi/L (d)
			ppb leachate	Tc-99, ppb sample (b,c)	Tc-99, ppb spike	Tc-99 spike, % recovery		ppb leachate	U, ppb sample (b,c)	U, ppb spike	
90-5346-B1	0b16q2/0b15q2	1.033	0.02	0.02		339	<0.01	<0.01		<0.01	
90-5347-B1	0b16q3/0b15q3	1.033	0.01	0.01		170	<0.01	<0.01		<0.01	
90-5352-B1	0b16q4/0b15q4	1.033	0.01	0.01		170	<0.01	<0.01		<0.01	
90-5353-B1	0b16q5/0b15q5	1.034	0.01	0.01		170	<0.01	<0.01		<0.01	
90-6705-B1	0b15q9	1.034	<0.01	<0.01		<170	<0.01	<0.01		<0.01	
90-6705-B2	0b15q10	1.033	<0.01	<0.01		<170	<0.01	<0.01		<0.01	
90-6705-B3	0b15q11	1.033	0.05	0.05	0.05	892	0.05	0.05	0.05	92	
90-6705-B4	0b15q13	1.033	<0.01	<0.01		<170	0.08	0.09		0.06	
90-6705-B5	0b15q14	1.03	<0.01	<0.01		<170	0.01	0.01		0.01	
90-6705-B6	0b15q15	1.031	0.05	0.05	0.05	892	0.05	0.05	0.05	92	
90-6705-B7	0b15q17	0.999	0.05	0.05	0.05	892	0.05	0.05	0.05	95	
Tc/U Std	0.0494/0.497			0.05				0.49			
Tc/U Std	0.0988/0.994			0.10				1.00			
Tc/U Std	0.494/4.97			0.50				5.03			
Tc/U Std	0.988/9.94			1.00				9.98			

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(a) Sample types:

- B1- sample
- B2- sample, duplicate
- B3- sample + 0.05 ppb Tc/U spike
- B4- laboratory control sample (5/95 ICV-2, no Tc or U data available)
- B5- procedure blank
- B6- sample + 0.05 ppb Tc/U spike, duplicate
- B7- blank + 0.05 ppb Tc/U spike

(b) leachate concentration data corrected for internal standard addition (x 5.00/4.75), preparation dilution factor

(c) ICP/MS sample #s 0b16q_ data used for Tc-99; 0bq15_ data for U

(d) Total U activity calculated using natural isotopic abundance for sample [U] <200 ppb: pCi = [U] *0.000336/0.481

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PLUTONIUM ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. The digested samples were then processed by procedure PNL-ALO-466, Plutonium Separation; PNL-ALO-468, Electroplating; and PNL-ALO-469, Alpha Energy Analysis. An approximately 10 gram sample aliquot was digested for soils analysis and 100 ml aliquots for water samples (PE water sample aliquots were 200 ml and 800 ml). The sample results for solids is reported per received sample weight (i.e. not corrected for wt % solids). The digestion, source preparation and counting were performed in building 329 in the 300 area.

The samples were prepared using a Pu-242 tracer (therefore no matrix spike samples were required to be run). The plutonium analyses are calculated on the basis of their peaks ratioed to the Pu-242 tracer peak. The % recovery is monitored only as a means of determining that enough Pu was recovered for meaningful results. All samples, including duplicates in the sample delivery group showed no detectable activity for Pu-238 or Pu-239+240. Upon review of the Laboratory Control Sample (LCS) soil analyses, triplicate results for Pu-238 presented a relative standard deviation (RSD) of 27% (near the detection limit for soil sample analyses). The RSD for the triplicate analyses of the same LCS soil samples for Pu-239&240 results is 2.4%. The RSD for triplicate analyses for LCS water samples for Pu-239&240 results is 1.4% for one LCS sample and 2.4% for the other LCS sample. The Pu-238 analyses for these LCS water samples resulted in detectable activity for only one analysis which was very close to the detection limit.

No hold times are defined for Plutonium analyses.

TABLE 13: Pu 238 AND Pu 239/240 DATA ANALYSIS

Batch 1

Project Sample ID	Lab Sample ID	Description	pCi/g Pu238	+/- 1 sigma	pCi/g Pu 239+240	+/- 1 sigma	242Pu % recovery
90-5335-A-1c	90-5335	Soil	ND<1.62E-03		ND <1.07E-03		21.9
90-5336-A-1c	90-5336	Soil	ND<1.60E-03		ND <5.12E-04		22.7
90-5343-A-1c	90-5343a	Soil	ND<2.11E-03		ND <9.26E-04		15.2
90-5343-A-2c	90-5343b	Duplicate	ND<1.24E-03		ND <7.14E-04		20.3
90-5335-A-5c	BL-5335Pu	Blank	ND<1.76E-03 *		ND <1.16E-03 *		20.0
90-5351-A-1c	90-5351	Soil	ND<2.48E-03		ND <7.93E-04		14.2
(1)90-6818-A-4c	53289-34A	PE soil	2.13E-03	4.60E-04	3.23E-02	1.58E-03	20.0
(1)90-6818-A-2c	53289-34B	PE soil	1.45E-03	5.37E-04	3.24E-02	1.64E-03	17.0
(1)90-6820**	53289-33C	PE water	ND<9.49E-02 (pCi/L)		8.56E+00	4.63E-01	5.7

* Based on 10 g sample size.

**Reported as pCi/L

Batch 2

Project Sample ID	Lab Sample ID	Description	pCi/g Pu 238	+/- 1 sigma	pCi/g Pu 239+240	+/- 1 sigma	242Pu % recovery
90-5344-A-1c	90-5344	soil	ND<1.96E-03		ND< 8.00E-04		20.0
90-5345-A-1c	90-5345	soil	ND<2.58E-03		ND< 1.70E-03		17.0
90-5350-A-1c	90-5350	soil	ND<1.79E-03		ND< 5.75E-04		24.7
90-5350-A-2c	90-5350	duplicate	ND<1.76E-03		ND< 7.74E-04		22.7
90-5344-A-5c	BL-5344	blank	ND<2.74E+00 (pCi/L)		ND< 1.58E+00 (pCi/L)		11.2
(1)90-6818-A-4c	53289-34C	PE soil	1.31E-03	5.74E-04	3.37E-02	1.71E-03	17.9
(1)90-6820	53289-33A	PE water	ND<1.21E-02 (pCi/L)		8.53E+00	2.55E-01 pC	20.5
(1)90-6820	53289-33B	PE water	ND<1.10E-02 (pCi/L)		8.34E+00	2.48E-01 pC	23.1

BATCH 3

Project Sample ID	Lab Sample ID	Description	pCi/L Pu 238	+/- 1 sigma	pCi/L Pu 239+240	+/- 1 sigma	242Pu % recovery
90-5346-A-1c	90-5346	water	ND<1.73E-01		ND< 9.97E-02		15.6
90-5347-A-1c	90-5347	water	ND<3.87E-01		ND< 1.58E-01		9.0
90-5352-A-1c	90-5352	water	ND<2.84E-01		ND< 4.55E-02		14.0
90-5352-A-2c	90-5352	duplicate	ND<3.29E-01		ND< 1.45E-01		10.7
90-5353-A-1c	90-5353	water	ND<3.94E-01		ND< 2.37E-01		9.6
90-5346-A-5c	BL-5346	blank	ND<2.40E-01		ND< 1.58E-01		15.8
(1)90-6818-A-4c	53289-31A	PE water	ND<1.13E-01		2.31E+01	8.88E-01	14.0
(1)90-6818-A-4c	53289-31B	PE water	ND<1.44E-01		2.39E+01	9.52E-01	12.0
(1)90-6818-A-4c	53289-31C	PE water	6.70E-02	3.18E-02	2.42E+01	7.48E-01	15.3

The errors quoted (1 sigma) are the propogated error of individual measurements.

(1)Laboratory Control Sample

90-6818 (QAP-33) soil PNL mean = 3.28E-02 pCi/g (% recovery = 105)

DOE/QAP value = 3.11E-02 pCi/g

90-6818 (QAP-33) water PNL mean = 23.7 pCi/L (% recovery = 80)

DOE/QAP value = 29.5 pCi/L

90-6820 (EMSL - Pu239 in water, August 24, 1990) mean = 8.48 pCi/L (std. dev.=0.12) (% recovery = 93)

EPA/EMSL value = 9.1 pCi/L (std. dev.=1.3)

Detection Limit (approximate)

	Soils	Water
Pu238	0.002 pCi/g	0.3 pCi/L
Pu239&240	0.001 pCi/g	0.2 pCi/L

NOTE: Lower detection limits can be obtained when using larger sample aliquots or longer count times.

STRONTIUM-90 ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. The digested samples were then processed by procedure PNL-ALO-465, Strontium Separation and counted by PNL-ALO-463, Beta Counting. An approximately 10 gram sample aliquot was digested for soils analysis and 100 ml aliquots for water samples. The sample results are not corrected for Sr-89 activity; it is assumed that the samples have been in the field sufficient time to allow for all Sr-89 to decay away. A Laboratory Control Sample (LCS) was analyzed in one batch of Sr-90 analyses. The assumption was made that this LCS sample contains no Sr-89. The sample results for solids is reported per received sample weight (i.e. not corrected for wt % solids). The digestion, source preparation and counting were performed in building 329 in the 300 area.

Upon review of the sample data, the average recovery of the spike in soil analyses is 102% and the standard deviation is 4%. The spike recovery of the matrix spike sample in the water analysis batch was 101%. The relative percent differences of the two soil samples analyzed in duplicate are 40% and 18%. This difference is attributed to heterogeneity of the samples. The resulting activity of the water sample and its duplicate analysis were non-detectable.

No hold times are defined for Strontium-90 analyses.

941317.2519

TABLE 14: STRONTIUM-90 ANALYSIS RESULTS

Strontium-90 results not corrected for Strontium-89 that may be present.

One sigma uncertainties are based on propagation of mass, volumetric and counting uncertainties.

Soil Samples

Batch 1

Sample #	Sample Type	Sr-90 pCi/g	+/- 1 sigma	RPD	Spike Conc. pCi/g	+/- 1 sigma	Spike % Recov.	Normalized % Yield (1)	
90-5335-A-1b	Soil	0.081	0.039						
90-5335-A-2b	Duplicate	0.122	0.040	40					
90-5336-A-1b	Soil	0.094	0.038						
90-5343-A-1b	Soil	ND<0.065							
90-5335-A-5b	Blank	ND<0.056 **							
90-5335-A-4b	Blank Spike	2.41	0.262		2.489	0.124	96.8		
90-5343-A-3b	Matrix Spike	Used to determine batch yield							100
90-5344-A-1b	Soil	ND<0.058							

Batch 2

Sample #	Sample Type	Sr-90 pCi/g	+/- 1 sigma	RPD	Spike Conc. pCi/g	+/- 1 sigma	Spike % Recov.	Normalized % Yield (1)	
90-5345-A-1b	Soil	ND<0.071							
90-5351-A-1b	Soil	0.095	0.042						
90-5351-A-2b	duplicate	ND<0.068							
90-5345-A-5b	Blank	ND<0.062 **							
90-5345-A-4b	Blank Spike	2.481	0.216		2.404	0.119	103.2		
90-5345-A-3b	Matrix Spike	Used to determine batch yield							96

Batch 4

Sample #	Sample Type	Sr-90 pCi/g	+/- 1 sigma	RPD	Spike Conc. pCi/g	+/- 1 sigma	Spike % Recov.	Normalized % Yield (1)	
90-5350-A-1b	Soil	ND<0.070							
90-5350-A-5b	Blank	ND<0.091 **							
90-5350-A-4b	Blank Spike	Used to determine batch yield for soils							89
* 90-6818-A-1b	Soil	0.264	0.048						
* 90-6818-A-2b	Duplicate	0.317	0.053	18					
* 90-6818-A-3b	Matrix Spike	26.47	3.141		24.93	1.23	105		

Detection Limit = 0.07 pCi/g (theoretical)

* Laboratory Control Samples - not a part of this sample delivery group but reported for QC purposes.
 90-6818 (QAP 33) soil PNL mean = 0.291 pCi/g (% recovery = 129)
 DOE/QAP value = 0.225 pCi/g

** Based on 10 g sample size.

Water Samples

Batch 3

Sample #	Sample Type	Sr-90 pCi/L	+/- 1 sigma	RPD	Spike Conc. pCi/L	+/- 1 sigma	Spike % Recov.	Normalized % Yield (1)	
90-5346-A-1b	Water	ND<5.8							
90-5346-A-2b	Duplicate	ND<5.7							
90-5347-A-1b	Water	ND<5.5							
90-5352-A-1b	Water	ND<5.7							
90-5352-A-3b	Matrix Spike	5030	444		4978	247	101		
90-5353-A-1b	Water	ND<5.7							
90-5346-A-5b	Blank	ND<5.5							
90-5346-A-4b	Blank Spike	Used to determine batch yield							95

Detection limit = 5.5 pCi/L

(1) All Sr-90 analyses are calculated on the basis of their ratio to the corresponding matrix spike recovery normalized to 100%.

TRITIUM ANALYSIS RESULTS

The samples and their accompanying QC samples were prepared by procedure PNL-ALO-441, Tritium Separation, and counted by PNL-ALO-443, Liquid Scintillation Counting. An approximately 5 gram sample aliquot was leached for soils analysis and 50 ml aliquots were distilled for water samples. The sample results for solids is reported per received sample weight (i.e. not corrected for wt % solids). The leach, distillation and counting were performed in building 329 in the 300 area.

The methods blank spike was used to determine batch yield. No other methods blank spikes were analyzed.

The mean batch yield for water analysis is 96% and for soil analysis is 87%. All results and duplicates were below detectable activities, therefore relative percent differences and accuracy and precision results cannot be calculated.

No hold times are defined for Tritium-90 analyses.

TABLE 15: TRITIUM ANALYSIS DATA

Water Samples

Sample #	Sample Type	Tritium (pCi/L)	+/- 1 sigma	RPD	Spike Conc. (pCi/L)	+/- 1 sigma	Spike % Recov.
90-5346-K-1	Water	ND<420					
90-5346-K-4	Blank Spike	Used to determine batch yield					97.9
90-5346-K-4	Blank Spike Duplicate	Used to determine batch yield					94.9
90-5346-K-5	Blank	ND<420					
90-5347-K-1	Water	ND<420					
90-5347-K-2	Duplicate	ND<420					
90-5352-K-1	Water	ND<420					
90-5353-K-1	Water	ND<420					

Detection Limit = 420 pCi/L

Soil Samples

Sample #	Sample Type	Tritium (pCi/g)	+/- 1 sigma	RPD	Spike Conc. (pCi/g)	+/- 1 sigma	Spike % Recov.
90-5335-K-1	Soil	ND<12.					
90-5335-K-2	Duplicate	ND<13.					
90-5335-K-4	Blank Spike	Used to determine batch yield					86.7
90-5335-K-4	Blank Spike Duplicate	Used to determine batch yield					87.9
90-5335-K-5	Blank	ND<8.3	*				
90-5335-K-5	Blank Duplicate	ND<8.4	*				
90-5336-K-1	Soil	ND<16.					
90-5343-K-1	Soil	ND<16.					
90-5344-K-1	Soil	ND<16.					
90-5345-K-1	Soil	ND<14.					
90-5350-K-1	Soil	ND<14.					
90-5351-K-1	Soil	ND<16.					
90-5351-K-5	Blank	ND<14.					

Detection Limit = 16 pCi/g (theoretical)

* Based on 5 g. sample size.

9513477, 2552

Westinghouse Hanford Company

CHAIN OF CUSTODY

Company Contact W.S. Thompson; Telephone (509) 373-3818

Sample Collected by W.S. Thompson, JW Roberts Date 9/26/90 Time 0845; 1008

Sample Locations 699-52-57; 699-55-55

Ice Chest No. #SLEEPY POLYCOOLER Field Logbook and Page No. WHC-N-287-2p.

Remarks SOIL SAMPLES COLLECTED IN 500 ml. AMBER GLASS BOTTLES, SENT TO 325 LAB. FOR ANALYSIS OF PARAMETERS OF INTEREST (200-AP-1 RI/FS) DOE/RL 88-32 Rev 1

Bill of Lading No. NA Offsite Property No. NA

Method of Shipment HAND CARRY ON ASL SAMPLE VAN TO 325 LAB.

Shipped to 325 Bldg, PNL LAB.

Possible Sample Hazards none identified with field instruments - may be POTENTIAL UNKNOWN CONSTITUENTS.

Sample Identification

1) 699-52-57-001
2, 500 ml, amber glass, soil, chemical analysis for Parameters of Interest
with 9/26/90
RADIONUCLIDES: TOTAL ALPHA, TOTAL BETA; TRITIUM; Technetium
Strontium-90; Cesium-137; Cobalt-60; Plutonium-238;
Plutonium-239/240; TOTAL URANIUM; Ruthenium-106;
NON-RADIONUCLIDES; NITRATE; TOTAL CYANIDE; SULFATE; SELENIUM;
FERRICYANIDE; FREE CYANIDE; Bismuth; Phosphate

2) 699-55-55-001
2, 500 ml, amber glass; soil; chemical analysis for Parameters of Interest
AS STATED ABOVE

Chain of Possession

Relinquished by: <u>W.S. Thompson</u> <u>W.S. Thompson</u>	Received by: <u>R.Z. Steffler</u> <u>R.Z. Steffler</u>	Date/Time: <u>9/26/90 10:30 AM.</u>
Relinquished by: <u>R.Z. Steffler</u> <u>R.Z. Steffler</u>	Received by: <u>T.W. [unclear]</u> <u>T.W. [unclear]</u>	Date/Time: <u>9/26/90 11:52 am</u>
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:

B01-002

9613477.2053



Westinghouse Hanford Company

SAMPLE ANALYSIS REQUEST

PART I: FIELD SECTION

Collector W.S. Thompson; JW Roberts; RZ Steffer Date Sampled 9/26/90 Time 0845 hours
Company Contact W.S. Thompson; JW Roberts Telephone (509) 373-3818 1008

Sample Number	Number and Type of Sample Containers	Type of Sample*	Analysis Requested
699-52-57-001	2, 500ml; amber glass; soil;	chemical analysis for Parameters of Interest	RADIONUCLIDES: TOTAL ALPHA; TOTAL BETA; TRITIUM; TECHNETIUM-99; STRONTIUM-90; CESIUM-137; COBALT-60; PLUTONIUM-238; PLUTONIUM-239/240; TOTAL URANIUM; RUTHENIUM-106. NON RADIONUCLIDES: NITRATE; TOTAL CYANIDE; SULPHATE; SELENIUM; FERROCYANIDE; FREE CYANIDE; BISMUTH; Phosphate
699-55-55-001	2, 500ml; amber glass; soil;	chemical analysis for Parameters of Interest	

Field Information** soil sample collected in bottles and placed on wet ice; field instruments detect NO hazardous constituents

Special Handling and/or Storage hand carry in ASL sample van to 325 PNL Lab - same day delivery

PART II: LABORATORY SECTION

Received by MW Thur Title Trich Group Leader Date 9/26/90

Analysis Required _____

*Indicate whether sample is soil, sludge, water, etc.

**Use back of page for additional information relative to sample location.

SAMPLE RECEIPT FORM

Delivered by: R.I. Steffler Date/Time: 9/26/90 11:52

Received by: MICHAEL W. URIE

Customer Sample Number(s): 699-52-57-001, 699-55-55-001

ALO Sample Number(s): 90-5335, 90-5336

- 1. Customer Chain-of-Custody Form: Present Absent
- 2. Additional Shipping Forms (list):
SAMPLE ANALYSIS REQUEST ACCOMPANIED COC.
- 3. Custody Seals on Shipping and/or Sample Containers and their Conditions.
Present Absent
If Present, Condition: RED PLASTIC SEAL ON BOTTLES GOOD
- 4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes:

- 5. Condition of Shipping Container (Verify that ice still exists such that samples are at refrigerated temperature).
ICE IN COOLER - COOLER IN GOOD CONDITION
- 6. Condition of Sample Vials.
OKAY
- 7. Verification of Agreement or Nonagreement of Information on Receiving Documents.
Agreement Made
- 8. Resolution of Problems or Discrepancies.
N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-004

Westinghouse Hanford Company

CHAIN OF CUSTODY

Company Contact W.S. Thompson Telephone 373-3818

Sample Collected by W.S. Thompson / R.E. Steffer Date 10/2/90 Time 1425

Sample Locations 699-52-57

Ice Chest No. SLEEPY Field Logbook and Page No. WHC-N-287-2

Remarks Samples collected for 200BP-1 RI/ES

27-2
79
WAT
10/14

Bill of Lading No. N/A Offsite Property No. N/A

Method of Shipment hand carry to 325 PNL lab.

Shipped to 325 PNL for Parameter of Interest analysis

Possible Sample Hazards none indicated with field instruments

Sample Identification

1) 699-52-57-027

1, 1 liter, glass, soil, chemical analysis of Parameters of Interest
see Statement of Work.

Chain of Possession

Relinquished by: <u>W.S. Thompson</u>	Received by: <u>R.E. Steffer</u> <u>R. Z. Steff</u>	Date/Time: <u>10/2/90 1515h.</u>
Relinquished by: <u>R. Z. Steff</u>	Received by: <u>M. W. Chin</u>	Date/Time: <u>10/2/90 1600 Hrs</u>
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:

SAMPLE RECEIPT FORMDelivered by: Steffler Date/Time: 10/2/90 1600Received by: URIECustomer Sample Number(s): 699-52-57-027ALO Sample Number(s): 90-5343

1. Customer Chain-of-Custody Form: Present Absent
2. Additional Shipping Forms (list):
Sample Analysis Request
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.
Present Absent
If Present, Condition: GOOD
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: N/A

5. Condition of Shipping Container (Verify that ice still exists such that samples are at refrigerated temperature).
PACKED IN TO 325 BLDG BY STEFFLER - COULD NOT VERIFY SHIPPING CONTAINER, SAMPLE FELT COLD
6. Condition of Sample Vials.
GOOD
7. Verification of Agreement or Nonagreement of Information on Receiving Documents.
AGREE MWL
8. Resolution of Problems or Discrepancies.
N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-007

9613477 5000

Westinghouse Hanford Company

CHAIN OF CUSTODY

Company Contact W.S. Thompson Telephone 373-3818

Sample Collected by W.S. Thompson/RZ Staff Date 10/3/90 Time 0850

Sample Locations 699-55-55, well nr north of 800 EST

Ice Chest No. NA Field Logbook and Page No. WMC-N-287-2 p29,30

Remarks Samples to be analyzed for 200BP-1 parameters of interest (1/2 full) samples put in 2 jars instead of one - ^{with} 50 lab-can

Bill of Lading No. NA Offsite Property No. NA 10/3/90

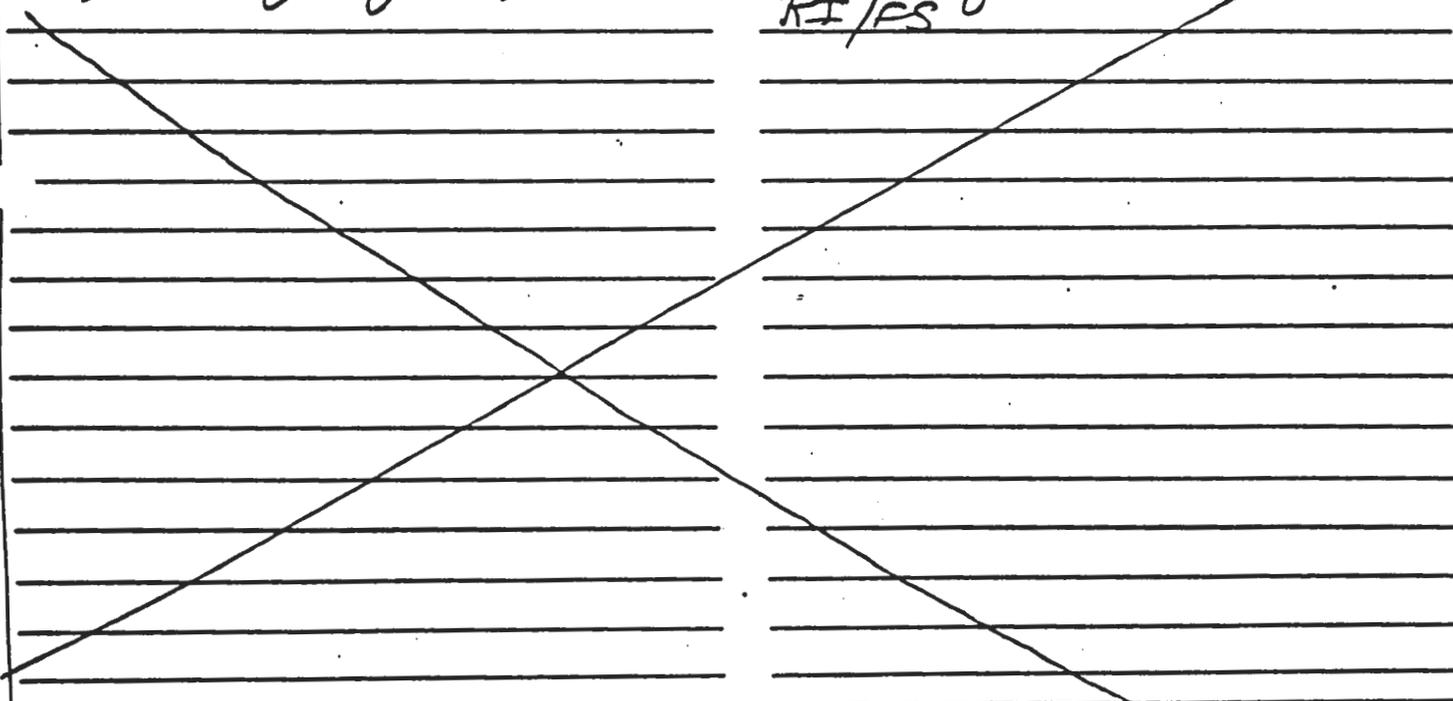
Method of Shipment hand carry to 325 Lab by ASL sample van

Shipped to 325 ANL LAB.

Possible Sample Hazards none indicated by field instruments

Sample Identification

D699-55-55-025
2, 1-liter glass jars, soil, Parameters of Interest - 200BP-1 RI/FS



Chain of Possession

Relinquished by: <u>W.S. Thompson</u> <u>W.S. Thompson</u>	Received by: <u>R.Z. Staff</u> <u>R.Z. Staff</u>	Date/Time: <u>10/3/90 11:00</u>
Relinquished by: <u>R.Z. Staff</u> <u>R.Z. Staff</u>	Received by: <u>W.W. [unclear]</u> <u>W.W. [unclear]</u>	Date/Time: <u>10/3/90 12:00 pm</u>
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:

SAMPLE RECEIPT FORM

Delivered by: Steffler Date/Time: 10/3/90 12:01 pm

Received by: M. URIE

Customer Sample Number(s): 699-55-55-025 (Two Bottles)

ALO Sample Number(s): 90-5344

1. Customer Chain-of-Custody Form: Present Absent

2. Additional Shipping Forms (list):
Sample Analysis Request

3. Custody Seals on Shipping and/or Sample Containers and their Conditions.
Present Absent

If Present, Condition: _____

4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: N/A

5. Condition of Shipping Container (Verify that ice still exists such that samples are at refrigerated temperature).

PACKED INTO 325 Bldg by Steffler, Could NOT verify shipping container. Samples felt OLD

6. Condition of Sample Vials.
GOOD

7. Verification of Agreement or Nonagreement of Information on Receiving Documents.

Agree MUR

8. Resolution of Problems or Discrepancies.

N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

Westinghouse Hanford Company

CHAIN OF CUSTODY

Company Contact: Wendy Thompson Telephone: 373-3818

Sample Collected by: W.S. Thompson/R.Z. Steffler Date: 10/5/90 Time: 1030:0945:1045

Sample Locations: 699-52-57, 600 AREA, North of 200 EAST (200-BP-1)

Ice Chest No.: "sleepy cooler" Field Logbook and Page No.: WHC-N-287-2 pg 32-35

Remarks: samples collected for analysis of 200-BP-1 RI/FS Parameters of Interest (see statement of work * DOE/RL 88-32)

Bill of Lading No.: NA Offsite Property No.: NA

Method of Shipment: hand carry, same day - day in ASL sample van

Shipped to: 323 PNL, 300 AREA

Possible Sample Hazards: none indicated by field instruments
samples chilled on wet ice

Sample Identification

1) 699-52-57-050 200-BP-1
2, 1-liter, glass, soil (1/2 full), Parameters of Interest (see statement of work)

2) 699-52-57-049
1, 500ml., glass, water, chemical analysis of anions & tritium
3, 1-liter, glass, water, NaOH, chemical analysis of CN and Free CN
1-liter, glass, water, HNO₃, chemical analysis of metals, radiochemical analysis

3) 699-52-57-050A
1, 500ml., glass, water, chemical analysis of anions & tritium
3, 1-liter, glass, water, NaOH, chemical analysis of CN and Free CN
3, 1-liter, glass, water, HNO₃, chemical analysis of metals, radiochemical analysis

Chain of Possession

Relinquished by: <u>W.S. Thompson</u> <u>Wendy S. Thompson</u>	Received by: <u>R.Z. Steffler</u> <u>R.Z. Steffler</u>	Date/Time: <u>10/5/90 1200 hrs</u>
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Relinquished by: <u>R.Z. Steffler</u> <u>R.Z. Steffler</u>	Received by: <u>B.M. Gillespie</u> <u>B.M. Gillespie</u>	Date/Time: <u>10/5/90 13:17 hrs</u>
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Relinquished by:	Received by:	Date/Time:
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Relinquished by:	Received by:	Date/Time:
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9813477.2582



Westinghouse Hanford Company

SAMPLE ANALYSIS REQUEST

PART I: FIELD SECTION

Director Wendy S. Thompson / RE Steffler
Company Contact W.S. Thompson

Date Sampled 10/5/90 Time 1030 hours
Telephone (809) 373-3818 1045

Sample Number	Number and Type of Sample Containers	Type of Sample*	Analysis Requested
1) 699-52-57-050	2, 1-liter, glass, soil	Parameters of Interest	200-BP-1 (see Statement of Work)
2) 699-52-57-049	1, 500ml, glass, water	chemical analysis of anions + tritium	(bottle 1/2 full of soil)
	3, 1-liter, glass, water, NaOH	chem. analysis of CN + Free CN	
	3, 1-liter glass, water, HNO ₃	chem. analysis of metals, ^{radiochem} analysis	
3) 699-52-57-050A	3, 1-liter, glass, water, NaOH	chem. analysis of CN + Free CN	
	3, 1-liter, glass, water, HNO ₃	chem. analysis of metals, ^{radiochem} analysis	
	1, 500ml, glass, water	chem. analysis of anions + tritium	
NA			

Field Information** Samples collected for 200-BP-1 RIFS to be analyzed for Parameters of Interest. Samples chilled on wet ice + same day delivery to 325 PNL LAB.

Special Handling and/or Storage keep chilled (see statement of work)

PART II: LABORATORY SECTION

Received by B.M. Gillespie Title Project Manager Date 10-5-90

Analysis Required _____

*Indicate whether sample is soil, sludge, water, etc.

**Use back of page for additional information relative to sample location.

SAMPLE RECEIPT FORM

Delivered by: Steffler Date/Time: 13:17

Received by: Gillette

Customer Sample Number(s): 699-52-57-050

ALO Sample Number(s): 90-5345

1. Customer Chain-of-Custody Form: Present Absent

2. Additional Shipping Forms (list):
Sample analysis Request

3. Custody Seals on Shipping and/or Sample Containers and their Conditions.
Present Absent

If Present, Condition: GOOD

4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: N/A

5. Condition of Shipping Container (Verify that ice still exists such that samples are at refrigerated temperature).

Good; ice in existence around sample vials. Bmg/llh/psm 10-5-96

6. Condition of Sample Vials.
GOOD

7. Verification of Agreement or Nonagreement of Information on Receiving Documents.
Agree

8. Resolution of Problems or Discrepancies.
N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

SAMPLE RECEIPT FORM

Delivered by: Steffler Date/Time: 13:17 pm

Received by: Gillespie

Customer Sample Number(s): 699-52-57-049 699-52-57-05A

ALO Sample Number(s): 90-5346 90-5347

1. Customer Chain-of-Custody Form: Present Absent

2. Additional Shipping Forms (list):
Sample Analysis Request

3. Custody Seals on Shipping and/or Sample Containers and their Conditions.
Present Absent

If Present, Condition: _____

4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: 1 500 ml glass ~~GO/FREE~~ CN ANIONS/Tritium (NOTHING)
3 1L metals/radchem (NaOH)
3 1L CN/FREE CN (NaOH)

5. Condition of Shipping Container (Verify that ice still exists such that samples are at refrigerated temperature).

Sample shipping container. Ice in existence around sample vials.
Gillespie 10-5-90

6. Condition of Sample Vials.

GOOP

7. Verification of Agreement or Nonagreement of Information on Receiving Documents.

Agree MWA

8. Resolution of Problems or Discrepancies.

N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

Westinghouse Hanford Company

CHAIN OF CUSTODY

Company Contact: Wendy S. Thompson Telephone (509) 373-3818

Sample Collected by W.S. Thompson Date 10/10/90 Time 1015, 1100, 1100, 1115

Sample Locations 699-50 699-52-57; WELLSITE IN 600 AREA, NORTH of 200 EAST

Ice Chest No. #3 Coleman cooler Field Logbook and Page No. WHC-N-287-2 pg 42-44

Remarks Samples collected for analysis of Parameters of Interest supporting the 200-BP-1 RI/FS. (See statement of work & workplan DOE/RL 88-32)

Bill of Lading No. NA Offsite Property No. NA

Method of Shipment Hand carry same day by ASL Sample Van to 325 PNL lab

Shipped to 325 PNL LABORATORY (300 AREA)

Possible Sample Hazards none indicated by field instruments. (Keep chilled on ice during transportation to lab)

Sample Identification

1) 699-52-57-077

2, 1-liter, glass, soil, (1/2 FULL AS REQUESTED BY LAB), Parameters of Interest (see 200-BP-1 statement of work)

2) 699-52-57-077B

2, 1-liter, glass, soil, (1/2 FULL AS REQUESTED BY LAB), PARAMETERS OF INTEREST

3) 699-52-57-074

1, 500ml, clear glass, water; chemical analysis of ANIONS & TRITIUM

3, 1 liter, amber glass; water; 2ml NaOH; analysis of CN & FREE CYANIDE

3, 1 liter, glass; water 2ml HNO3; analysis of metals & radiochemical analysis

4) 699-52-57-077A

1, 500ml, clear glass; water; chemical analysis of anions & tritium

3, 1 liter, amber glass; water; 2ml NaOH; analysis of CN & free CN

3, 1 liter, amber glass; water; 2ml HNO3; analysis of metals & radiochemicals

Chain of Possession

Relinquished by: W.S. Thompson Received by: R.2. Steffler Date/Time: 10/10/90 1155

Relinquished by: R.2. Steffler Received by: M.W. Chiu Date/Time: 10/10/90 1305 HR

Relinquished by: Received by: Date/Time:

Relinquished by: Received by: Date/Time:

Parameter of Interest



SAMPLE ANALYSIS REQUEST

PART I: FIELD SECTION

Collector W.S. Thompson / R.Z. Steffler Date Sampled 10/10/90 Time 10:00 ^{10:15} ~~10:00~~ ^{WS 7/10/90} hours
 Company Contact W.S. Thompson Telephone (509) 373-3815 ^{11:00} ~~11:15~~

200-BP-1

Sample Number	Number and Type of Sample Containers	Type of Sample*	Analysis Requested
1) 699-52-57-077	2-1 liter, clear glass	soil, (1/2 full)	Parameters of Interest ^{200-BP-1}
2) 699-52-57-077B	2-1 liter, clear glass	soil (1/2 full)	Parameters of Interest
3) 699-52-57-074;	1, 500ml, clear glass	water, anions + tritium;	Parameters of Interest
	3, 1 liter, amber glass;	water, 2ml NaOH;	analysis of CN & Free CN
	3, 1 liter, amber glass;	water, 2ml HNO ₃ ;	^{WS 7/10/90} analysis of metals + ^{radiochem}
4) 699-52-57-077A;	1, 500ml, clear glass	water; anions + tritium;	Parameters of Interest
	3, 1-liter, amber glass;	water 2ml NaOH;	analysis of CN + Free CN
	3, 1-liter, amber glass;	water 2ml HNO ₃ ;	analysis of metals + radiochem-

Field Information** All samples (soil + water) to be analyzed for Parameters of Interest Supporting 200-BP-1 KI/FS

Special Handling and/or Storage keep samples chilled. Hand delivery same day to 325 PNL LAB - 300 AREA

PART II: LABORATORY SECTION

Received by MW Zhu Title Group Leader Date 10/10/90
 Analysis Required _____

*Indicate whether sample is soil, sludge, water, etc.
 **Use back of page for additional information relative to sample location.

SAMPLE RECEIPT FORM

Delivered by: Truffer Date/Time: 10/10/90 13:05

Received by: Uru

Customer Sample Number(s): 699-52-57-077, 0778, 074-077A

ALO Sample Number(s): 90-5350, 5351, 5352, 5354, 5353 *DMR 10/11/90*

1. Customer Chain-of-Custody Form: Present Absent

2. Additional Shipping Forms (list):
Request for analysis

3. Custody Seals on Shipping and/or Sample Containers and their Conditions.

Present Absent

If Present, Condition: GOOD

4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: N/A

5. Condition of Shipping Container (Verify that ice still exists such that samples are at refrigerated temperature).

ICED

6. Condition of Sample Vials.

GOOD

7. Verification of Agreement or Nonagreement of Information on Receiving Documents.

Agree MUR

8. Resolution of Problems or Discrepancies.

N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

9613477.2568

B2 - PNL CHAIN OF CUSTODY FORMS

B02-001

ALO CHAIN OF CUSTODY

<u>90-5335</u> ALO SAMPLE NUMBER	<u>Free CN</u> ANALYSIS REQUESTED	<u>699-52-57-001</u> SAMPLE DESCRIPTION
SENDER <u>MW Um</u>		<u>10/4/90</u> DATE
RECEIVER <u>S. O. Slate</u>		<u>10/4/90</u> DATE
<u>wt 28.3 - 13.4 = 14.9 gm</u>		

<u>90-5336</u> ALO SAMPLE NUMBER	<u>Free CN</u> ANALYSIS REQUESTED	<u>699-55-55-001</u> SAMPLE DESCRIPTION
SENDER <u>MW Um</u>		<u>10/4/90</u> DATE
RECEIVER <u>S. O. Slate</u>		<u>10/4/90</u> DATE
<u>wt 36.7 - 13.4 =</u>		

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-7

B02-002

ALO CHAIN OF CUSTODY

90-5335 ALO SAMPLE NUMBER	GEA ANALYSIS REQUESTED	699-52-57-001 SAMPLE DESCRIPTION
SENDER <u>MW Ur</u>		<u>10/10/00</u> DATE
RECEIVER <u>J. Brodsky</u>		<u>10-10-90</u> DATE
wt = 508.2 - 10.7 gm =		

90-5336 ALO SAMPLE NUMBER	GEA ANALYSIS REQUESTED	699-55-55-001 SAMPLE DESCRIPTION
SENDER <u>MW Ur</u>		<u>10/10/00</u> DATE
RECEIVER <u>J. Brodsky</u>		<u>10-10-90</u> DATE
wt = 472.8 - 11.2 g =		

ALO SAMPLE NUMBER	ANALYSIS REQUESTED	SAMPLE DESCRIPTION
SENDER _____		DATE _____
RECEIVER _____		DATE _____

ALO SAMPLE NUMBER	ANALYSIS REQUESTED	SAMPLE DESCRIPTION
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction
TI-200BP-1-7

ALO CHAIN OF CUSTODY

<u>90-5335</u> ALO SAMPLE NUMBER	<u>Tc & U</u> ANALYSIS REQUESTED	<u>699-52-57-001</u> SAMPLE DESCRIPTION
SENDER <u>Nina Barua</u>	<u>10/23/90</u>	<u>8:30</u> DATE
RECEIVER <u>Eric Wolfe</u>	<u>10/23/90</u>	<u>08:30</u> DATE

<u>90-5336</u> ALO SAMPLE NUMBER	<u>Tc & U</u> ANALYSIS REQUESTED	<u>699-55-55-001</u> SAMPLE DESCRIPTION
SENDER <u>Nina Barua</u>	<u>10/23/90</u>	<u>8:30</u> DATE
RECEIVER <u>Eric Wolfe</u>	<u>10/23/90</u>	<u>08:30</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____	_____	_____ DATE
RECEIVER _____	_____	_____ DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____	_____	_____ DATE
RECEIVER _____	_____	_____ DATE

Original - Project Management Office
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Applicable Test Instruction
TI-200BP-1-7

ALO CHAIN OF CUSTODY

<u>90-5335</u> ALO SAMPLE NUMBER	<u>Sr, Pu, H3, Total α&β</u> ANALYSIS REQUESTED	<u>699-52-57-001</u> SAMPLE DESCRIPTION
SENDER <u>MW Thur</u>		<u>10/10/90</u> DATE
RECEIVER <u>GL Rodriguez</u>		<u>10-10-90</u> DATE
<u>wt = 212.1 - 10.4g =</u>		
<u>wt = 223.3 - 12.1g = null</u>		

<u>90-5336</u> ALO SAMPLE NUMBER	<u>Sr, Pu, H3, Total α&β</u> ANALYSIS REQUESTED	<u>699-55-55-001</u> SAMPLE DESCRIPTION
SENDER <u>MW Thur</u>		<u>10/10/90</u> DATE
RECEIVER <u>GL Rodriguez</u>		<u>10-10-90</u> DATE
<u>wt = 30.1 - 5.3 = null</u>		
<u>wt = 223.3 - 12.9g</u>		

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
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Applicable Test Instruction
TI-200BP-1-7

ALO CHAIN OF CUSTODY

<u>90-5343</u> ALO SAMPLE NUMBER	<u>Cyanide</u> ANALYSIS REQUESTED	<u>699-52-57-027</u> SAMPLE DESCRIPTION
SENDER <u>MW Zhu</u>		<u>10/4/90</u> DATE
RECEIVER <u>Jill Cerrin</u>		<u>10/4/90</u> DATE
<u>wt = 39.7 - 13.6 = wt = 37.6 - 13.8 =</u>		

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
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Applicable Test Instruction

TI-200BP-1-9

ALO CHAIN OF CUSTODY

<u>90-5343</u> ALO SAMPLE NUMBER	<u>Sr/Pu/Tot Alpha/Tot Beta/H3</u> ANALYSIS REQUESTED	<u>699-52-57-027</u> SAMPLE DESCRIPTION
SENDER <u>MW Thur</u>		<u>10/10/90</u> DATE
RECEIVER <u>G. G. Brody</u>		<u>10-10-90</u> DATE
<u>wt = 275.2 - 11.9 =</u>		

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
 Copy - Sender
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Applicable Test Instruction
TI-200BP-1-9

ALO CHAIN OF CUSTODY

<u>90-5343</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-027</u> SAMPLE DESCRIPTION
SENDER <u>MW Umi</u>		<u>10/10/90</u> DATE
RECEIVER <u>LH Brody</u>		<u>10/10/90</u> DATE
<u>wt = 696.4 - 11.6g</u>		

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
 Copy - Sender
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Applicable Test Instruction
TI-200BP-1-9

ALO CHAIN OF CUSTODY

<u>90-5343</u> ALO SAMPLE NUMBER	<u>Tc & U</u> ANALYSIS REQUESTED	<u>699-52-57-027</u> SAMPLE DESCRIPTION
SENDER <u><i>Amor Bacon</i></u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u><i>Eric J. [unclear]</i></u>		<u>10/23/90</u> <u>08:30</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
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Applicable Test Instruction
TI-200BP-1-9

B02-013

ALO CHAIN OF CUSTODY

<u>90-5344</u>	<u>Tc/U</u>	<u>699-55-55-025</u>
ALO SAMPLE NUMBER	ANALYSIS REQUESTED	SAMPLE DESCRIPTION
SENDER <u>Simon Burman</u>		<u>10/23/90</u> <u>8:30</u>
		DATE
RECEIVER <u>Eric J. Wynn</u>		<u>10/23/90</u> <u>08:30</u>
		DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____
		DATE
RECEIVER _____		_____
		DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____
		DATE
RECEIVER _____		_____
		DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____
		DATE
RECEIVER _____		_____
		DATE

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-10

B02-016

ALO CHAIN OF CUSTODY

<u>90-5344</u> ALO SAMPLE NUMBER	<u>Free Cyanide</u> ANALYSIS REQUESTED	<u>699-55-55-025</u> SAMPLE DESCRIPTION
SENDER <u>MW Chui</u>		<u>10/4/90</u> DATE
RECEIVER <u>S.D. Slater</u>		<u>10/4/90</u> DATE
<u>wt - 42.1 - 13.9g</u>		

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
 Copy - Sender
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Applicable Test Instruction
TI-200BP-1-10

ALO CHAIN OF CUSTODY

<u>90-5345</u> ALO SAMPLE NUMBER	<u>Tot Alpha/Tot Beta/Sr/Pu/H3</u> ANALYSIS REQUESTED	<u>699-52-57-050</u> SAMPLE DESCRIPTION
SENDER <u>MW Umi</u>		<u>10/10/90</u> DATE
RECEIVER <u>GG Brodayanti</u>		<u>10-10-90</u> DATE
<u>wt = 249.5 - 6.19 =</u>		

<u>90-5346</u> ALO SAMPLE NUMBER	<u>Tot Alpha/Tot Beta/Sr/Pu/H3</u> ANALYSIS REQUESTED	<u>699-52-57-049</u> SAMPLE DESCRIPTION
SENDER <u>MW Umi</u>		<u>10/10/90</u> DATE
RECEIVER <u>GG Brodayanti</u>		<u>10-10-90</u> DATE

<u>90-5347</u> ALO SAMPLE NUMBER	<u>Tot Alpha/Tot Beta/Sr/Pu/H3</u> ANALYSIS REQUESTED	<u>699-52-57-05A</u> SAMPLE DESCRIPTION
SENDER <u>MW Umi</u>		<u>10/10/90</u> DATE
RECEIVER <u>GG Brodayanti</u>		<u>10-10-90</u> DATE

ALO SAMPLE NUMBER	ANALYSIS REQUESTED	SAMPLE DESCRIPTION
SENDER		DATE
RECEIVER		DATE

Original - Project Management Office
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Applicable Test Instruction
TI-200BP-1-11

ALO CHAIN OF CUSTODY

<u>90-5345</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-050</u> SAMPLE DESCRIPTION
SENDER <u>MW Th</u>		<u>10/10/90</u> DATE
RECEIVER <u>GG Brodaeyoshi</u>		<u>10-10-90</u> DATE
WT = 557.5 - 6.4 g		

<u>90-5346</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-049</u> SAMPLE DESCRIPTION
SENDER <u>MW Th</u>		<u>10/10/90</u> DATE
RECEIVER <u>GG Brodaeyoshi</u>		<u>10-10-90</u> DATE

<u>90-5347</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-05A</u> SAMPLE DESCRIPTION
SENDER <u>MW Th</u>		<u>10/10/90</u> DATE
RECEIVER <u>GG Brodaeyoshi</u>		<u>10-10-90</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
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Applicable Test Instruction

TI-200BP-1-11

B02-021

ALO CHAIN OF CUSTODY

<u>90-5345</u> ALO SAMPLE NUMBER	<u>TC/U</u> ANALYSIS REQUESTED	<u>699-52-57-050</u> SAMPLE DESCRIPTION
SENDER <u>Nina Barrow</u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u>Eric J. Hype</u>		<u>10/23/90</u> <u>08:30</u> DATE

<u>90-5346</u> ALO SAMPLE NUMBER	<u>TC/U</u> ANALYSIS REQUESTED	<u>699-52-57-049</u> SAMPLE DESCRIPTION
SENDER <u>Nina Barrow</u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u>Eric J. Hype</u>		<u>10/23/90</u> <u>08:30</u> DATE

<u>90-5347</u> ALO SAMPLE NUMBER	<u>TC/U</u> ANALYSIS REQUESTED	<u>699-52-57-05A</u> SAMPLE DESCRIPTION
SENDER <u>Nina Barrow</u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u>Eric J. Hype</u>		<u>10/23/90</u> <u>08:30</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____ DATE
RECEIVER _____		_____ DATE

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-11

ALO CHAIN OF CUSTODY

<u>90-5345</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-050</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Burrow</i></u>		<u>10/23/90 9:10</u> DATE
RECEIVER <u><i>James Robb</i></u>		<u>10/23/90</u> DATE

<u>90-5346</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-049</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Burrow</i></u>		<u>10/23/90 9:10</u> DATE
RECEIVER <u><i>James Robb</i></u>		<u>10/23/90</u> DATE

<u>90-5347</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-05A</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Burrow</i></u>		<u>10/23/90 9:10</u> DATE
RECEIVER <u><i>James Robb</i></u>		<u>10/23/90</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____ DATE
RECEIVER _____		_____ DATE

Original - Project Management Office
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Applicable Test Instruction
TI-200BP-1-11

ALO CHAIN OF CUSTODY

<u>90-5345</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-050</u> SAMPLE DESCRIPTION
SENDER <u>Simon Burrows</u>		<u>10/10/90</u> DATE
RECEIVER <u>James Robbins</u>		<u>10/10/90</u> DATE
WT = 38.6 - 13.6g =		

<u>90-5346</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-049</u> SAMPLE DESCRIPTION
SENDER <u>Simon Burrows</u>		<u>10/10/90</u> DATE
RECEIVER <u>James Robbins</u>		<u>10/10/90</u> DATE

<u>90-5347</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-05A</u> SAMPLE DESCRIPTION
SENDER <u>Simon Burrows</u>		<u>10/10/90</u> DATE
RECEIVER <u>James Robbins</u>		<u>10/10/90</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
 Copy - Sender
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Applicable Test Instruction
TI-200BP-1-11

ALO CHAIN OF CUSTODY

<u>90-5345</u> ALO SAMPLE NUMBER	<u>Free Cyanide</u> ANALYSIS REQUESTED	<u>699-52-57-050</u> SAMPLE DESCRIPTION
SENDER <u>MW Ull</u>		<u>10/10/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/10/90</u> DATE
WT = <u>38.3 - 13.5 g =</u>		

<u>90-5346</u> ALO SAMPLE NUMBER	<u>Free Cyanide</u> ANALYSIS REQUESTED	<u>699-52-57-049</u> SAMPLE DESCRIPTION
SENDER <u>MW Ull</u>		<u>10/10/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/10/90</u> DATE

<u>90-5347</u> ALO SAMPLE NUMBER	<u>Free Cyanide</u> ANALYSIS REQUESTED	<u>699-52-57-05A</u> SAMPLE DESCRIPTION
SENDER <u>MW Ull</u>		<u>10/10/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/10/90</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office
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Applicable Test Instruction
TI-200BP-1-11

ALO CHAIN OF CUSTODY

<u>90-5350</u> ALO SAMPLE NUMBER	<u>Sr/Pu/Tot Alpha/Tot Beta/H3</u> ANALYSIS REQUESTED	<u>699-52-57-077</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Berman</i></u>		<u>10/17/90 12:35</u> DATE
RECEIVER <u><i>M. J. Wysocki</i></u>		<u>10-17-90 12:35</u> DATE
<u>320.3-6.8</u>		

<u>90-5351</u> ALO SAMPLE NUMBER	<u>Sr/Pu/Tot Alpha/Tot Beta/H3</u> ANALYSIS REQUESTED	<u>699-52-57-077B</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Berman</i></u>		<u>10/17/90 12:35</u> DATE
RECEIVER <u><i>M. J. Wysocki</i></u>		<u>10-17-90 12:35</u> DATE
<u>344-6.7</u>		

<u>90-5352</u> ALO SAMPLE NUMBER	<u>Sr/Pu/Tot Alpha/Tot Beta/H3</u> ANALYSIS REQUESTED	<u>699-52-57-074</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Berman</i></u>		<u>10/17/90 12:35</u> DATE
RECEIVER <u><i>M. J. Wysocki</i></u>		<u>10-17-90 12:35</u> DATE

<u>90-5353</u> ALO SAMPLE NUMBER	<u>Sr/Pu/Tot Alpha/Tot Beta/H3</u> ANALYSIS REQUESTED	<u>699-52-57-077A</u> SAMPLE DESCRIPTION
SENDER <u><i>Lisa Berman</i></u>		<u>10/17/90 12:35</u> DATE
RECEIVER <u><i>M. J. Wysocki</i></u>		<u>10-17-90 12:35</u> DATE

Original - Project Management Office
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Applicable Test Instruction

TI-200BP-1-14

ALO CHAIN OF CUSTODY

<u>90-5350</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-077</u> SAMPLE DESCRIPTION
SENDER <u>Simon Barron</u>		<u>10/17/90 12:33</u> DATE
RECEIVER <u>MJ Wyniff</u>		<u>10-17-90 12:33</u> DATE
<u>506.6-7.6</u>		

<u>90-5351</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-077B</u> SAMPLE DESCRIPTION
SENDER <u>Simon Barron</u>		<u>10/17/90 12:33</u> DATE
RECEIVER <u>MJ Wyniff</u>		<u>10-17-90 12:33</u> DATE
<u>516.1-6.8</u>		

<u>90-5352</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-074</u> SAMPLE DESCRIPTION
SENDER <u>Simon Barron</u>		<u>10/17/90 12:33</u> DATE
RECEIVER <u>MJ Wyniff</u>		<u>10-17-90 12:33</u> DATE

<u>90-5353</u> ALO SAMPLE NUMBER	<u>GEA</u> ANALYSIS REQUESTED	<u>699-52-57-077A</u> SAMPLE DESCRIPTION
SENDER <u>Simon Barron</u>		<u>10/17/90 12:33</u> DATE
RECEIVER <u>MJ Wyniff</u>		<u>10-17-90 12:33</u> DATE

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-14

ALO CHAIN OF CUSTODY

<u>90-5350</u> ALO SAMPLE NUMBER	<u>Tc/U</u> ANALYSIS REQUESTED	<u>699-52-57-077</u> SAMPLE DESCRIPTION
SENDER <u><i>Simon Barrow</i></u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u><i>Eric J. Wynn</i></u>		<u>10/23/90</u> <u>08:30</u> DATE

Not Sent - JML 10/23/90

<u>90-5351</u> ALO SAMPLE NUMBER	<u>Tc/U</u> ANALYSIS REQUESTED	<u>699-52-57-077B</u> SAMPLE DESCRIPTION
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>90-5352</u> ALO SAMPLE NUMBER	<u>Tc/U</u> ANALYSIS REQUESTED	<u>699-52-57-074</u> SAMPLE DESCRIPTION
SENDER <u><i>Simon Barrow</i></u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u><i>Eric J. Wynn</i></u>		<u>10/23/90</u> <u>08:30</u> DATE

<u>90-5353</u> ALO SAMPLE NUMBER	<u>Tc/U</u> ANALYSIS REQUESTED	<u>699-52-57-077A</u> SAMPLE DESCRIPTION
SENDER <u><i>Simon Barrow</i></u>		<u>10/23/90</u> <u>8:30</u> DATE
RECEIVER <u><i>Eric J. Wynn</i></u>		<u>10/23/90</u> <u>08:30</u> DATE

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-14

B02-028

ALO CHAIN OF CUSTODY

<u>90-5350</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-077</u> SAMPLE DESCRIPTION
SENDER <u>Jim Brown</u>		<u>10/23/90 9:10</u> DATE
RECEIVER <u>James Robbins</u>		<u>10/23/90</u> DATE

Not Sent YMC 10/23/90

<u>90-5351</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-077B</u> SAMPLE DESCRIPTION
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>90-5352</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-074</u> SAMPLE DESCRIPTION
SENDER <u>Jim Brown</u>		<u>10/23/90 9:10</u> DATE
RECEIVER <u>James Robbins</u>		<u>10/23/90</u> DATE

<u>90-5353</u> ALO SAMPLE NUMBER	<u>Se/Bi</u> ANALYSIS REQUESTED	<u>699-52-57-077A</u> SAMPLE DESCRIPTION
SENDER <u>Jim Brown</u>		<u>10/23/90 9:10</u> DATE
RECEIVER <u>James Robbins</u>		<u>10/23/90</u> DATE

Original - Project Management Office
 Copy - Sender
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Applicable Test Instruction
TI-200BP-1-14

ALO CHAIN OF CUSTODY

<u>90-5350</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-077</u> SAMPLE DESCRIPTION
SENDER <u>James Robbins</u>		<u>10/15/90</u> DATE
RECEIVER <u>Linn Barnes</u>		<u>10/15/90</u> DATE
44.2 -16.7		

<u>90-5351</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-077B</u> SAMPLE DESCRIPTION
SENDER <u>James Robbins</u>		<u>10/15/90</u> DATE
RECEIVER <u>Linn Barnes</u>		<u>10/15/90</u> DATE
47.7 -16.9		

<u>90-5352</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-074</u> SAMPLE DESCRIPTION
SENDER <u>James Robbins</u>		<u>10/15/90</u> DATE
RECEIVER <u>Linn Barnes</u>		<u>10/15/90</u> DATE
45.9 16.7 2 L mu		

<u>90-5353</u> ALO SAMPLE NUMBER	<u>CN</u> ANALYSIS REQUESTED	<u>699-52-57-077A</u> SAMPLE DESCRIPTION
SENDER <u>James Robbins</u>		<u>10/15/90</u> DATE
RECEIVER <u>Linn Barnes</u>		<u>10/15/90</u> DATE
2 L mu		

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-14

ALO CHAIN OF CUSTODY

<u>90-5350</u> ✓ ALO SAMPLE NUMBER	<u>Free CN</u> ANALYSIS REQUESTED	<u>699-52-57-077</u> SAMPLE DESCRIPTION
SENDER <u>James Robb</u>		<u>10/15/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/15/90</u> DATE
<u>43.5-16.6</u>		

<u>90-5351</u> ✓ ALO SAMPLE NUMBER	<u>Free CN</u> ANALYSIS REQUESTED	<u>699-52-57-077B</u> SAMPLE DESCRIPTION
SENDER <u>James Robb</u>		<u>10/15/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/15/90</u> DATE
<u>46.3-16.8</u>		

<u>90-5352</u> ✓ ALO SAMPLE NUMBER	<u>Free CN</u> ANALYSIS REQUESTED	<u>699-52-57-074</u> SAMPLE DESCRIPTION
SENDER <u>James Robb</u>		<u>10/15/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/15/90</u> DATE
<u>43.4-16.8 1L mull</u>		

<u>90-5353</u> ✓ ALO SAMPLE NUMBER	<u>Free CN</u> ANALYSIS REQUESTED	<u>699-52-57-077A</u> SAMPLE DESCRIPTION
SENDER <u>James Robb</u>		<u>10/15/90</u> DATE
RECEIVER <u>Karl Pool</u>		<u>10/15/90</u> DATE
<u>1L mull</u>		

Original - Project Management Office
 Copy - Sender
 Copy - Receiver

Applicable Test Instruction

TI-200BP-1-14



OSM RCRA LEVEL C DATA ASSESSMENT

DATE 12/5/90 SAMPLES/MATRIX 699-52-57-001 699-52-57-050A
 REVIEWED BY JA Lerch 699-55-55-001 699-52-57-071
 LABORATORY PNL 699-52-57-027 699-52-57-078
 CASE # PNL project #16772 699-55-55-025 699-52-57-074
 SDG # N/A 699-52-57-050 699-52-57-071A
699-52-57-049

DATA ASSESSMENT SUMMARY

QUALITY CONTROL CHECK	ANALYSIS	?Solids	Anion	CN (total)
1. <u>Holding Time</u>	<u>N/A</u>	<u>X</u>	<u>X</u>	<u>X</u>
2. <u>Blank Analysis</u>	<u>N/A</u>	<u>X</u>	<u>X</u>	<u>X</u>
3. <u>MS/MSD</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
4. <u>Duplicate Analysis</u>	<u>0</u>	<u>X</u>	<u>0</u>	<u>0</u>
5. <u>Matrix Spike</u>	<u>N/A</u>	<u>0</u>	<u>0</u>	<u>0</u>
6. <u>Calibrations/Control Stds</u>	<u>N/A</u>	<u>0</u>	<u>0</u>	<u>M</u>
7. <u>Other QC</u>	<u>N/A</u>	<u>see Attachment</u>		
8. _____	_____	_____	_____	_____
9. _____	_____	_____	_____	_____
10. _____	_____	_____	_____	_____

0 = data had no problems
 X = data qualified due to minor problems
 M = data qualified due to major problems/some data may be unusable

OVERALL ASSESSMENT: CN result unusable (R) due to low LCS recovery on 699-52-57-001; all other results acceptable w/qualification

NOTES: see "Other QC" for cross ref. sample #'s & matrix

o Refer to the corresponding attachments for explanation of any problems.



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OSM RCRA LEVEL C DATA ASSESSMENT

DATE 12/5/90 SAMPLES/MATRIX _____
 REVIEWED BY JA Lerch *See Page* _____
 LABORATORY PNC _____
 CASE # PNC project #16772 _____
 SDG # N/A _____

DATA ASSESSMENT SUMMARY

QUALITY CONTROL CHECK	ANALYSIS	GFAA	CN (free)
1. <u>Holding time</u>		<u>0</u>	<u>0</u>
2. <u>Blank Analysis</u>		<u>0</u>	<u>0</u>
3. <u>MS/MSD</u>		<u>0</u>	<u>N/A</u>
4. <u>Duplicate Analysis</u>		<u>0</u>	<u>0</u>
5. <u>Matrix Spike</u>		<u>X¹</u>	<u>X</u>
6. <u>Calibration/Control Std</u>		<u>0</u>	<u>0</u>
7. <u>Other QC</u>		<u>see attachment</u>	
8. _____		_____	_____
9. _____		_____	_____
10. _____		_____	_____

0 = data had no problems
 X = data qualified due to minor problems
 M = data qualified due to major problems/some data may be unusable

OVERALL ASSESSMENT: see page 1

NOTES: analytical spikes

o Refer to the corresponding attachments for explanation of any problems.

RCRA LEVEL C QC

Name JA Lerch / J Date 12/5/90

QC Check: Holding times

COMMENTS: 70 solids - Holding time N/A, all samples (soil) analyzed within 23 days

Anions - nitrate, nitrite, phosphate HT's exceeded for samples 699-52-57-074 and ~~699-52-57-074~~ 699-52-57-077A

~~70 solids~~ CN(total) - 14 day holding time exceeded on several water + soil samples (see below)

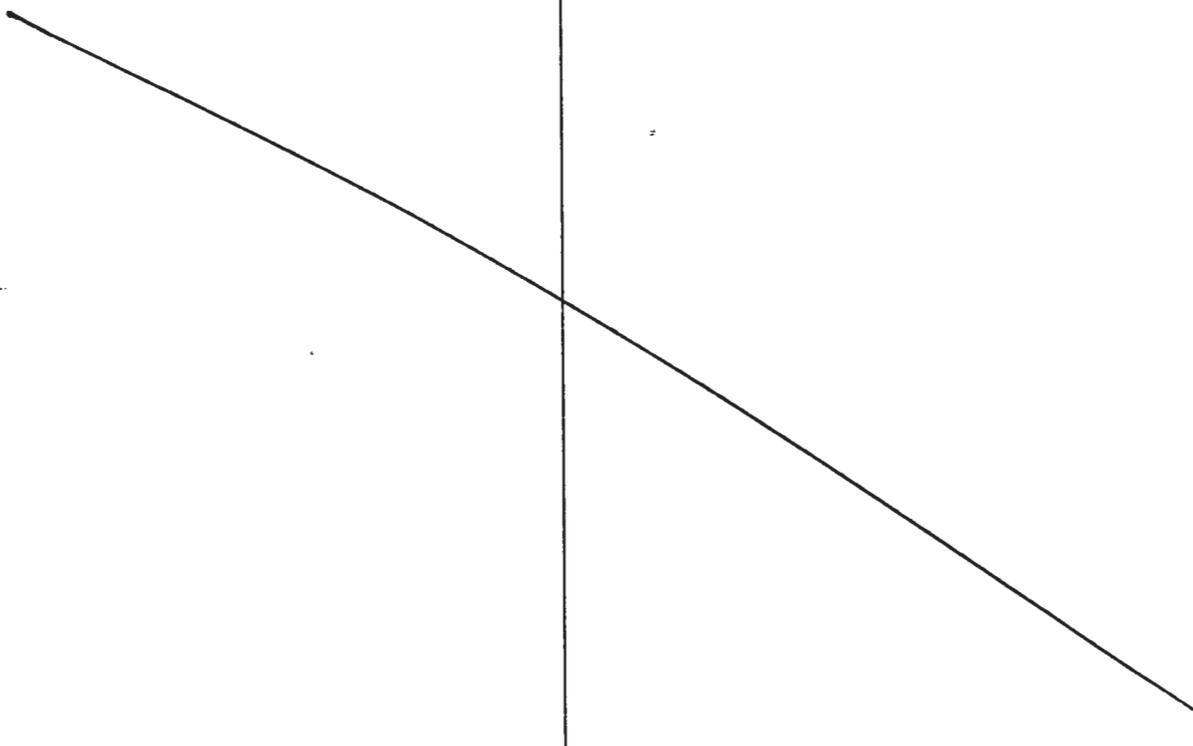
ACTION: Qualify associated results as per OSM guidelines

sample #	constituent	value/qual	sample #	constituent	value/qual
699-52-57-074	Nitrate	J			
	Nitrite	UJ			
	Phosphate	UJ			
699-52-57-077A	Nitrate	UJ			
	Nitrite	UJ			
	Phosphate	UJ			
699-52-57-027	CN(total) ↓	J			
699-55-55-025		J			
699-52-57-049		J			
699-52-57-050A		J			
699-52-57-074		J			
699-52-57-077A		J			

RCRA LEVEL C QC

Name JA Lerch Date 12/5/90QC Check: Holding times (cont)COMMENTS: GFAA - all elements analyzed within 6mo HT
Free CN - all samples analyzed within Holding timeACTION: none

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
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RCRA LEVEL C QC

Name JA Kerch Date 12/5/90

QC Check: Blank Analysis

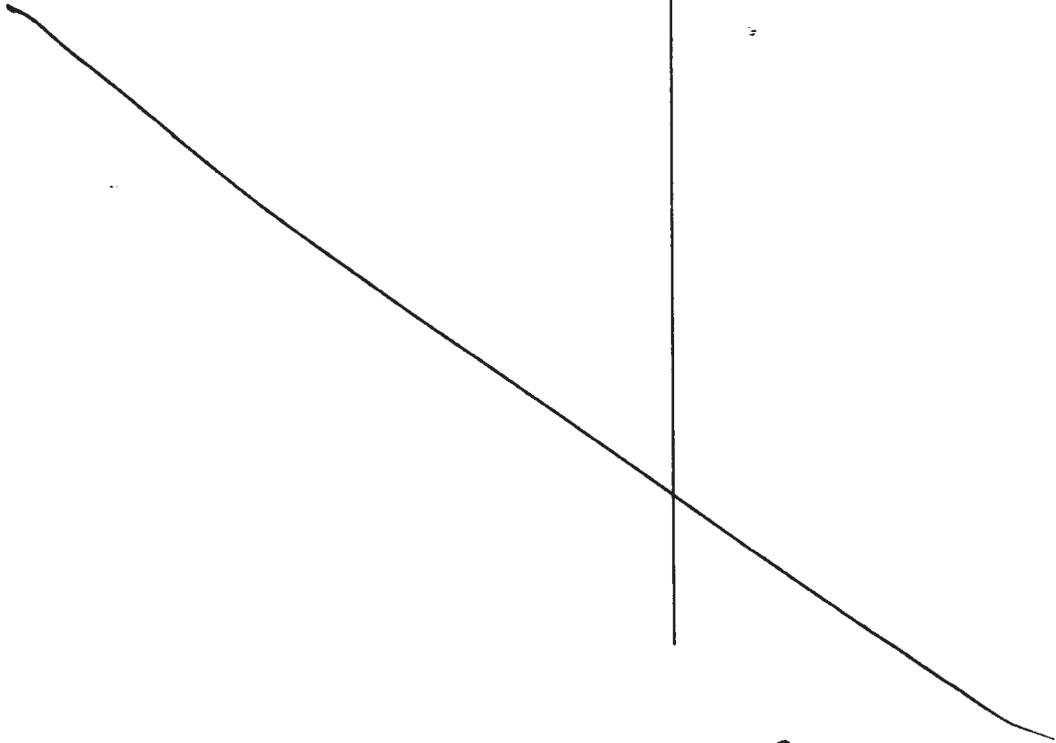
COMMENTS: 7. Solids - N/A

Anions - trace contam. of ^{Nitrate} phosphate blank for 699-52-57-001
all other blanks free of contamination

CN - trace contamination on 699-52-57-001; other detections
observed below listed DL's - no qualification based on sample results

ACTION: qualify associated results as per OSM
guidelines

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
699-52-57-001	CN	acceptable			
	Nitrate	2.9 u			



RCRA LEVEL C QC

Name JA Lerch *JL* Date 12/5/90

QC Check: Blank Analysis (cont)

COMMENTS: GFAA - all procedure + continuing cal. blanks
free of contamination

Free CN - free CN blank Free of contamination

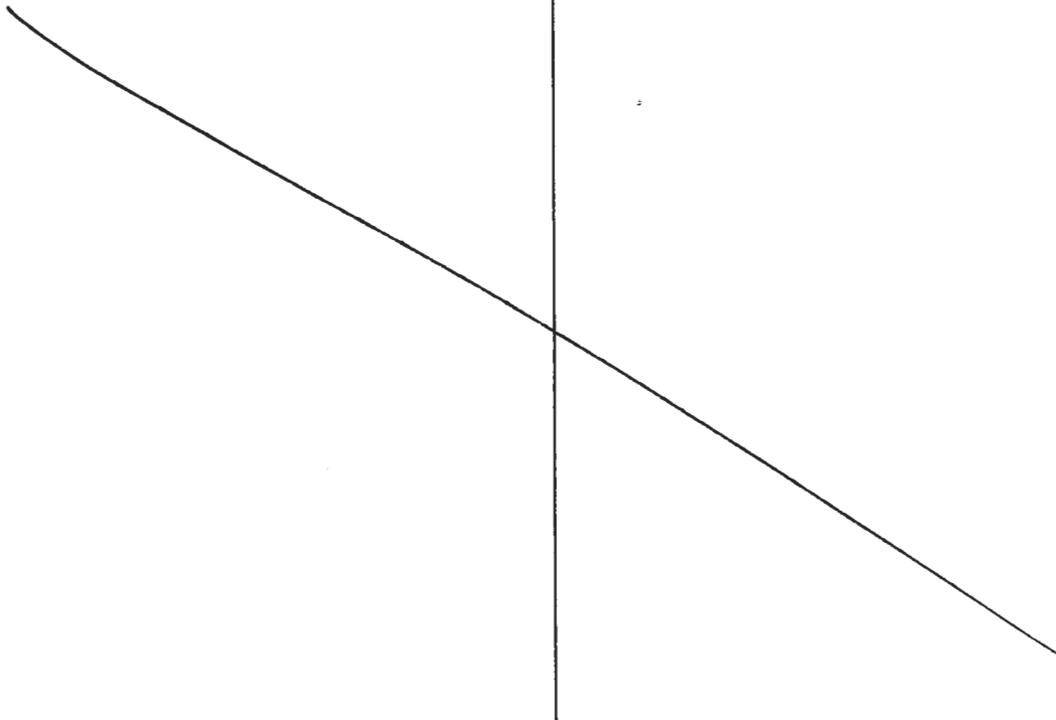
ACTION: none

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
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RCRA LEVEL C QCName JA Lerch  Date 10/05/90QC Check: MS/MSDCOMMENTS: GFAA - MS, MSD recoveries and associated
RTD's acceptable for Se, Bi analysisACTION: none

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
-----------------	--------------------	-------------------	-----------------	--------------------	-------------------



RCRA LEVEL C QCName JA Lerch  Date 12/5/90QC Check: Duplicate analysisCOMMENTS: ? solid - all duplicate RPD's ok
Anions - Nitrate RPD 26% for 699-52-57-001; all other
RPD's ok or N/ACN - all CN duplicate RPD's okACTION: qualify associated results as per
OSM guidelines

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
699-52-57-001	Nitrate	2.9 UJ			

RCRA LEVEL C QC

Name JA Lerch *JA* Date 12/5/90

QC Check: Duplicate analysis (cont)

COMMENTS: GFAA - see MS/MSD QC
Free CN - duplicate RPD N/A both sample + Dup < DL

ACTION: none

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
<i>(Table content is crossed out with a large diagonal line)</i>					

RCRA LEVEL C QC

Name JA Lerch Date 12/5/90QC Check: Matrix spikeCOMMENTS: % solids - N/AAnions - all spike %R within 75-125% no problemsCN - all recoveries within 93-116% no problemsACTION: none

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
 					

RCRA LEVEL C QC

Name JA Lerch Date 12/5/90QC Check: Matrix Spike (cont)

COMMENTS: GFAA (analytical spikes) - all Bismuth analytical spike 70R within limits, all Se water analytical spike ok; Several Se soil recoveries out of control (see below)
Free CN - spike recovery low

ACTION: qualify associated results as per OSM guidelines

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
699-52-57-001	Se	UJ			
699-55-55-001	Se	UJ			
699-52-57-027	Se	UJ			
699-55-55-025	Se	UJ			
699-55-57-050	Se	UJ			
699-52-57-077	Se	UJ			
699-52-57-078	Se	UJ			
699-52-55-001	Free CN	UJ			
699-55-55-001					
699-52-57-027					
699-55-55-025					

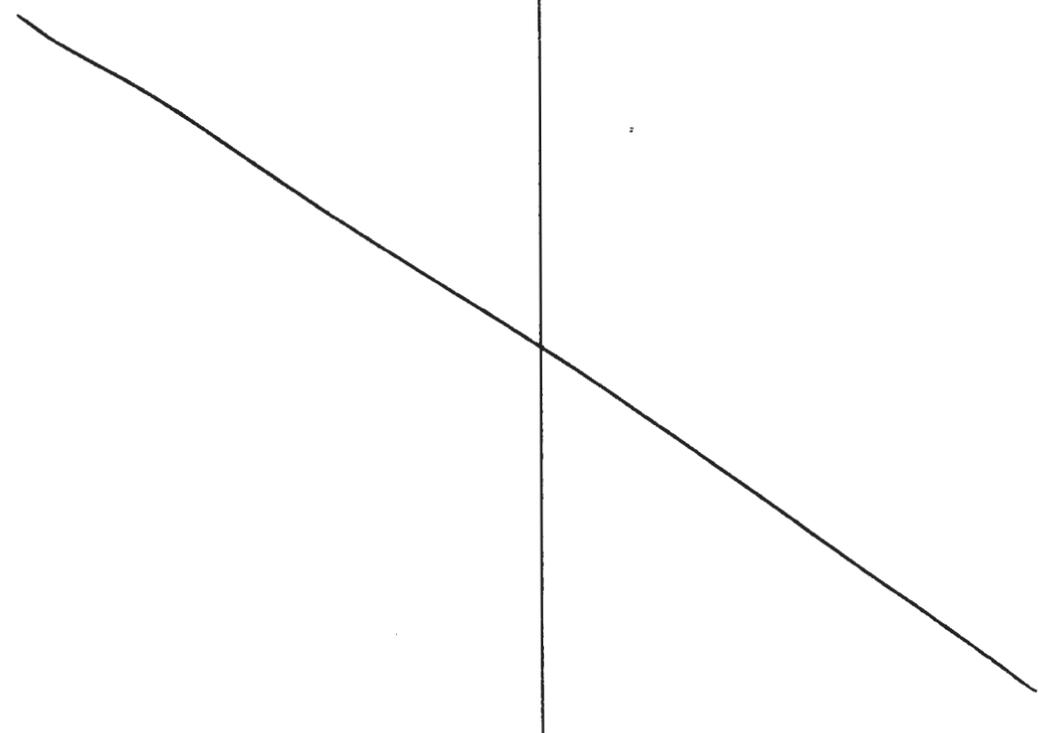
RCRA LEVEL C QC

Name JA Lerch JL Date 12/5/90QC Check: Calibrations/Control SamplesCOMMENTS: % Solids - N/AAnions - all verification std + LCS recoveries okCN - calibration recoveries ok; LCS recovery very low (<4%
for 699-52-57-001, all other LCS %R okACTION: qualify associated results as per
OSM ~~qualif~~ guidelines

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
699-52-57-001	CN	R			
due to very low recovery					

RCRA LEVEL C QC

Name JA Lerch  Date 12/5/90QC Check: Calibrations/Control Samples (cont)COMMENTS: BFAA - all initial + continuing cal. verification
7.0R, control std recovery ok
Free CN - control std recoveries acceptableACTION: none

<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>	<u>sample #</u>	<u>constituent</u>	<u>value/qual</u>
					

RCRA LEVEL C QC

Name JA Lerch *JL* Date 12/05/90

QC Check: Other

COMMENTS: Free CN run on only four samples (1st four listed on data assessment cover sheet)

Several results for CN reported less than detection limit with no flag

ACTION: qualify a CN results reported < DL as estimated (J)

sample #	constituent	value/qual
699-52-57-001	CN	0 J
699-52-55-001		0 J
699-52-57-027		0 J
699-55-55-025		0.4 J
699-52-57-049		0.9 J
699-52-57-050A		0.1 J
699-52-57-074		0.1 J
699-52-57-077A		

sample #	constituent	value/qual
Sample Cross Reference		
	WHC	PNL
		matrix
699-52-57-001	90-5335	soil
699-52-55-001	90-5336	soil
699-52-57-027	90-5343	soil
699-55-55-025	90-5344	soil
699-55-57-050	90-5345	soil
699-52-57-077	90-5350	soil
699-52-57-078	90-5351	soil
699-52-57-049	90-5346	water
699-52-57-050A	90-5347	water
699-52-57-074	90-5352	water
699-52-57-077A	90-5353	water

TABLE 3: ANION IC ANALYSIS DATA

NITRITE

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (mg/Kg)	C2 SAMPLE DUP (mg/Kg)	RPD	C5 BLANK (ug)	C3		C6		C3 SAMPLE + SPIKE	% RECOVERIES	
						SPIKE (mg/Kg)	SPIKE (mg/Kg)	BLANK SPIKE (mg/Kg)	SPIKE (mg/Kg)		C6 BLANK SPIKE	C4 LSC SAMPLE
699-52-57-001	90-5335	<DL	<DL	NA	<DL	60.9	61.8	57.3	58.1	98.5	98.6	99.3
	90-5335R	<DL	<DL	NA	<DL	21.4	21.7			98.6		102.6
699-52-55-001	90-5336	<DL	<DL	NA	<DL	78.1	80.5	72.9	71.6	80.5	71.6	98.0
	90-5336R	<DL	<DL	NA	<DL	22.5	23.4			96.2		99.3
699-52-57-027	90-5343	<DL	<DL	NA	<DL	23.1	24.9			92.8		97.4
	90-5344	<DL	<DL	NA	<DL	27.5	29.3			93.6		100.7
699-55-55-025	90-5344	<DL	<DL	NA	<DL	27.5	29.3			93.6		103.9
	90-5345	<DL	<DL	NA	<DL	24.0	23.4	23.7	23.7	102.6	100.0	101.3
699-55-57-050	90-5345	<DL	<DL	NA	<DL							98.0
699-52-57-077	90-5350	<DL	<DL	NA	<DL							
699-52-57-077-B	90-5351	<DL	<DL	NA	<DL							
										mean	94.7	
										std. dev.	7.1	

*DL = detection limit of 0.5 mg/Kg (theoretical)

6

WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (ug/L)	C2 SAMPLE DUP (ug/L)	RPD	C5 BLANK (ug)	C3		C6		C3 SAMPLE + SPIKE	% RECOVERIES		
						SPIKE (ug/L)	SPIKE (ug/L)	BLANK SPIKE (ug/L)	SPIKE (ug/L)		C6 BLANK SPIKE	C4 LSC SAMPLE	
699-52-57-049	90-5346	<DL	<DL	NA									
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	1680.0	1520.0	1670.0	1520.0	110.5	109.9	102.6	
699-52-57-074	90-5352 (a)	<DL	UJ <DL	NA		1810.0	1520.0			119.1			
699-52-57-077A	90-5353 (b)	<DL	UJ <DL	NA		1830.0	1520.0			120.4			
										mean	116.7	95.0	100.3
										std. dev.	5.4	16.4	2.1

*DL = detection limit of 5 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

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TABLE 3: ANION IC ANALYSIS DATA

NITRATE

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1		C2	RPD	C5	C3		C6		C3	C6	C4
		SAMPLE	SAMPLE DUP				SAMPLE	SAMPLE	SAMPLE +	BLANK SPIKE			
		(mg/Kg)	(mg/Kg)	(mg/Kg)		(ug)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	% REC.	% REC.	% REC.
699-52-57-001	90-5335	2.9	2.3	UJ	26.2	1.7	46.4	45.9	44.5	43.1	95.4	97.2	99.1
	90-5335R	1.6	1.6		0	<DL	18.0	16.1			102.0		100.9
699-52-55-001	90-5336	<DL	<DL	NA	NA	<DL	60.2	59.8	53	53.1	100.7	99.8	100.0
	90-5336R	0.4	0.5		8.7	<DL	17.9	17.3			100.8		100.9
699-52-57-027	90-5343	1.6	1.6		1.2	<DL	20.3	18.5			100.9		100.0
699-55-55-025	90-5344	1.2	1.2		1.6	<DL	23.8	21.7			104.0		100.0
699-55-57-050	90-5345	1.2											100.9
699-52-57-077	90-5350	1.0											101.8
699-52-57-077-B	90-5351	0.9	0.9		1.1	<DL	18.3	17.4	18.1	17.6	99.9	97.6	99.1
											mean	100.5	
											std. dev.	2.6	

*DL = detection limit of 0.5 mg/Kg (theoretical)

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1		C2	RPD	C5	C3		C6		C3	% RECOVERIES		
		SAMPLE	SAMPLE DUP				SAMPLE	SAMPLE	SAMPLE +	BLANK SPIKE		SPIKE	BLANK SPIKE	C4
		(ug/L)	(ug/L)	(ug/L)		(ug)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	% REC.	% REC.	LSC	
699-52-57-049	90-5346	<DL	<DL		NA									
699-52-57-050A	90-5347	<DL	<DL		NA	<DL	1140.0	1120.0	1140.0	1130.0	101.8	100.9	100.0	
699-52-57-074	90-5352 (a)	56.2	56.2	J	0		1230.0	1130.0			103.9			
699-52-57-077A	90-5353 (b)	<DL	<DL	UJ	NA		1200.0	1130.0			106.2			
											mean	104.0	98.9	100.6
											std. dev.	2.2	1.8	1.1

*DL = detection limit of 5 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

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TABLE 3: ANION IC ANALYSIS DATA

PHOSPHATE

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (mg/Kg)	C2 SAMPLE DUP (mg/Kg)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES		
						SPIKE (mg/Kg)	SAMPLE (mg/Kg)	BLANK (mg/Kg)	SPIKE (mg/Kg)	C3 SAMPLE + SPIKE	C6 BLANK SPIKE	C4 LSC SAMPLE
699-52-57-001	90-5335	<DL	<DL	NA	<DL	59.8	66.2	57	62.2	90.3	91.6	88.3
	90-5335R	<DL	<DL	NA	<DL	23.2	23.2			100.0		96.9
699-52-55-001	90-5336	<DL	<DL	NA	<DL	78.1	86.3	71.5	76.7	90.5	93.2	90.8
	90-5336R	1.2	<DL	NA	<DL	25.1	25.0			98.0		93.9
699-52-57-027	90-5343	<DL	<DL	NA	<DL	23.0	26.7			86.1		95.1
699-55-55-025	90-5344	<DL	<DL	NA	<DL	25.6	31.4			81.5		92.6
699-55-57-050	90-5345	<DL										93.9
699-52-57-077	90-5350	<DL										93.9
699-52-57-077-B	90-5351	<DL	<DL	NA	<DL	20.9	25.1	21.8	25.3	83.3	86.2	92.6
										mean	90.0	
										std. dev.	7.0	

*DL = detection limit of 3 mg/Kg (theoretical)

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (ug/L)	C2 SAMPLE DUP (ug/L)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES		
						SPIKE (ug/L)	SAMPLE (ug/L)	BLANK (ug/L)	SPIKE (ug/L)	C3 SAMPLE + SPIKE	C6 BLANK SPIKE	C4 LSC SAMPLE
699-52-57-049	90-5346	<DL	<DL	NA								
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	1570.0	1620.0	1600.0	1630.0	96.9	98.2	98.2
699-52-57-074	90-5352 (a)	<DL	WJ <DL	NA		1640.0	1630.0			100.6		
699-52-57-077A	90-5353 (b)	<DL	WJ <DL	NA		1630.0	1630.0			100.0		
										mean	99.2	93.5
										std. dev.	2.0	2.6

*DL = detection limit of 31 ug/L

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

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12/06/00

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TABLE 3: ANION IC ANALYSIS DATA

SULFATE

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (mg/Kg)	C2 SAMPLE DUP (mg/Kg)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES		
						SPIKE (mg/Kg)	SPIKE (mg/Kg)	BLANK SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SAMPLE + SPIKE	C6 BLANK SPIKE	C4 LSC SAMPLE
699-52-57-001	90-5335	<DL	<DL	NA	<DL	203.0	203.0	191.0	191.0	100.0	100.0	98.8
	90-5335R	<DL	<DL	NA	<DL	72.9	71.3			102.2		99.8
699-52-55-001	90-5336	<DL	<DL	NA	<DL	265.0	265.0	236.0	235.0	100.0	100.4	99.2
	90-5336R	3.7	<DL	NA	<DL	78.5	76.8			99.8		99.6
699-52-57-027	90-5343	22.7	21.3	6.4	<DL	97.5	81.9			92.2		98.8
699-55-55-025	90-5344	17.2	16.8	2.4	<DL	116.0	96.2			102.9		99.2
699-55-57-050	90-5345	19.7										
699-52-57-077	90-5350	15										
699-52-57-077-B	90-5351	13.3	13.3	0	<DL	87.5	76.9			96.5		101.6
										mean		
										std. dev.		

*DL = detection limit of 6 mg/Kg (theoretical)

mean
std. dev.

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WATER SAMPLES

SAMPLE ID#	PNL LOG#	C1 SAMPLE (ug/L)	C2 SAMPLE DUP (ug/L)	RPD	C5 BLANK (ug)	C3		C6		% RECOVERIES		
						SPIKE (ug/L)	SPIKE (ug/L)	BLANK SPIKE (ug/L)	SPIKE (ug/L)	C3 SAMPLE + SPIKE	C6 BLANK SPIKE	C4 LSC SAMPLE
699-52-57-049	90-5346	<DL	<DL	NA				5040.0	4990.0	100.0	101.0	100.0
699-52-57-050A	90-5347	<DL	<DL	NA	<DL	4980.0	4980.0			105.0		
699-52-57-074	90-5352 (a)	<DL	<DL	NA		5250.0	5000.0			104.8		
699-52-57-077A	90-5353 (b)	<DL	<DL	NA		5220.0	4980.0					
										mean		
										std. dev.		

*DL = detection limit of 55 ug/L

mean
std. dev.

Note: RPD only calculated when results are >DL.

(a) Hold time missed by 4.3 hrs.

(b) Hold time missed by 3.5 hrs.

9613177-2416

TABLE 4: TOTAL CYANIDE ANALYSIS DATA

SOLID SAMPLES

SAMPLE ID#	PNL LOG#	G1 SAMPLE (mg/Kg)	G2 SAMPLE DUP (mg/Kg)	RPD	G5 BLANK (ug)	G3		G6		% RECOVERIES			
						SPIKE SAMPLE (mg/Kg)	SPIKE (mg/Kg)	BLANK SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SAMPLE + SPIKE	C6 BLANK SPIKE	LCS SAMPLE	
699-52-57-001	90-5335 (d)	0	0.1		1.7 (a)	16.14	16.70 (b)	N/A	N/A	96.6	82.7	3.98 (c)	
699-52-55-001	90-5336	0.1	0.1		0	15.29	15.66 (b)	N/A	N/A	97.6	100.2	110.8	
699-52-57-027	90-5343 (e)	0	0.1		0	9.20	9.85	N/A	N/A	93.5	107.8	96.3	
699-55-55-025	90-5344 (e)	0	0.1		0	8.52	8.20	N/A	N/A	103.9	114.5	113.5	
699-55-57-050	90-5345	0.6	0.2		0	9.39	8.07	N/A	N/A	116.4	106.7	116.1	
699-52-57-077	90-5350	0.1	0.1		0.4	8.70	7.98	N/A	N/A	109.0	115.2	101.6	
699-52-57-077-B	90-5351	0.1	0.1		0.6	8.93	8.40	8.5	8.4	106.3	106.7	91.1	
										mean	103.3	104.8	
										std. dev.	8.0	11.0	

WATER SAMPLES

SAMPLE ID#	PNL LOG#	G1 SAMPLE (ug/L)	G2 SAMPLE DUP (ug/L)	RPD	G5 BLANK (ug)	G3		G6		% RECOVERIES			
						SPIKE SAMPLE (ug/L)	SPIKE (ug/L)	BLANK SPIKE (ug/L)	SPIKE (ug/L)	C3 SAMPLE + SPIKE	C6 BLANK SPIKE	LCS SAMPLE	
699-52-57-049	90-5346 (f)	0.4	0.8		0.2	41.15	39.82	41.84	39.82	103.4	105.1	108.3	
699-52-57-050A	90-5347 (g)	0.9	0.3		0.7	41.47	39.82	40.61	39.82	104.2	102.0	104.7	
699-52-57-074	90-5352 (h)	0.1	0.2		1.9	40.19	39.82			100.9		97.2	
699-52-57-077A	90-5353 (i)	0.1	-0.2		-0.3	42.24	39.82	37.12	39.82	106.1	93.2	100.9	
										mean	103.7	100.1	
										std. dev.	2.2	6.2	

Detection limits for water = 1 ug/L

Detection limit for soil = 0.1-0.4 mg/Kg (theoretical)

- (a) Blank was turbid due to exfoliation of precipitates from glass frit of adsorber.
- (b) Spike level higher than required due to miss calculation of spike level by analyst.
- (c) LCS recovery low. Attributed to Analytical Error.
- (d) Hold time missed by 1 day.
- (e) Hold time missed by 3 days.
- (f) Hold time missed by 14 days.
- (g) Hold time missed by 13 days.
- (h) Hold time missed by 7 days.
- (i) Hold time missed by 8 days.

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12/06/02

9603977-2617

TABLE 5A: SELENIUM ANALYSIS DATA
ACID EXTRACTABLE SELENIUM IN WATER SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (ug/L)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	0.5						
ICV (a)	26.0					98	
CCB	0.5						
CRA	5.1					102	
CCB	-0.1						
90-5346-B5	-0.1						
90-5346-B5-AS	11.5			10	115		
90-5346-B1	-0.4	<DL					U
90-5346-B1AS	10.0			10	100		
90-5346-B3	19.7	19.7		25	79		
90-5346-B2	0.5	<DL	N/A				B
90-5346-B2-AS	9.4			10	94		
90-5346-B4	21.9	21.9		25		88	
90-5346-B4-AS	33.5			10	116		
90-5346-B6	21.8	21.8		25	87		
90-5347-B1	0.3	<DL					B
90-5347-B1-AS	10.6			10	103		
CCV	25.5					97	
CCB	0.0						
90-5352-B1	-0.2	<DL					U
90-5352-B1-AS	9.9			10	99		
90-5353-B1	0.1	<DL					B
90-5353-B1-AS	10.0			10	100		
(d) 90-5357-B1	0.1	<DL					B
(d) 90-5357-B1-AS	10.2			10	102		
(d) 90-5358-B1	0.5	<DL					B
(d) 90-5358-B1-AS	9.0			10	85		
CCV	25.7					97	
CCB	0.6						

Notes:

(a) Used a dilution of ICF/ICV-2= 26.4 ug/L
 (b) Analytical spike (AS) = 10 ug/L.
 (c) Pre-digest spike = 25 ug/L. for B3, B4 and B6.
 (d) Samples not part of Data Package #1
 (e) RPD only calculated if both sample and duplicate are greater than detection limit.

B1 = SAMPLE
 B2 = SAMPLE DUPLICATE
 B3 = SAMPLE + Se SPIKE
 B4 = LAB. CONTROL STANDARD
 B5 = PROCEDURAL BLANK
 B6 = SAMPLE + Se SPIKE DUPLICATE

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-049	90-5346	10/04/86	10/21/86	11/05/86
699-52-55-050A	90-5347	10/04/86	10/21/86	11/05/86
699-52-57-074	90-5352	10/09/86	10/21/86	11/05/86
699-55-57-077A	90-5353	10/09/86	10/21/86	11/05/86

CRDL*: 5 ug/L
 DL (IDL x 2.5): 3.75 ug/L

*CRDL = Contract required detection limit

TABLE 5B: SELENIUM ANALYSIS DATA
ACID EXTRACTABLE SELENIUM IN SOIL SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (mg/Kg)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	0.2						
ICV (a)	25.6					97	
CCB	-0.1						
CRA	4.8					96	
CCB	-0.1						
90-5335-B5	-0.1						
90-5335-B5-AS	9.5			10	95		
90-5335-B1	-3.6	<DL	UJ				W,U
90-5335-B1-AS	5.3	0		10	53		
90-5335-B3	-1.3	0		25	0		
90-5335-B3-AS	7.5			10	75		
90-5335-B2	-2.4	<DL	N/A				U
90-5335-B2-AS	5.9			10	59		
90-5335-B4 (d)	10.7	34.2				87	W
90-5335-B4-AS	18.1			10	74		
90-5335-B6	-0.8	0		25	0		
90-5335-B6-AS	7.8			10	78		
90-5335-B7	23.8			25	95		
90-5336-B1	-2.7	<DL	UJ				W,U
90-5336-B1-AS	5.9			10	59		
CCV	25.3					96	
CCB	0.5						
90-5343-B1	-3.8	<DL	UJ				W,U
90-5343-B1-AS	5.4			10	54		
90-5344-B1	-4.3	<DL	UJ				W,U
90-5344-B1-AS	5.0			10	50		
90-5345-B1	-5.3	<DL	UJ				W,U
90-5345-B1-AS	3.6			10	36		
90-5350-B1	3.3	<DL	UJ				W,U
90-5350-B1-AS	6.2			10	62		
90-5351-B1	-2.7	<DL	UJ				W,U
90-5351-B1-AS	5.9			10	59		
CCV	25.2					95	
CCB	0.3						

Notes:

- (a) Used a dilution of ICF/ICV-2= 26.4 ug/L
- (b) Analytical spike (AS) = 10 ug/L.
- (c) Pre-digest spike = 25 ug/L. for B3, B6 and B7.
- (d) B4 = LCS-0287 containing 39.2 mg/Kg Se
- (e) RPD only calculated if both sample and duplicate are greater than detection limit.

- B1 = SAMPLE
- B2 = SAMPLE DUPLICATE
- B3 = SAMPLE + Se SPIKE
- B4 = LAB. CONTROL STANDARD
- B5 = PROCEDURAL BLANK
- B6 = SAMPLE + Se SPIKE DUPLICATE
- B7 = SPIKED PROCEDURAL BLANK

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-001	90-5335	09/25/86	11/11/86	11/13/86
699-52-55-001	90-5336	09/25/86	11/11/86	11/13/86
699-52-57-027	90-5343	10/01/86	11/11/86	11/13/86
699-55-55-025	90-5344	10/01/86	11/11/86	11/13/86
699-55-57-050	90-5345	10/04/86	11/11/86	11/13/86
699-52-57-077	90-5350	10/09/86	11/11/86	11/13/86
699-52-57-077-B	90-5351	10/09/86	11/11/86	11/13/86

CRDL*: 0.5 mg/Kg
DL (IDL x 2.5): 3.75 ug/L

*CRDL = Contract required detection limit

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12/06/90

TABLE 6A: BISMUTH ANALYSIS DATA
ACID EXTRACTABLE BISMUTH IN WATER SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (ug/L)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	-0.6						
ICV (a)	33.5					98	
CCB	0.6						
CRA	9.8					98	
CCB	-0.8						
90-5346-B5	-0.1						
90-5346-B5-AS	19.1			20	95		
90-5346-B1	-0.2	<DL					U
90-5346-B1AS	19.9			20	99		
90-5346-B3	48.3	48.3		50	97		
90-5346-B2	1.7	<DL	N/A				
90-5346-B2-AS	21.8			20	100		
90-5346-B4	14.9	44.7		50		89	
90-5346-B4-AS	36.5			20	108		
90-5346-B6	48.3	48.3		50	97		
90-5347-B1	2.0	<DL					
90-5347-B1-AS	21.9			20	108		
CCV	36.7					110	
CCB	0.4						
90-5352-B1	-1.3	<DL					U
90-5352-B1-AS	23.1			20	115		
90-5353-B1	-1.1	<DL					U
90-5353-B1-AS	20.0			20	100		
(d) 90-5357-B1	-0.8						U
(d) 90-5357-B1-AS	20.4			20	102		
(d) 90-5358-B1	-0.6						U
(d) 90-5358-B1-AS	19.7			20	98		
CCV	32.6					98	
CCB	0.4						

Notes:

- (a) ICV & CCV = 33.33 ug/L
 (b) Analytical spike (AS) = 20 ug/L.
 (c) Pre-digest spike for B3, B4 and B6 = 50 ug/L.
 (d) Samples not part of Data Package #1
 (e) RPD only calculated if both sample and duplicate are greater than detection limit.

- B1 = SAMPLE
 B2 = SAMPLE DUPLICATE
 B3 = SAMPLE + BI SPIKE
 B4 = LAB. CONTROL STANDARD
 B5 = PROCEDURAL BLANK
 B6 = SAMPLE + B1 SPIKE DUPLICATE

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-049	90-5346	10/04/86	10/21/86	11/04/86
699-52-55-050A	90-5347	10/04/86	10/21/86	11/04/86
699-52-57-074	90-5352	10/09/86	10/21/86	11/04/86
699-55-57-077A	90-5353	10/09/86	10/21/86	11/04/86

CRDL* : 60 ug/L
 DL (IDL x 2.5): 7.25 ug/L

*CRDL = Contract required detection limit

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TABLE 6B: BISMUTH ANALYSIS DATA
ACID EXTRACTABLE BISMUTH IN SOIL SAMPLES

Lab log #	Soln. Conc. (ug/L)	Results (mg/Kg)	Duplicate RPD (e)	Spike (ug/L) (b,c)	Spike %Rec.	Standard %Rec.	CLP flags
ICB	-0.1						
ICV (a)	24.5					98	
CCB	0.0						
CRA	9.4					94	
CCB	-0.1						
90-5335-B5	-0.3						
90-5335-B5-AS	18.2			20	91		
90-5335-B1	-0.6	<DL					U,N
90-5335-B1AS	18.0			20	90		
90-5335-B3	36.5	3.53		50	73		N
90-5335-B2	0.1	<DL	N/A				
90-5335-B2-AS	18.9			20	94		
90-5335-B4 (d)	17.8	32.5				89	
90-5335-B4-AS	35.6			20	89		
90-5335-B6	37.2	3.44		50	74		N
90-5335-B7	50.8			50	102		
90-5336-B1	0.3	<DL					
90-5336-B1-AS	19.6			20	96		
CCV	26.0					106	
CCB	0.6						
90-5343-B1	-2.5	<DL					U,N
90-5343-B1-AS	19.3			20	96		
90-5344-B1	-2.6	<DL					U,N
90-5344-B1-AS	18.3			20	91		
90-5345-B1	-2.4	<DL					U,N
90-5345-B1-AS	18.9			20	94		
90-5350-B1	-1.4	<DL					U,N
90-5350-B1-AS	19.5			20	97		
90-5351-B1	-1.8	<DL					U,N
90-5351-B1-AS	18.1			20	90		
CCV	26.8					107	
CCB	0.7						

Notes:

- (a) Used a dilution of ICV-2 = 26.4 ug/L
- (b) Analytical spike (AS) = 20 ug/L.
- (c) Pre-digest spike = 50 ug/L.
- (d) B4 = LCS-0287+ 40 ug Bi spike
- (e) RPD only calculated if both sample & duplicate are greater than detection limit.

- B1 = SAMPLE
- B2 = SAMPLE DUPLICATE
- B3 = SAMPLE + Bi SPIKE
- B4 = LAB. CONTROL STANDARD
- B5 = PROCEDURAL BLANK
- B6 = SAMPLE + Bi SPIKE DUPLICATE
- B7 = SPIKED PROCEDURAL BLANK

Sample I.D.	Lab. Log #	Sampling Date	Extraction Date	Analysis date
699-52-57-001	90-5335	09/25/86	11/11/86	11/13/86
699-52-55-001	90-5336	09/25/86	11/11/86	11/13/86
699-52-57-027	90-5343	10/01/86	11/11/86	11/13/86
699-55-55-025	90-5344	10/01/86	11/11/86	11/13/86
699-55-57-050	90-5345	10/04/86	11/11/86	11/13/86
699-52-57-077	90-5350	10/09/86	11/11/86	11/13/86
699-52-57-077-B	90-5351	10/09/86	11/11/86	11/13/86

CRDL* : 10 mg/Kg
DL (IDL x 2.5): 7.25 ug/L

*CRDL = Contract required detection limit

TABLE 7: FREE CYANIDE ANALYSIS

Sample ID#	Sample mg/Kg	Sample Duplicate mg/Kg	Sample+ Spike mg/Kg	Spike Added mg/Kg	(20ppb) Control Std. ppb	Matrix Blank mg/Kg	Spike Duplicate mg/Kg	Spike Rec %	Control Std. % Rec.
90-5335-J-1	<0.2	UJ							
90-5335-J-4					19.9				99.5
90-5335-J-4					15.9				79.5
90-5335-J-4					14.7				73.5
90-5335-J-4					18.3				91.5
90-5335-J-5						<0.2			
90-5336-J-1	<0.2	UJ							
90-5336-J-3			0.44	1				44	
90-5336-J-6				1			<0.2		
90-5336-J-6				1			0.58 *	58	
90-5336-J-6				1			0.745 **	74.5	
90-5343-J-1	<0.2	UJ							
90-5343-J-2		<0.2							
90-5344-J-1	<0.2	UJ							
							mean	58.8	86
							std. dev.	15.3	11.7

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Note: Sample results reported based on undried sample weight.

* Freshly sonicated spiked sample - spike sonicated 10/8/90.

** Stirred (magnetically) spiked sample - not sonicated and hence no temperature rise during leaching.

Note: Based on control standard run before and immediately after this spiked sample, the spike recovery is within allowable limits. Detector response drift is obvious here in later portion of the analytical session.

- J1 = SAMPLE
- J2 = DUPLICATE SAMPLE
- J3 = SPIKE SAMPLE
- J4 = STANDARD
- J5 = METHODS BLANK
- J6 = SPIKE DUPLICATE

A. J. 12/1/91