0047917

S0001-2225

Numatec
Hanford Corporation

Internal
Memo

From: Process Chemistry
Phone: 373-4995 T6-07
Date: May 13, 1997
Subject: 105-N BASIN VISCOSITY RESULTS

8C510-97-010

OCT 1997
RECEIVED
EDMC

MAY 1997
RECEIVED
Data
Log In

To: G. L. Miller T6-06

cc: D. L. Herting T6-07
J. R. Jewett T6-07
A. D. Rice T6-06
JFO File/LB

This letter summarizes the viscosity measurements recently performed on settled sediment from 105-N Basin samples S97N000013 and S97N000014. The viscosity of sample S97N000006 was not measured because the sample primarily consisted of pebbles and other objects which exceeded the gap size for the viscometer. Laboratory Technology Procedure LT-519-115 (Revision B-0) was followed for all of the viscosity analyses.

The sediment in samples S97N000013 and S97N0000014 had not been disturbed for two weeks prior to the analyses on May 5, 1997. The viscosities were measured with shear rates increasing from 0 s^{-1} to 300 s^{-1} and decreasing from 300 s^{-1} to 0 s^{-1}. At the viscosities observed in these samples, the lower shear rate limit for the ME-45 sensor system is approximately 20 s^{-1}. Measurements with shear rates below 20 s^{-1} should be considered highly questionable. The viscosity analyses were performed at ambient temperature (approximately 24°C).

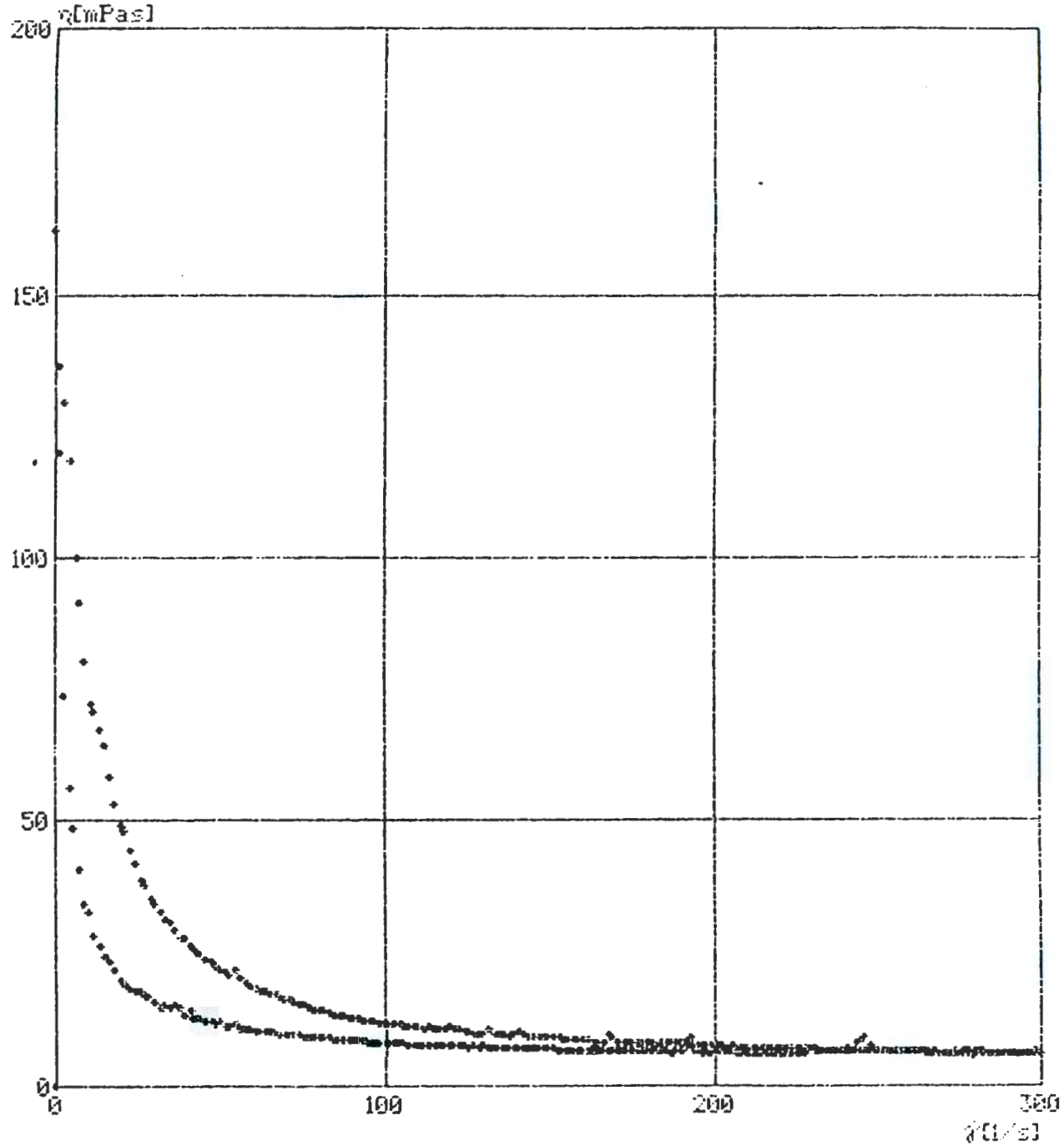
Sample S97N000014 contained a number of metal shavings, the majority of which were removed prior to the analysis. The objects ranged in size from several millimeters to two centimeters. A few metal shavings were discovered in the cup during cleanup after the run. The metal pieces probably caused a large degree of the variability observed in the results. One or two metal shavings were also discovered in the sample cup during cleanup of the sample S97N000013 run.

The attachment contains viscosity curves (viscosity vs. shear rate and shear stress vs. shear rate) and raw data for the sample runs. Both samples appear to be somewhat thixotropic with the increasing shear rate curve having greater viscosities than the decreasing curve.

All information associated with this testing was recorded in the controlled laboratory notebooks HNF-N-22-1 and WHC-N-1272-1. If you have any questions on this letter, feel free to call me at 373-4995.

J. F. O'Rourke
Process Chemistry
Numatec Hanford Corporation

Attachments (2)



numetec

Operator:
jwo

Substance:
s97n000013

Test No.:
01

Test of:
05-05-1997

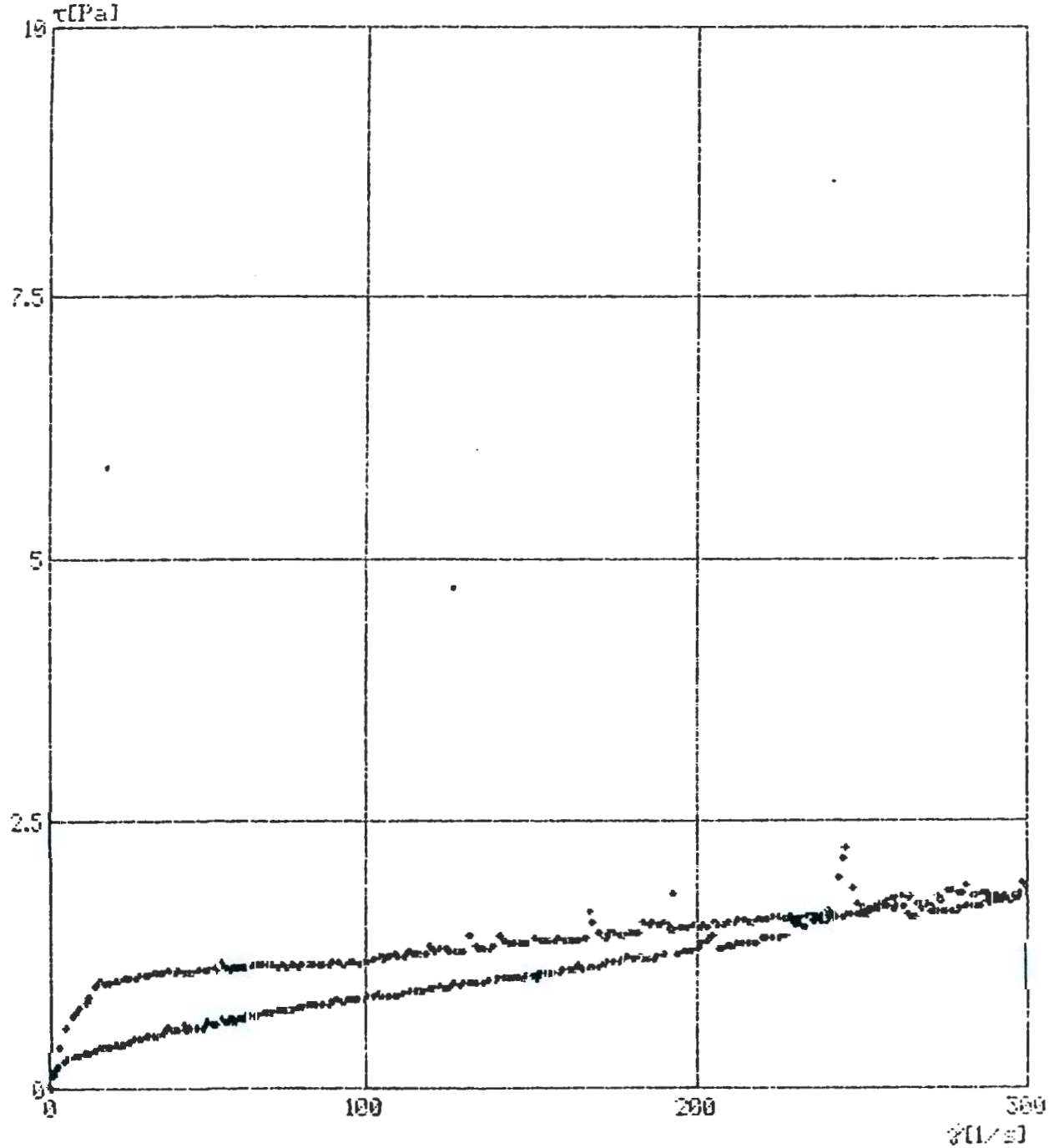
System:
CV20/ME45

Temperature:
25.0°C

*** S97N13A.ROT

BOJY50
DSA
5/16/97

HAAKE Rot 2.4



HAAKE Rot 2.4

numetec

Operator:
jwc

Substance:
s97n000013

BOJ450
DSa
5/16/97

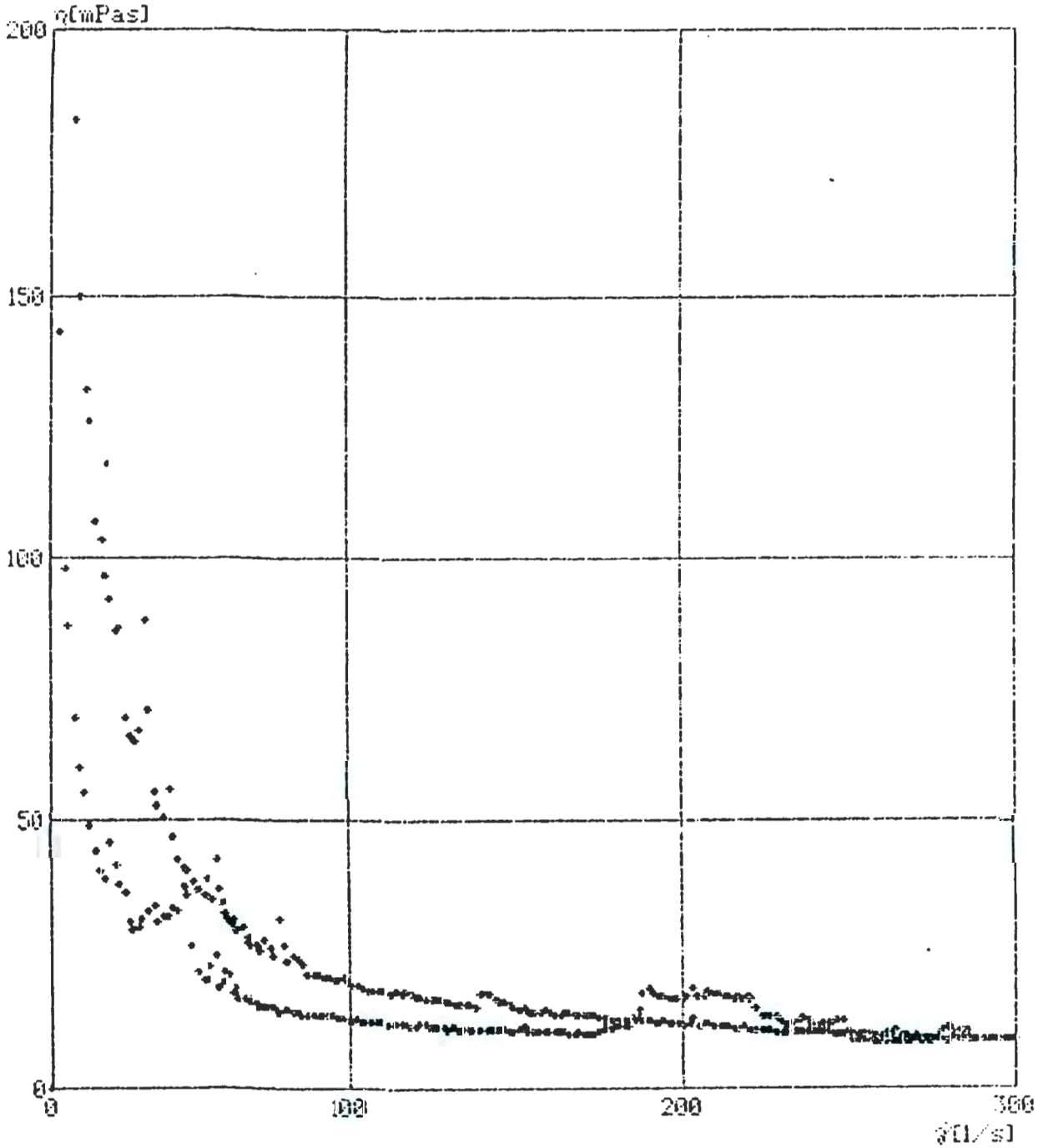
Test No.:
01

Test of:
05-05-1997

System:
CV20/ME45

Temperature:
25.0°C

*** S97N13A.ROT



numatec

Operator:
jwc

Substance:
s97n000014 JPO 5/5/97

Test No.:
01

Test of:
05-05-1997

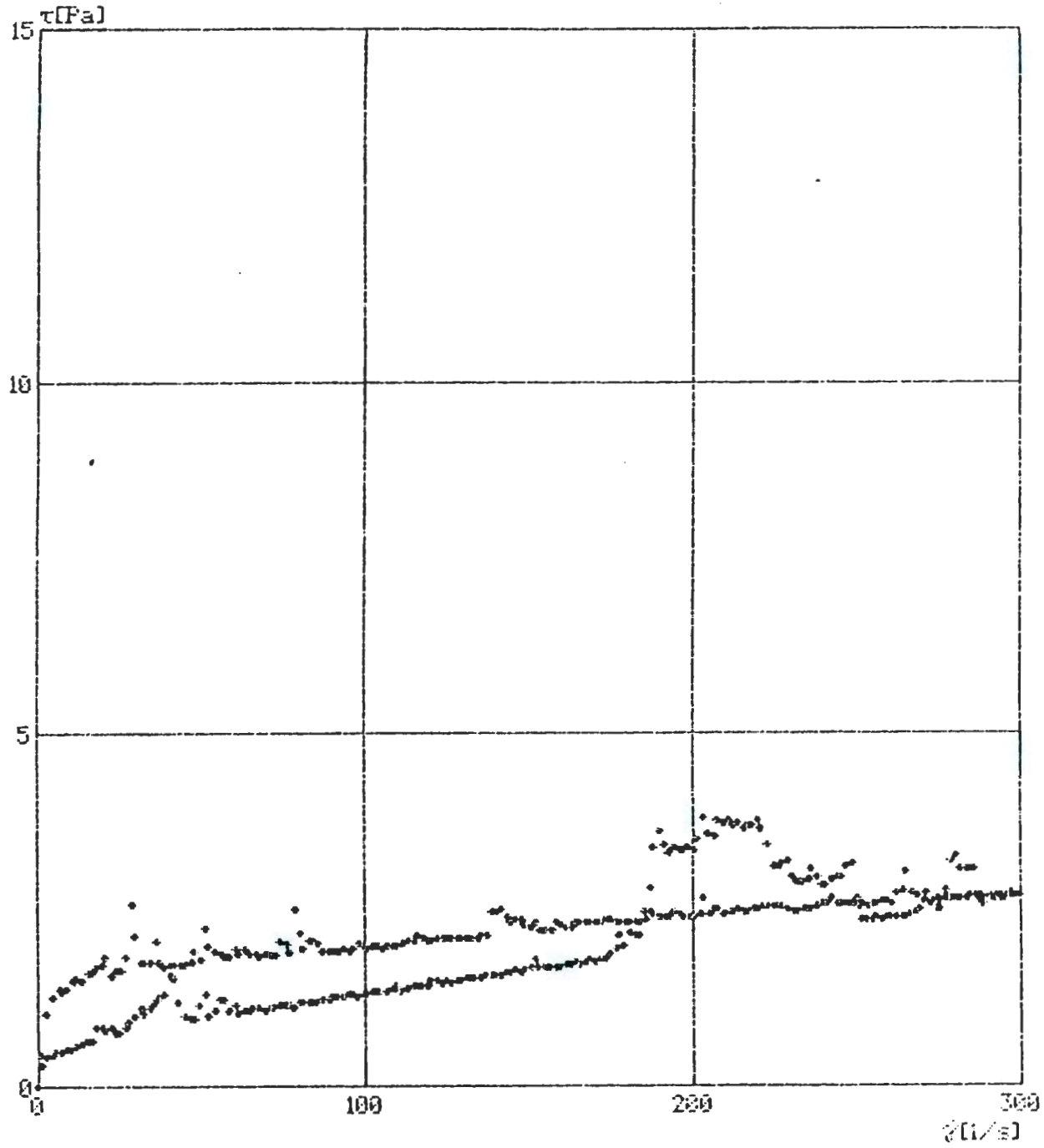
System:
DV2D/MS45

Temperature:
25.0°C

*** 97M13.ROT

BOJY51
DSQ
5/16/97

RHAKE Rot 2.4



numetec

Operator:
JWC

Substance:
s97n000014 JPO 5/5/97

BOJY51
Dea
5/16/97

Test No.:
01

Test of:
05-05-1997

System:
CV20/ME45

Temperature:
25.0°C

*** S97N13.ROT

HAAKE Rot 2.4

Numatec Hanford Corporation | **Internal Memo**

From: Process Chemistry
Phone: 373-4995 T6-07
Date: April 22, 1997
Subject: 105-N BASIN PHYSICAL TESTING RESULTS (Revision 1)

8C510-97-007

MAY 1997
RECEIVED
Data
Log In

To: G. L. Miller T6-06

cc: D. L. Herting T6-07
J. R. Jewett T6-07
A. D. Rice T6-06
JFO File/LB

Reference: Internal Memo, J. F. O'Rourke to G. L. Miller, "Test Plan for Processing Sediment Samples from 105-N Basin", dated March 12, 1997.

This letter has been revised to include the correct notebook number for the 105-N Basin sample preparation.

This letter reports the results of the physical testing conducted by Process Chemistry on sediment samples collected from the 105-N Basin. All information associated with this testing was recorded in laboratory notebooks HNF-N-22-1 and RHO-RE-NB-208.

The settled and centrifuged solids densities from samples S97N000001, S97N000002, and S97N000005 are presented in Attachment I. The settled and centrifuged solids measurements were made as directed in the reference. The settled solids densities were measured after the samples were allowed to sit overnight. The cones were then centrifuged for greater than an hour and the centrifuged solids densities were measured. The settled and centrifuged solids measurements were completed on March 25, 1997.

The results of the particle size analyses on samples S97N000006, S97N000013, and S97N000014 are presented in Attachment II. Most of the particles in the three samples were less than 10 μm in diameter. The particulate mass was spread over diameter ranges up to 150 μm. The sediment samples also likely contain particles with diameters less than 0.5 μm and greater than 150 μm, which would not be detected by this instrument.

J. F. O'Rourke, Advanced Engineer
Process Chemistry
Numatec Hanford Corporation

Attachments (2)

8C510-PCS97-007

Attachment I

105-N BASIN SEDIMENT SETTLED AND CENTRIFUGED SOLIDS DENSITIES

Consisting of 2 Pages including the cover page

TABLE 1 105-N BASIN SETTLED AND CENTRIFUGED SOLIDS DENSITIES

SAMPLE	SETTLED SOLIDS DENSITY (g/mL)	CENTRIFUGED SOLIDS DENSITY (g/mL)
S97N000001	1.35	1.64
	1.59	1.67
		1.68
		1.65
S97N000002	1.06	1.10
	1.03	1.15
S97N000005	1.23	1.36
	1.32	1.53

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

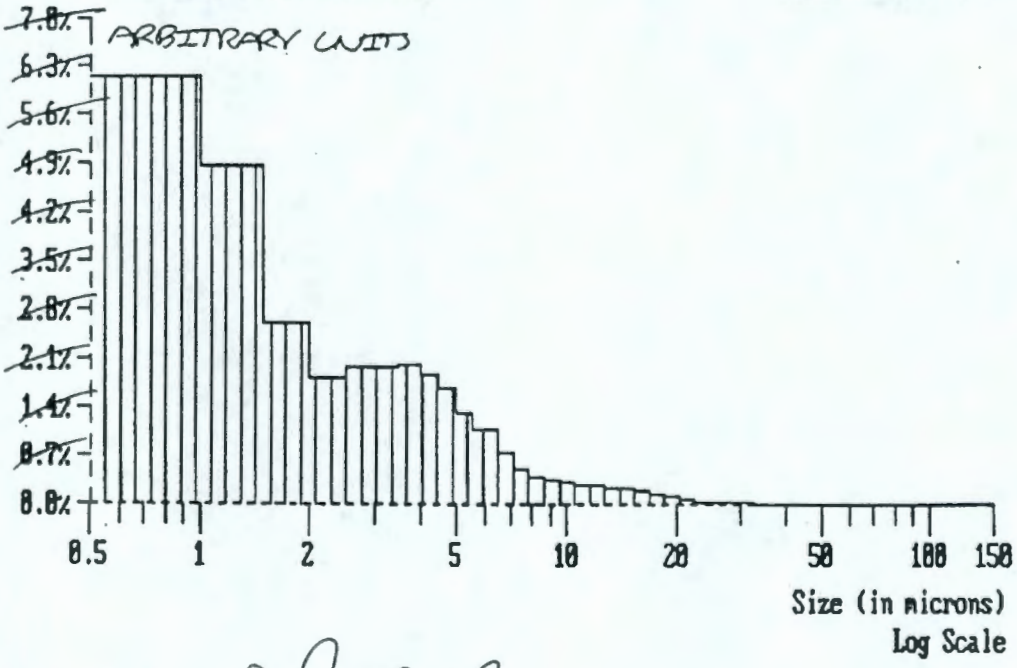
SAMPLE NAME : ~~S97N06B~~ S97N0000006 J.P.O 4/21/97 B0J449 DSA 5/16/97
FILE NAME : S97N06A

DATE	: 21/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 435451
TIME	: 12:11	ACQ. MODE	: SAMPLE	S.N.F.	: 0.54
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 2918 SEC	S.D.U.	: 5227
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5	CONCENTR.	: 1.1E+06 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.0E-02 %

PROBABILITY NUMBER DENSITY GRAPH

Name: S97N06B
1.1E+06 #/ml(100.0%)
Mode at 0.75 µm
<< SCALE RANGE (µm): ADJUSTED >>

Median : 1.12µm
Mean(nl): 2.10µm
S.D.(nl): 3.20µm
Conf(nl):100.00 %



4-21-97

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

NUMBER DISTRIBUTION TABLE (RANGES)

SAMPLE NAME : ~~S97N06B~~ S97N000006 JTD 4/21/97
FILE NAME : S97N06A

DATE	: 21/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 435451
TIME	: 12:11	ACQ. MODE	: SAMPLE	S.N.F.	: 0.54
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 2918 SEC	S.D.U.	: 5227
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5	CONCENTR.	: 1.1E+06 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.0E-02 %

RANGE (microns)	LOCAL (%)	UNDER(%)	-CUMULATIVE-	OVER(%)
0.0 - 1.0	44.94	44.94		55.06
1.0 - 2.0	28.86	73.79		26.21
2.0 - 3.0	8.11	81.90		18.10
3.0 - 4.0	6.10	88.00		12.00
4.0 - 5.0	4.22	92.22		7.78
5.0 - 6.0	2.51	94.73		5.27
6.0 - 7.0	1.44	96.18		3.82
7.0 - 8.0	0.76	96.94		3.06
8.0 - 9.0	0.47	97.41		2.59
9.0 - 10.0	0.39	97.80		2.20
10.0 - 20.0	1.69	99.48		0.52
20.0 - 30.0	0.33	99.82		0.18
30.0 - 40.0	0.09	99.90		0.10
40.0 - 50.0	0.06	99.96		0.04
50.0 - 60.0	0.02	99.98		0.02
60.0 - 70.0	0.01	99.99		0.01
70.0 - 80.0	0.00	99.99		0.01
80.0 - 90.0	0.00	100.00		0.00
90.0 - 100.0	0.00	100.00		0.00
100.0 - 150.0	0.00	100.00		0.00

G A L A I - C I S - 1

Computerized Inspection System

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM . LABS)

SAMPLE NAME : ~~S97N06B~~ S97N000006 JPO 4/21/97 BOJ449 DEA 5/16/97
FILE NAME : S97N06A

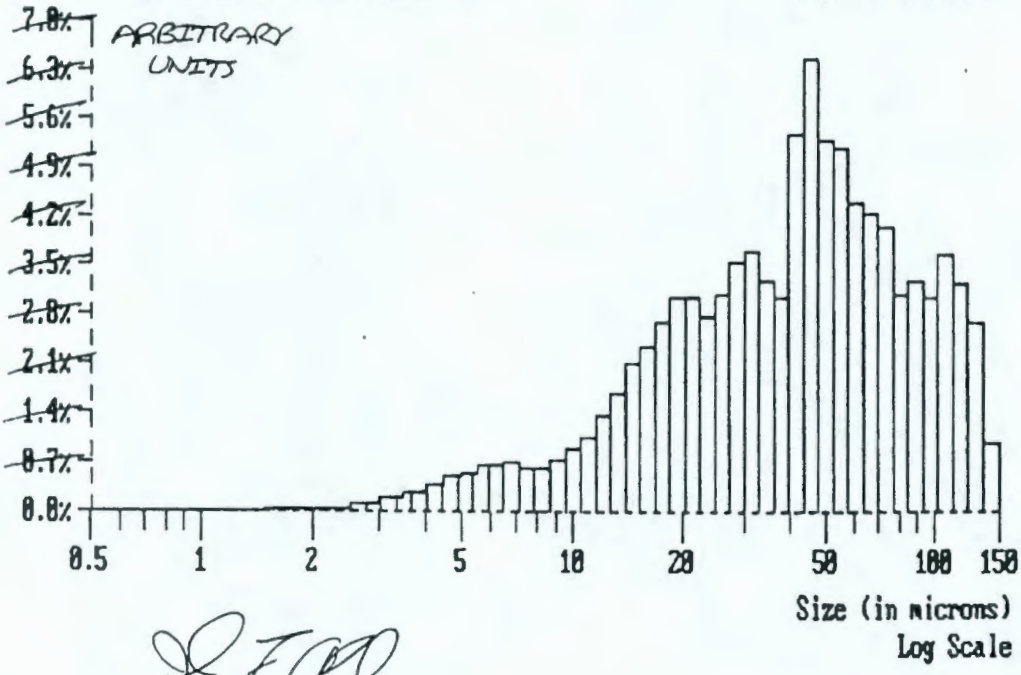
DATE	: 21/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 435451
TIME	: 12:11	ACQ. MODE	: SAMPLE	S.N.F.	: 0.54
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 2918 SEC	S.D.U.	: 5227
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5	CONCENTR.	: 1.1E+06 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.0E-02 %

PROBABILITY VOLUME DENSITY GRAPH

Name: S97N06B
2.0E-04 cc/ml(100.0%)
Mode at 45.76 µm
<< SCALE RANGE (µm): ADJUSTED >>

Mean(nu): 7.05µm
S.D.(nu): 5.90µm

Median : 43.41µm
Mean(vm): 49.69µm
S.D.(vm): 33.88µm
Conf(vm):100.00 %



4-21-97

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM . LABS)

VOLUME DISTRIBUTION TABLE (RANGES)

SAMPLE NAME : ~~S97N06B~~ S97N000006 TPO 4/24/97 BOJY49 DEA 5/16/97
FILE NAME : S97N06A

DATE	: 21/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 435451
TIME	: 12:11	ACQ. MODE	: SAMPLE	S.N.F.	: 0.54
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 2918 SEC	S.D.U.	: 5227
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5	CONCENTR.	: 1.1E+06 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.0E-02 %

RANGE (microns)	LOCAL (%)	UNDER(%)	-CUMULATIVE-	OVER(%)
0.0 - 1.0	0.05	0.05		99.95
1.0 - 2.0	0.24	0.29		99.71
2.0 - 3.0	0.37	0.66		99.34
3.0 - 4.0	0.75	1.41		98.59
4.0 - 5.0	1.09	2.50		97.50
5.0 - 6.0	1.19	3.68		96.32
6.0 - 7.0	1.12	4.80		95.20
7.0 - 8.0	0.90	5.71		94.29
8.0 - 9.0	0.83	6.54		93.46
9.0 - 10.0	0.95	7.48		92.52
10.0 - 20.0	14.27	21.76		78.24
20.0 - 30.0	13.38	35.13		64.87
30.0 - 40.0	10.01	45.15		54.85
40.0 - 50.0	14.03	59.18		40.82
50.0 - 60.0	9.91	69.09		30.91
60.0 - 70.0	6.68	75.78		24.22
70.0 - 80.0	5.29	81.07		18.93
80.0 - 90.0	4.50	85.57		14.43
90.0 - 100.0	3.06	88.63		11.37
100.0 - 150.0	11.37	100.00		0.00

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM . LABS)

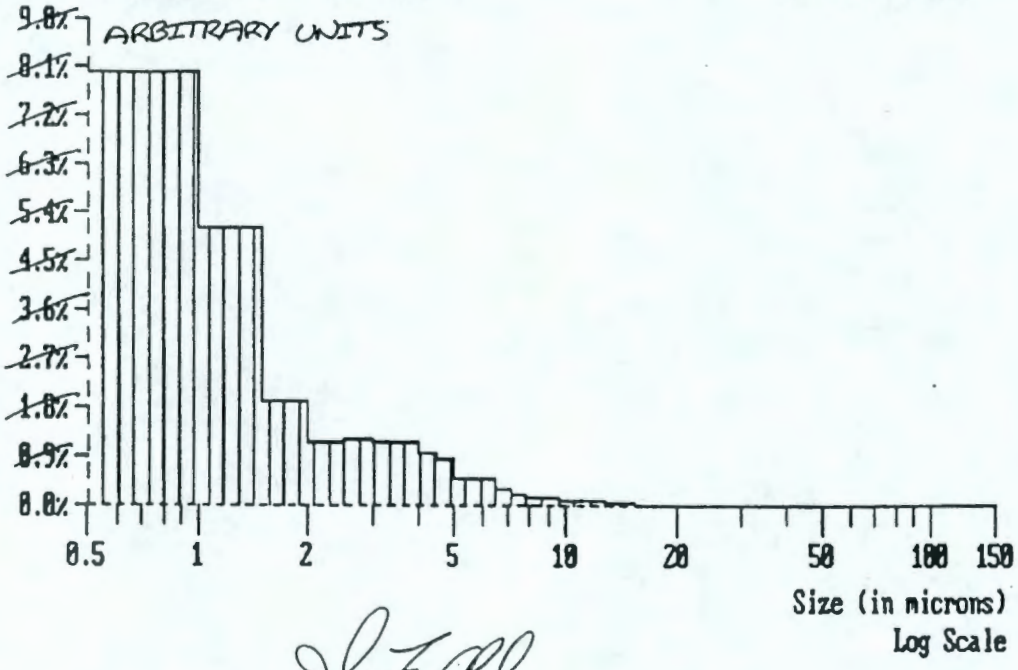
SAMPLE NAME : S97N000013 105-N B0J450 DFA 5/16/97
FILE NAME : s97n13

DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 478393
TIME	: 09:34	ACQ. MODE	: SAMPLE	S.N.F.	: 0.50
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 6785 SEC	S.D.U.	: 3961
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.7E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.9E-03 %

PROBABILITY NUMBER DENSITY GRAPH

Name: S97N000013 105-N
5.7E+05 #/ml(100.0%)
Mode at 0.75 µm
<< SCALE RANGE (µm): ADJUSTED >>

Median : 0.93µm
Mean(nl): 1.43µm
S.D.(nl): 1.88µm
Conf(nl):100.00 %



4-21-97

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

NUMBER DISTRIBUTION TABLE (RANGES)

SAMPLE NAME : S97N000013 105-N BOJ450 DFA 3/16/97
FILE NAME : s97n13

DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 478393
TIME	: 09:34	ACQ. MODE	: SAMPLE	S.N.F.	: 0.50
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 6785 SEC	S.D.U.	: 3961
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.7E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.9E-03 %

RANGE (microns)	LOCAL (%)	UNDER(%)	-CUMULATIVE-	OVER(%)
0.0 - 1.0	58.49	58.49		41.51
1.0 - 2.0	27.54	86.03		13.97
2.0 - 3.0	5.12	91.16		8.84
3.0 - 4.0	3.56	94.72		5.28
4.0 - 5.0	2.19	96.91		3.09
5.0 - 6.0	1.01	97.91		2.09
6.0 - 7.0	0.69	98.60		1.40
7.0 - 8.0	0.32	98.91		1.09
8.0 - 9.0	0.23	99.15		0.85
9.0 - 10.0	0.16	99.31		0.69
10.0 - 20.0	0.57	99.88		0.12
20.0 - 30.0	0.07	99.95		0.05
30.0 - 40.0	0.02	99.97		0.03
40.0 - 50.0	0.02	99.99		0.01
50.0 - 60.0	0.01	99.99		0.01
60.0 - 70.0	0.00	100.00		0.00
70.0 - 80.0	0.00	100.00		0.00
80.0 - 90.0	0.00	100.00		0.00
90.0 - 100.0	0.00	100.00		0.00
100.0 - 150.0	0.00	100.00		0.00

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

SAMPLE NAME : S97N000013 105-N B6J450 DMA 5/16/97
FILE NAME : S97N13

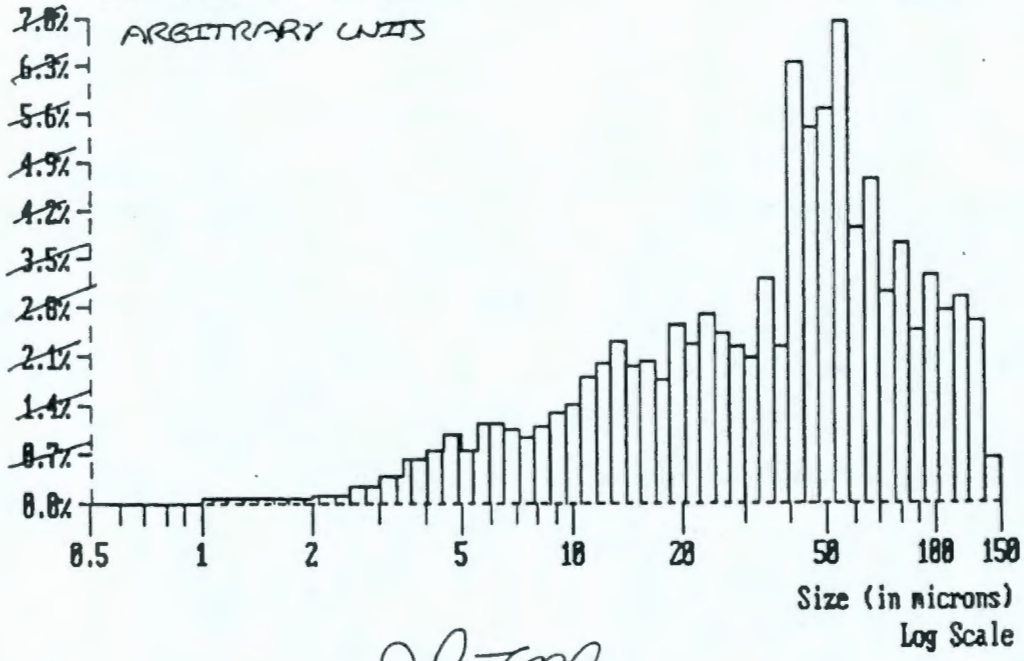
DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 478393
TIME	: 09:34	ACQ. MODE	: SAMPLE	S.N.F.	: 0.50
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 6785 SEC	S.D.U.	: 3961
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.7E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.9E-03 %

PROBABILITY VOLUME DENSITY GRAPH

Name: S97N000013 105-N
2.9E-05 cc/ml(100.0%)
Mode at 55.35 µm
<< SCALE RANGE (µm): ADJUSTED >>

Mean(nv): 4.59µm
S.D.(nv): 3.68µm

Median : 42.54µm
Mean(vm): 46.60µm
S.D.(vm): 33.97µm
Conf(vm):100.00 %



JL Zell
4-21-97

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

VOLUME DISTRIBUTION TABLE (RANGES)

SAMPLE NAME : S97N000013 105-N BOJ 450 DJA 5/16/97
FILE NAME : s97n13

DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 478393
TIME	: 09:34	ACQ. MODE	: SAMPLE	S.N.F.	: 0.50
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 6785 SEC	S.D.U.	: 3961
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.7E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 2.9E-03 %

RANGE (microns)	LOCAL (%)	UNDER(%)	-CUMULATIVE-	OVER(%)
0.0 - 1.0	0.26	0.26		99.74
1.0 - 2.0	0.76	1.01		98.99
2.0 - 3.0	0.83	1.84		98.16
3.0 - 4.0	1.57	3.42		96.58
4.0 - 5.0	2.05	5.46		94.54
5.0 - 6.0	1.73	7.20		92.80
6.0 - 7.0	1.91	9.10		90.90
7.0 - 8.0	1.35	10.46		89.54
8.0 - 9.0	1.48	11.94		88.06
9.0 - 10.0	1.44	13.38		86.62
10.0 - 20.0	14.69	28.06		71.94
20.0 - 30.0	10.27	38.33		61.67
30.0 - 40.0	7.53	45.87		54.13
40.0 - 50.0	13.98	59.85		40.15
50.0 - 60.0	11.82	71.66		28.34
60.0 - 70.0	6.97	78.64		21.36
70.0 - 80.0	5.03	83.66		16.34
80.0 - 90.0	3.66	87.32		12.68
90.0 - 100.0	2.36	89.69		10.31
100.0 - 150.0	10.31	100.00		0.00

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM . LABS)

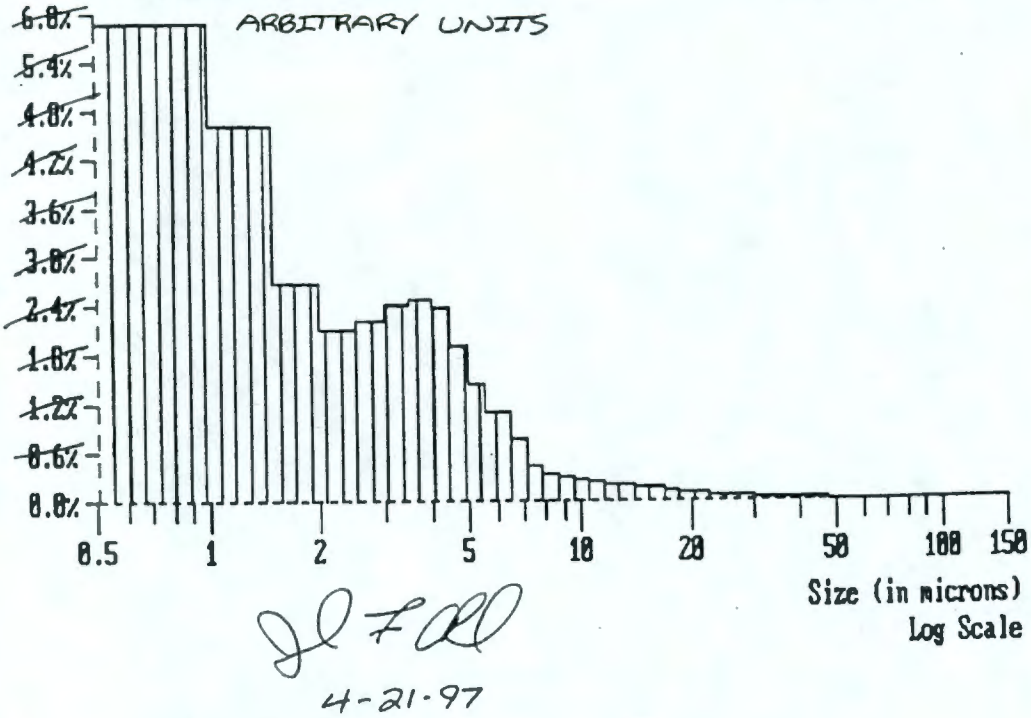
SAMPLE NAME : S97N000014 105-N BOJYSI DSC 5/16/97
FILE NAME : S97N14

DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 533937
TIME	: 11:35	ACQ. MODE	: SAMPLE	S.N.F.	: 0.52
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 4432 SEC	S.D.U.	: 5052
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.2E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 1.6E-02 %

PROBABILITY NUMBER DENSITY GRAPH

Name: S97N000014 105-N
5.2E+05 #/ml(100.0%)
Mode at 0.75 µm
<< SCALE RANGE (µm): ADJUSTED >>

Median : 1.18µm
Mean(nl): 2.21µm
S.D.(nl): 3.67µm
Conf(nl):100.00 %



4-21-97

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

NUMBER DISTRIBUTION TABLE (RANGES)

SAMPLE NAME : S97N000014 105-N BOJ451 DFA 5/16/97
FILE NAME : S97N14

DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 533937
TIME	: 11:35	ACQ. MODE	: SAMPLE	S.N.F.	: 0.52
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 4432 SEC	S.D.U.	: 5052
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.2E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 1.6E-02 %

RANGE (microns)	LOCAL (%)	UNDER(%)	-CUMULATIVE-	OVER(%)
0.0 - 1.0	42.95	42.95		57.05
1.0 - 2.0	27.77	70.71		29.29
2.0 - 3.0	9.20	79.91		20.09
3.0 - 4.0	7.42	87.33		12.67
4.0 - 5.0	5.07	92.40		7.60
5.0 - 6.0	2.56	94.96		5.04
6.0 - 7.0	1.51	96.47		3.53
7.0 - 8.0	0.66	97.13		2.87
8.0 - 9.0	0.40	97.53		2.47
9.0 - 10.0	0.32	97.85		2.15
10.0 - 20.0	1.43	99.29		0.71
20.0 - 30.0	0.40	99.68		0.32
30.0 - 40.0	0.13	99.81		0.19
40.0 - 50.0	0.10	99.91		0.09
50.0 - 60.0	0.05	99.96		0.04
60.0 - 70.0	0.02	99.98		0.02
70.0 - 80.0	0.01	99.99		0.01
80.0 - 90.0	0.00	99.99		0.01
90.0 - 100.0	0.00	99.99		0.01
100.0 - 150.0	0.01	100.00		0.00

G A L A I - C I S - 1

Computerized Inspection System

GALAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

SAMPLE NAME : S97N000014 105-N BOJ 4/51 DEA 5/14/97
FILE NAME : S97N14

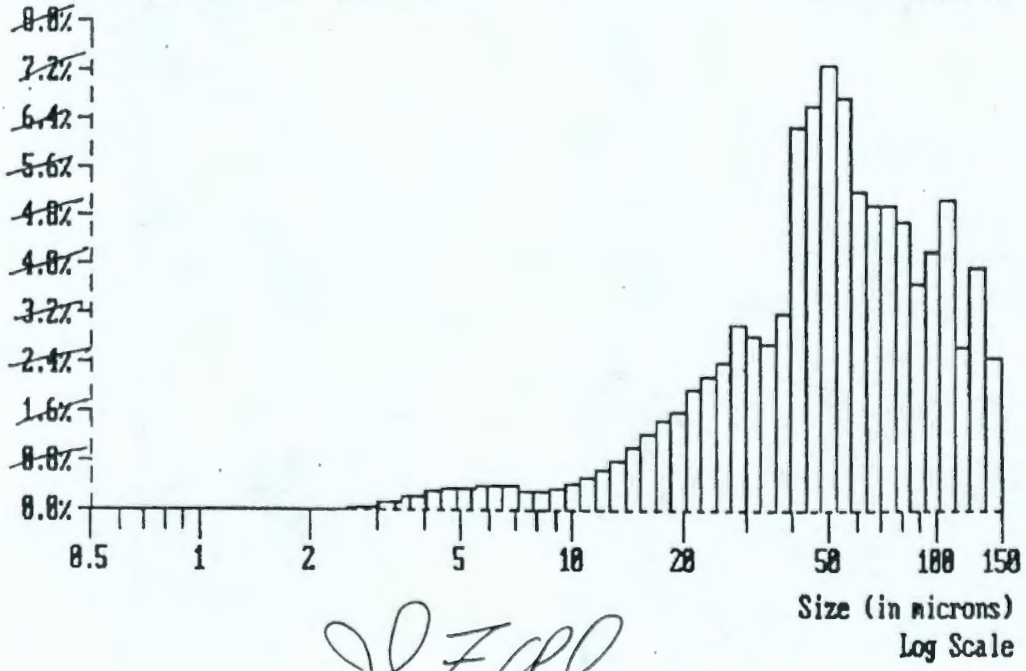
DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 533937
TIME	: 11:35	ACQ. MODE	: SAMPLE	S.N.F.	: 0.52
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 4432 SEC	S.D.U.	: 5052
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.2E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 1.6E-02 %

PROBABILITY VOLUME DENSITY GRAPH

Name: S97N000014 105-N
1.6E-04 cc/ml(100.0%)
Mode at 50.33 µm
<< SCALE RANGE (µm): ADJUSTED >>

Mean(nv): 8.32µm
S.D.(nv): 7.12µm

Median : 52.13µm
Mean(vm): 58.84µm
S.D.(vm): 34.55µm
Conf(vm):100.00 %



JL Fall
4-21-97

GAIAI CIS1 VERSION 4.3 (WHC PROCESS CHEM. LABS)

VOLUME DISTRIBUTION TABLE (RANGES)

SAMPLE NAME : S97N000014 105-N BOJ/51 DSA 5/16/97
FILE NAME : S97N14

DATE	: 18/04/1997	ACQ. RANGE	: 0.5-150	COUNTS	: 533937
TIME	: 11:35	ACQ. MODE	: SAMPLE	S.N.F.	: 0.52
CONFIG.	: 1 (0.7 S1)	ACQ. TIME	: 4432 SEC	S.D.U.	: 5052
CELL TYPE	: MAGNETIC (3)	SAMPLE SIZE	: 5 (ABORTED)	CONCENTR.	: 5.2E+05 #/ml
SAMPLE TYPE	: REGULAR	REQ. CONF.	: None	SOLIDS	: 1.6E-02 %

RANGE (microns)	LOCAL (%)	UNDER(%)	-CUMULATIVE-	OVER(%)
0.0 - 1.0	0.03	0.03		99.97
1.0 - 2.0	0.14	0.17		99.83
2.0 - 3.0	0.25	0.42		99.58
3.0 - 4.0	0.55	0.98		99.02
4.0 - 5.0	0.79	1.77		98.23
5.0 - 6.0	0.73	2.50		97.50
6.0 - 7.0	0.71	3.21		96.79
7.0 - 8.0	0.47	3.69		96.31
8.0 - 9.0	0.43	4.11		95.89
9.0 - 10.0	0.47	4.59		95.41
10.0 - 20.0	7.39	11.97		88.03
20.0 - 30.0	10.26	22.23		77.77
30.0 - 40.0	8.90	31.14		68.86
40.0 - 50.0	16.05	47.19		52.81
50.0 - 60.0	12.61	59.80		40.20
60.0 - 70.0	8.15	67.96		32.04
70.0 - 80.0	7.25	75.21		24.79
80.0 - 90.0	4.68	79.88		20.12
90.0 - 100.0	4.62	84.50		15.50
100.0 - 150.0	15.50	100.00		0.00

S0001-222S

HNF-SD-WM-DP-240, REV. 0

ANALYTICAL SERVICES

APR 1997
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Data
Log In

CASE NARRATIVE ON THE ANALYTICAL RESULTS FOR THE 105-N BASIN SEDIMENT DISPOSITION, SAMPLE CHARACTERIZATION PROJECT, PHASE ONE

Project Coordinator: GEORGE L. MILLER

Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

by

222-S Laboratory
Rust Federal Services of Hanford Inc.
P.O. Box 700
Richland, Washington

CASE NARRATIVE ON THE ANALYTICAL RESULTS FOR THE 105-N BASIN SEDIMENT DISPOSITION, SAMPLE CHARACTERIZATION PROJECT, PHASE ONE

INTRODUCTION

Project Documentation and Direction

Analytical direction for this project was provided in the following References.

1. Duncan, G. M., BHI-00975, Rev. 0, *105-N Basin Sediment Disposition Phase One, Sampling and Analysis Plan*, published on January 16, 1997, Bechtel Hanford, Inc., Richland, Washington 99352.

2. Logan, T. E., *Letter of Instruction for 105-N Basin Sediment Disposition Phase-One Sample Analysis*, written to C. G. Mattsson, Fluor Daniel Hanford, Inc. on January 31, 1997.

3. Meznarich, H. K., WHC-SD-CP-QAPP-016, Rev. 1A, *222-S Laboratory Quality Assurance Plan*, released on August 31, 1995, Westinghouse Hanford Company, Richland, WA 99352.

Project Description

Turnaround time for this project was 30 days, as required in Reference 2. The analyses were to be performed using SW-846 procedures whenever possible, however the project was not a Resource Conservation Recovery Act (RCRA) protocol project. Except for the analyses of polychlorinated biphenyl hydrocarbons (PCB), all preparative and analytical work was performed at the 222-S Laboratory. Pacific Northwest National Laboratory's (PNNL) Analytical Chemistry Laboratory (325 Laboratory) performed the PCB analyses.

During the course of analyses, three issues occurred which negatively impacted the 30 day deliverable schedule: waste handling issues at the 222-S Laboratory, the finding of PCBs in the N-Basin samples, and a change in quality control acceptance criteria.

Due to findings of regulatory non-compliance by the Washington State, Department of Ecology, the 222-S Laboratory placed a temporary administrative hold on its analytical work until all waste handling, designation and segregation issues were resolved. During the hold of approximately three weeks, all analytical and waste handling procedures were rewritten to comply with the legal regulations.

Upon finding significant concentrations of PCBs in these samples by the 325 Laboratory, it was determined that any uncompleted analyses at 222-S Laboratory would be further placed on hold until a legally compliant method of

segregating and disposal of PCB laden analytical waste could be implemented. The consequence of this action is that the following analyses could not be completed in time to be included with this report: viscosity, particle size distribution and (for one sample) laser ablation/mass spectrometry. These analytical results will be provided in a subsequent revision to this report.

On April 16, 1997, the Laboratory was informed verbally by the program that the accuracy control limits for this project were changed from ±2 standard deviations (based on LCS data) for the spikes and LCS standards to ±3 standard deviations for LCS standards and to 75 to 125 percent recovery for spikes.

SAMPLE COLLECTION AND RECEIVING

Table 1 provides dates associated with sample collection, and the receiving and analyses of samples at the 222-S Laboratory. Table 1 also indicates RCRA sample holding times.

ANALYTICAL REQUIREMENTS

The original quality control (QC) limits for this project for accuracy were unusually restrictive. The program specified that spike accuracy would be acceptable when the analytically derived spike values fell within ±2 standard deviations of the mean recovery for Laboratory Control Samples (LCS). The LCS is a sample containing a standard compound of known concentration in an interference-free matrix. The 222-S Laboratory maintains historical data and controls all analyses to within ±3 standard deviations for LCS. Thus, not only was the limit of ±2 standard deviations more restrictive than normal 222-S operations, but it was also required on spikes unrelated to the LCS system, which often have significant matrix interference. The consequence of such restrictive QC limits was that many analytical results which would ordinarily be acceptable would have been flagged as being out of control.

As noted above, the accuracy QC requirements were changed verbally just prior to completion of this project. The original requirements were specified in Revision 0 of References 1 and 2. The quality control requirements, which are summarized in Table 2 of this report, are based on the verbal corrections. These new quality control requirements will be reflected in revised documents to be produced by the program, and are now synchronous with those in Reference 3.

For settled density, centrifuged density and volume percent solids, the data were generated during the sample breakdown process. This breakdown is required to provide subsamples for subsequent analyses. Because the density and percent solids data cannot be provided after the samples have already been broken down, they are considered to be part of the breakdown process. The test plan on page 58 was specifically developed for the breakdown of these N-Basin samples, for which there was no pre-existing procedure which met the requirements of Reference 3. This test plan will be converted to an approved. controlled procedure, such as an "LT".

Table 1. Sample Collection and Analytical Dates

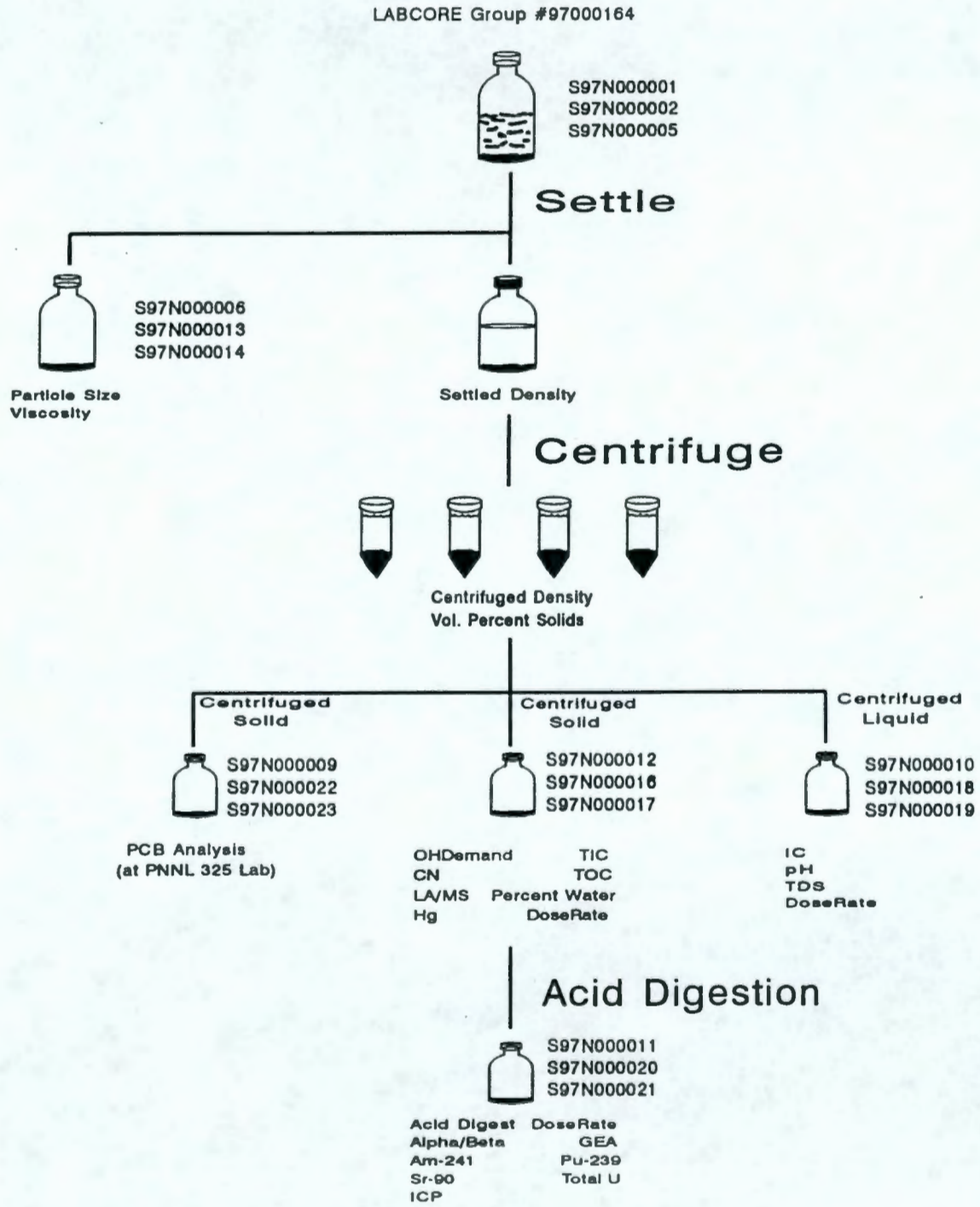
Sample Collection		Sample Receiving		Sample Identification			Analytical Operations		
Date	Time	Date	Time	Customer Sample Number	Laboratory Sample Number	Sample Description	Analyte or Procedure	Analysis Date	Sample Holding Time, days
2/11/97	1320	2/12/97	1235	BOJY49	S97N000001	Original Sample	Settled Density	3/24/97	41
							Centrifuged Density	3/25/97	42
							Volume % Solids	3/24/97	41
					S97N000006	Settled Solid	Particle Size Distribution	not analyzed	n/a
							Viscosity	not analyzed	n/a
					S97N000009	Centrifuged Solid	Shipped to PNL for PCB Analysis	3/26/97	43
					S97N000010	Centrifuged Liquid	Anions by IC	4/3/97	51
							pH	3/30/97	47
							Total Dissolved Solids	3/31/97	48
					S97N000012	Centrifuged Solid, Direct	Percent Water	3/30/97	47
							Hydroxide Demand	3/28/97	45
							Cyanide	4/5/97	53
							TIC/TOC	4/6/97	54
							Mercury	4/2/97	50
							Laser Ablation/Mass Spec	not analyzed	n/a
					S97N000011	Centrifuged Solid, Acid Digest	Acid Digestion	3/29/97	46
							Total Alpha/Beta	4/1/97	49
							Am-241	4/1/97	49
							Pu-238/239/240	4/1/97	49
							Total Uranium	4/2/97	50
							Gamma Energy Analyses	3/29/97	46
							Sr-90	4/2/97	50
							Metals by ICP	4/1/97	49
2/24/97	1240	2/24/97	1830	BOJY50	S97N000002	Original Sample	Settled Density	3/24/97	28
							Centrifuged Density	3/25/97	29
							Volume % Solids	3/24/97	28
					S97N000013	Settled Solid	Particle Size Distribution	not analyzed	n/a
							Viscosity	not analyzed	n/a
					S97N000022	Centrifuged Solid	Shipped to PNL for PCB Analysis	3/26/97	30
					S97N000018	Centrifuged Liquid	Anions by IC	4/3/97	38
							pH	3/30/97	34
							Total Dissolved Solids	3/31/97	35
					S97N000016	Centrifuged Solid, Direct	Percent Water	3/30/97	34
							Hydroxide Demand	3/28/97	32
							Cyanide	4/5/97	40
							TIC/TOC	4/6/97	41
							Mercury	4/2/97	37
							Laser Ablation/Mass Spec	4/2/97	37
					S97N000020	Centrifuged Solid, Acid Digest	Acid Digestion	3/29/97	33
							Total Alpha/Beta	4/1/97	36
							Am-241	4/1/97	36
							Pu-238/239/240	4/1/97	36
							Total Uranium	4/2/97	37
							Gamma Energy Analyses	3/29/97	33
							Sr-90	4/2/97	37
							Metals by ICP	4/1/97	36
3/7/97	2230	3/10/97	1300	BOJY51	S97N000005	Original Sample	Settled Density	3/25/97	18
							Centrifuged Density	3/26/97	19
							Volume % Solids	3/25/97	18
					S97N000014	Settled Solid	Particle Size Distribution	not analyzed	n/a
							Viscosity	not analyzed	n/a
					S97N000023	Centrifuged Solid	Shipped to PNL for PCB Analysis	3/26/97	19
					S97N000019	Centrifuged Liquid	Anions by IC	4/3/97	27
							pH	3/30/97	23
							Total Dissolved Solids	3/31/97	24
					S97N000017	Centrifuged Solid, Direct	Percent Water	3/30/97	23
							Hydroxide Demand	3/28/97	21
							Cyanide	4/5/97	29
							TIC/TOC	4/6/97	30
							Mercury	4/2/97	26
							Laser Ablation/Mass Spec	4/1/97	25
					S97N000021	Centrifuged Solid, Acid Digest	Acid Digestion	3/29/97	22
							Total Alpha/Beta	4/1/97	25
							Am-241	4/1/97	25
							Pu-238/239/240	4/1/97	25
							Total Uranium	4/2/97	26
							Gamma Energy Analyses	4/4/97	28
							Sr-90	4/2/97	26
							Metals by ICP	4/1/97	25

Table 2. Project Requirements: 105-N Basin (Phase 1)

Procedure	Analyte	LABCORE Procedure #	QC Requirements		Target MDA / MDL µCi/g or µg/g
			Duplicate RPD	Spike % Recovery	
Gross Alpha	Alpha	@AB-01	±30	75-125	0.05
Gross Beta	Beta	@AB-01	±30	75-125	0.1
GEA	Am-241	@GEA-04	±30	n/a	0.05
GEA	Sb-125	@GEA-04	±30	n/a	0.05
GEA	Co-60	@GEA-04	±30	n/a	0.05
GEA	Cs-134	@GEA-04	±30	n/a	0.05
GEA	Cs-137	@GEA-04	±30	n/a	0.05
GEA	Eu-152	@GEA-04	±30	n/a	0.05
GEA	Eu-154	@GEA-04	±30	n/a	0.05
GEA	Eu-155	@GEA-04	±30	n/a	0.05
GEA	Ra-226	@GEA-04	±30	n/a	0.05
Sr-90	Sr-90	@SR90-01	±30	n/a	0.05
Am-241 (AEA)	Am-241	@AM24101	±30	n/a	0.02
Pu-238 (AEA)	Pu-238	@PU23902	±30	n/a	0.02
Pu-239/240 (AEA)	Pu-239/240	@PU23902	±30	n/a	0.02
Total Uranium (Laser Ind. Kin. Phosph.)	Total U	@U-01	±30	n/a	1
Total Metals (ICP)	Ag	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Al	@ICP-A02	±30	75-125	100
Total Metals (ICP)	As	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Ba	@ICP-A02	±30	75-125	500
Total Metals (ICP)	Be	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Cd	@ICP-A02	±30	75-125	10
Total Metals (ICP)	Cr	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Fe	@ICP-A02	±30	75-125	100
Total Metals (ICP)	Mn	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Na	@ICP-A02	±30	75-125	500
Total Metals (ICP)	Ni	@ICP-A02	±30	75-125	100
Total Metals (ICP)	Pb	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Sb	@ICP-A02	±30	75-125	100
Total Metals (ICP)	Se	@ICP-A02	±30	75-125	10
Total Metals (ICP)	Tl	@ICP-A02	±30	75-125	100
Total Metals (ICP)	V	@ICP-A02	±30	75-125	50
Total Metals (ICP)	Zn	@ICP-A02	±30	75-125	50
Mercury (AA/Cold Vapor)	Hg	HG-02	±30	75-125	2
Anions (Ion Chromatography)	Br	@IC-01	±30	75-125	50
Anions (Ion Chromatography)	Cl	@IC-01	±30	75-125	50
Anions (Ion Chromatography)	F	@IC-01	±30	75-125	50
Anions (Ion Chromatography)	NO3	@IC-01	±30	75-125	50
Anions (Ion Chromatography)	NO2	@IC-01	±30	75-125	50
Anions (Ion Chromatography)	PO4	@IC-01	±30	75-125	100
Anions (Ion Chromatography)	SO4	@IC-01	±30	75-125	50
Cyanide (Colorimetric/Distillation)	CN	CN-03	±30	75-125	5
TOC (Combustion)	TOC	TOC-01	±30	75-125	50
TIC (Acidification/Coulometric)	TIC	TIC-02	±30	75-125	50
pH	pH	PH-01	±30	n/a	0.1 pH unit
Hydroxide Demand (Titration)	OH Demand	OHDEMAND	±30	n/a	n/a
Particle Size Distribution (Analyzer)	Particle Size	PARTSZ01	n/a	n/a	n/a
Density (Settled and Centrifuged)	Density	Test Plan	n/a	n/a	n/a
Percent Moisture/Water (Gravimetric)	% Water	Water-01	n/a	n/a	n/a
Percent Solids, centrifuged (Volumetric)	% Solids	Test Plan	n/a	n/a	n/a
Total Dissolved Solids	TDS	TDS-01	n/a	n/a	n/a
Viscosity	Viscosity	VISCSTY1	n/a	n/a	n/a
Laser Ablation/Mass Spectrometer	LA/MS screen	(LT-506-102)	n/a	n/a	n/a

Accuracy is ±3 standard deviations for the statistically derived LCS standard or 75 to 125 percent recovery for the spike.

Figure 1. 105-N Basin (Phase 1) Sample Processing Scheme



SAMPLE PREPARATION

Figure 1 depicts the processing scheme for samples and indicates the relationships between subsamples. The procedure for initial breakdown of samples, as well as for determining settled and centrifuged density of solids is provided as Attachment 1, *Test Plan for Processing Sediment Samples from 105-N Basin (Revision 1)*.

For those analyses requiring fully solubilized solids in an acid matrix, an acid digestion was performed on subsamples using procedure LA-505-159, Rev. D-0. The procedure was taken directly from EPA SW-846, Method 3050.

DISCUSSION OF ANALYTICAL RESULTS

Summary analytical results are presented in Analytical Summary Tables on pages 29 through 47. The data are organized by analyte and are accompanied by pertinent QC data. Analytical results displayed in **BOLD** characters do not meet program specified quality control requirements.

Those analytical results (except for PCB analyses) not shown in this report, but which were requested by the program, will be provided in a subsequent report. Results for the PCB analyses will be provided to the program separately by the 325 Laboratory.

All of the following reported data have met the ±3 standard deviation accuracy requirement for LCS (when an LCS is associated with that analyte).

Percent Moisture (Gravimetric), also known as Percent Water

Procedural Anomalies/Difficulties:	none noted
Required Procedure:	not specified
Procedure Used:	LA-564-101, Rev. G-0
Required Precision:	n/a
Met Precision Requirement?:	n/a
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	not specified
Samples Not Meeting Target PQL:	n/a
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	n/a

Volume Percent of Centrifuged Solids

Analytical data for this analysis were extracted from the determination of solids density. A formalized procedure number is not available, however the test plan from which the results were generated is provided as Attachment 1.

Volume percent of centrifuged solids is calculated as follows:

%Solids = (milliliters of centrifuged solids ÷ milliliters of settled solids) x 100.

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	Test Plan (see Attachment 1)
Required Precision:	not specified
Met Precision Requirement?:	n/a
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	not specified
Samples Not Meeting Target PQL:	n/a
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blanks Contaminated?:	n/a

Settled and Centrifuged Density

The method of analysis was given in Attachment 1, a test plan, thus a formalized procedure number is not available.

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	Test Plan
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	not specified
Samples Not Meeting Target PQL:	n/a
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blanks Contaminated?:	n/a

Total Dissolved Solids (Gravimetric)

Procedural Anomalies/Difficulties:

This procedure is applicable to samples that have a minimum residue of 0.0025 grams. None of these samples met this minimum. Because insufficient sample is available to increase the aliquot, but if available would exceed ALARA limits, the detection limit is elevated above the normal level.

Total Dissolved Solids (Gravimetric) continued

Required RCRA Procedure:	not specified
Procedure Used:	LA-510-115, Rev. B-0
Required Precision:	not specified
Met Precision Requirement?:	n/a
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	not specified
Samples Not Meeting Target PQL:	n/a
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	n/a

pH (Electrometric)

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	LA-212-106, Rev. B-0
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.1 pH unit
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	immediate field analysis
Samples Exceeding Max Holding Time:	BOJY49, BOJY50, BOJY51
Blank Contaminated?:	n/a

Hydroxide Demand (Titrametric), also known as Caustic Demand

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	LA-211-104, Rev. A-1
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	not specified
Samples Not Meeting Target PQL:	n/a
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Cyanide (Distillation, Colorimetric)

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	LA-695-102, Rev. G-0

Cyanide (Distillation, Colorimetric) continued

Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	5 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	14 days
Samples Exceeding Max Holding Time:	BOJY49, BOJY50, BOJY51
Blank Contaminated?:	no

Total Inorganic Carbon (Acid/Coulometric)

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	SW-846, 9060 modified
Procedure Used:	LA-342-100, Rev. E-0
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Total Organic Carbon (Combustion/Coulometric)

The combustion procedure (specified in Reference 2) for TOC has been discontinued and replaced with a persulfate oxidation procedure.

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	LA-342-100, Rev. E-0, Persulfate Oxidation
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	28 days
Samples Exceeding Max Holding Time:	BOJY49, BOJY50, BOJY51
Blank Contaminated?:	no

Bromide by Ion Chromatography

Procedural Anomalies/Difficulties:	none noted
Required Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056

Bromide by Ion Chromatography continued

Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Chloride by Ion Chromatography

Procedural Anomalies/Difficulties:

The chemist noted that there were matrix interference problems as evidenced by the aberrant spike recovery.

Required RCRA Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	50 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	28 days
Samples Exceeding Max Holding Time:	BOJY49, BOJY50
Blank Contaminated?:	no

Fluoride by Ion Chromatography

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Nitrate by Ion Chromatography

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056
Required Precision:	±30 RPD

Nitrate by Ion Chromatography continued

Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	48 hours
Samples Exceeding Max Holding Time:	BOJY49, BOJY50, BOJY51
Blank Contaminated?:	no

Nitrite by Ion Chromatography

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	RPD not calculable
Target Practical Quant Limit (PQL):	50 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Phosphate by Ion Chromatography

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	100 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Sulfate by Ion Chromatography

Procedural Anomalies/Difficulties:
The chemist noted that there were matrix interference problems as evidenced by the aberrant spike recovery.

Required RCRA Procedure:	SW-846, 9056
Procedure Used:	LA-533-105, Rev. D-1, equivalent to 9056
Required Precision:	±30 RPD

Sulfate by Ion Chromatography continued

Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	50 µg/ml
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	28 days
Samples Exceeding Max Holding Time:	BOJY49, BOJY50
Blank Contaminated?:	no

Uranium by Laser Induced Kinetic Phosphorescence

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-925-009, Rev. A-1
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	1 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Mercury by Cold Vapor Atomic Absorption Spectrometry

Procedural Anomalies/Difficulties:
The solid (LCS) standard recovery was 129% (exceeded the LCS upper control limit), however the recovery for all other LCS was acceptable.

Required RCRA Procedure:	SW-846, 7471
Procedure Used:	LA-325-104, Rev. D-0, equivalent to 7471
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	2 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	28 days
Samples Exceeding Max Holding Time:	BOJY49, BOJY50
Blank Contaminated?:	no

Aluminum by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	100 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Antimony by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	100 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Arsenic by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:

Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples. The chemist noted that the detection limit was greater than the target PQL and stated that the graphite furnace procedure would have given lower detection limits.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	50 µg/g
Samples Not Meeting Target PQL:	BOJY49, BOJY51
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Barium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:

Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	500 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Beryllium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the both the post-digestion and pre-digestion spikes was acceptable, however recovery of the pre-digestion spikes for other ICP analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Cadmium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the both the post-digestion and pre-digestion spikes was acceptable, however recovery of the pre-digestion spikes for other ICP analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	10 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Chromium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the both the post-digestion and pre-digestion spikes was acceptable, however recovery of the pre-digestion spikes for other ICP analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Iron by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was exceptionally poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, but is likely due at least in part to matrix interference in the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	100 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Lead by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the both the post-digestion and pre-digestion spikes was acceptable, however recovery of the pre-digestion spikes for other ICP analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	50 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Manganese by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	50 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Nickel by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the both the post-digestion and pre-digestion spikes was acceptable, however recovery of the pre-digestion spikes for other ICP analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	100 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Selenium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples. The chemist noted that the detection limit was greater than the target PQL and stated that the graphite furnace procedure would have given lower detection limits.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	10 μg/g
Samples Not Meeting Target PQL:	BOJY49, BOJY50, BOJY51
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Silver by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	50 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Sodium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	500 μg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Thallium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the pre-digestion and post-digestion spikes was acceptable, however recovery of the pre-digestion spike for other analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples. The chemist noted that the detection limit was greater than the target PQL and stated that the graphite furnace procedure would have given lower detection limits.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	100 μg/g
Samples Not Meeting Target PQL:	BOJY49, BOJY51
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Vanadium by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the pre-digestion and post-digestion spikes was acceptable, however recovery of the pre-digestion spike for other analytes was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement:	yes
Target Practical Quant Limit (PQL):	50 μg/g
Samples Not Meeting Target PQL:	BOJY49, BOJY51
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Zinc by Inductively Coupled Plasma/Atomic Emission Spectroscopy

Procedural Anomalies/Difficulties:
Recovery of the post-digestion spike was acceptable, however recovery of the pre-digestion spike was poor, indicating a difficulty with some phase of the digestion. This occurrence may be limited to the pre-digestion spike only, or it may be indicative of matrix interferences in each of the samples.

Required RCRA Procedure:	SW-846, 6010A
Procedure Used:	LA-505-161, Rev. C-1, equivalent to 6010
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	no
Target Practical Quant Limit (PQL):	50 µg/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	none
Blank Contaminated?:	no

Laser Ablation/Mass Spectrometry Screen

Analytical data are provided in the summary data table, and the chemist's narrative is provided as Attachment 2.

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	not specified
Procedure Used:	LT-506-102, Rev. A-0
Required Precision:	not specified
Met Precision Requirement?:	n/a
Required Spike Accuracy:	not specified
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	not specified
Samples Not Meeting Target PQL:	n/a
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	n/a

Total Alpha by Gas Proportional Counting

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-508-101, Rev. G-0
Required Precision:	±30 RPD
Met Precision Requirement?:	yes
Required Spike Accuracy:	75 - 125 %Recovery
Met Accuracy Requirement?:	yes
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	none

Total Alpha by Gas Proportional Counting continued

Maximum Sample Holding Time (RCRA): 6 months
Samples Exceeding Max Holding Time: none
Blank Contaminated?: no

Total Beta by Gas Proportional Counting

Procedural Anomalies/Difficulties:
The chemist's narrative stated, "Replicate (beta) data and GEA data confirm that the (large) RPD for sample 21 (BOJY51) is the result of inhomogeneity between the sample and the duplicate."

Required RCRA Procedure: none specified
Procedure Used: LA-508-101, Rev. G-0
Required Precision: ±30 RPD
Met Precision Requirement?: no
Required Spike Accuracy: 75 - 125 %Recovery
Met Accuracy Requirement?: yes
Target Practical Quant Limit (PQL): 0.1 µCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): 6 months
Samples Exceeding Max Holding Time: none
Blank Contaminated?: no

Strontium-89/90 by Chemical Separation/Beta Proportional Count

Procedural Anomalies/Difficulties: none noted
Required RCRA Procedure: none specified
Procedure Used: LA-220-101, Rev. D-1
Required Precision: ±30 RPD
Met Precision Requirement?: yes
Required Spike Accuracy: n/a
Met Accuracy Requirement?: n/a
Target Practical Quant Limit (PQL): 0.05 µCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified
Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Americium-241 by Chemical Separation/Alpha Energy Analysis

Procedural Anomalies/Difficulties: none noted
Required RCRA Procedure: none specified
Procedure Used: LA-953-104, Rev. B-0
Required Precision: ±30 RPD
Met Precision Requirement?: yes
Required Spike Accuracy: n/a
Met Accuracy Requirement: n/a
Target Practical Quant Limit (PQL): 0.02 µCi/g

Americium-241 by Chemical Separation/Alpha Energy Analysis, continued

Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified
Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Plutonium-239/240 by Chemical Separation/Alpha Energy Analysis

Procedural Anomalies/Difficulties: none noted
Required RCRA Procedure: none specified
Procedure Used: LA-953-104, Rev. B-0
Required Precision: ±30 RPD
Met Precision Requirement?: yes
Required Spike Accuracy: n/a
Met Accuracy Requirement?: n/a
Target Practical Quant Limit (PQL): 0.02 µCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified
Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Plutonium-238 by Chemical Separation/Alpha Energy Analysis

Procedural Anomalies/Difficulties: none noted
Required RCRA Procedure: none specified
Procedure Used: LA-953-104, Rev. B-0
Required Precision: ±30 RPD
Met Precision Requirement?: yes
Required Spike Accuracy: n/a
Met Accuracy Requirement?: n/a
Target Practical Quant Limit (PQL): 0.02 µCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified
Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Americium-241 by Gamma Energy Analysis

Procedural Anomalies/Difficulties: none noted
Required RCRA Procedure: none specified
Procedure Used: LA-548-121, Rev. E-0
Required Precision: ±30 RPD
Met Precision Requirement?: yes
Required Spike Accuracy: n/a
Met Accuracy Requirement?: n/a
Target Practical Quant Limit (PQL): 0.05 µCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified

Americium-241 by Gamma Energy Analysis continued

Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Cesium-134 by Gamma Energy Analysis

Procedural Anomalies/Difficulties: none noted
Required RCRA Procedure: none specified
Procedure Used: LA-548-121, Rev. E-0
Required Precision: ±30 RPD
Met Precision Requirement?: RPD not calculable
Required Spike Accuracy: n/a
Met Accuracy Requirement?: n/a
Target Practical Quant Limit (PQL): 0.05 μCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified
Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Cesium-137 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:
For sample BOJY51 the chemist noted, "The blank shows elevated levels of ^{137}Cs." However, because it is an order of magnitude less than the sample activity, which is near the detection limit, it does not appear that sample contamination during the analysis was a significant factor.

Required RCRA Procedure: none specified
Procedure Used: LA-548-121, Rev. E-0
Required Precision: ±30 RPD
Met Precision Requirement?: yes
Required Spike Accuracy: n/a
Met Accuracy Requirement?: n/a
Target Practical Quant Limit (PQL): 0.05 μCi/g
Samples Not Meeting Target PQL: none
Maximum Sample Holding Time (RCRA): not specified
Samples Exceeding Max Holding Time: n/a
Blank Contaminated?: no

Cobalt-60 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:
For sample BOJY51 the chemist noted, "The (duplicate) RPD is consistent with first run (data presented are from the rerun). TB (Total Beta) data also confirm the elevated RPD is the result of inhomogeneity between the sample and duplicate."

Required RCRA Procedure: none specified
Procedure Used: LA-548-121, Rev. E-0

Cobalt-60 by Gamma Energy Analysis continued

Required Precision:	±30 RPD
Met Precision Requirement?:	no
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Europium-152 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-548-121, Rev. E-0
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Europium-154 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-548-121, Rev. E-0
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	BOJY51
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Europium-155 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-548-121, Rev. E-0
Required Precision:	±30 RPD
Met Precision Requirement?:	yes

Europium-155 by Gamma Energy Analysis continued

Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Radium-226 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-548-121, Rev. E-0
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	BOJY49, BOJY50, BOJY51
Maximum Sample Holding Time (RCRA):	6 months
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

Antimony-125 by Gamma Energy Analysis

Procedural Anomalies/Difficulties:	none noted
Required RCRA Procedure:	none specified
Procedure Used:	LA-548-121, Rev. E-0
Required Precision:	±30 RPD
Met Precision Requirement?:	RPD not calculable
Required Spike Accuracy:	n/a
Met Accuracy Requirement?:	n/a
Target Practical Quant Limit (PQL):	0.05 µCi/g
Samples Not Meeting Target PQL:	none
Maximum Sample Holding Time (RCRA):	not specified
Samples Exceeding Max Holding Time:	n/a
Blank Contaminated?:	no

% Water by Weight
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result %	Duplicate Result %	Average Result %	Standard Recovery %	Reagent Blank	Duplicate Precision RPD	Spike Recovery %	Detection Limit %	Counting Error %
BOJY49	S97N000012	44.2	n/a	n/a	96.6	n/a	n/a	n/a	0.01	n/a
BOJY50	S97N000016	84.0	n/a	n/a	96.6	n/a	n/a	n/a	0.01	n/a
BOJY51	S97N000017	50.1	n/a	n/a	96.6	n/a	n/a	n/a	0.01	n/a

% Centrifuged Solids by Volume
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result %	Duplicate Result %	Average Result %	Standard Recovery %	Reagent Blank	Duplicate Precision RPD	Spike Recovery %	Detection Limit %	Counting Error %
BOJY49	S97N000001	93.0	n/a	n/a	n/a	n/a	n/a	n/a	0.01	n/a
BOJY50	S97N000002	40.0	n/a	n/a	n/a	n/a	n/a	n/a	0.01	n/a
BOJY51	S97N000005	65.9	n/a	n/a	n/a	n/a	n/a	n/a	0.01	n/a

Settled Density
Direct

Customer Sample Number	Laboratory Sample Number	First Result g/ml	Second Result g/ml	Average Result g/ml	Standard Recovery %	Reagent Blank	Duplicate Precision RPD	Spike Recovery %	Detection Limit %	Counting Error %
BOJY49	S97N000001	1.35	1.59	1.47	n/a	n/a	16.3	n/a	n/a	n/a
BOJY50	S97N000002	1.06	1.03	1.05	n/a	n/a	2.9	n/a	n/a	n/a
BOJY51	S97N000005	1.23	1.32	1.28	n/a	n/a	7.1	n/a	n/a	n/a

Centrifuged Density
Direct

Customer Sample Number	Laboratory Sample Number	First Result g/ml	Second Result g/ml	Third Result g/ml	Forth Result g/ml	Average Result g/ml	Duplicate Precision RPD	Standard Recovery %	Reagent Blank	Counting Error %
BOJY49	S97N000001	1.64	1.67	1.68	1.65	1.66	1.8	n/a	n/a	n/a
BOJY50	S97N000002	1.10	1.15	n/a	n/a	1.13	4.4	n/a	n/a	n/a
BOJY51	S97N000005	1.36	1.53	n/a	n/a	1.45	11.8	n/a	n/a	n/a

Total Dissolved Solids - Gravimetric
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result g/ml	Duplicate Result g/ml	Average Result g/ml	Standard Recovery %	Reagent Blank g/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit g/ml	Counting Error %
BOJY49	S97N000010	<7.75E-05	n/a	n/a	n/a	n/a	n/a	n/a	7.75E-05	n/a
BOJY50	S97N000018	<1.00E-05	n/a	n/a	n/a	n/a	n/a	n/a	1.00E-05	n/a
BOJY51	S97N000019	<1.75E-04	n/a	n/a	n/a	n/a	n/a	n/a	1.75E-04	n/a

pH Direct
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result pH units	Duplicate Result pH units	Average Result pH units	Standard Recovery %	Reagent Blank pH units	Duplicate Precision RPD	Spike Recovery %	Detection Limit pH units	Counting Error %
BOJY49	S97N000010	7.70	n/a	n/a	100.1	n/a	n/a	n/a	0.01	n/a
BOJY50	S97N000018	6.64	n/a	n/a	100.1	n/a	n/a	n/a	0.01	n/a
BOJY51	S97N000019	8.03	7.99	8.01	100.1	n/a	0.5	n/a	0.01	n/a

Caustic Demand
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result Moles OH-/Kg	Duplicate Result Moles OH-/Kg	Average Result Moles OH-/Kg	Standard Recovery %	Reagent Blank Moles OH-/Kg	Duplicate Precision RPD	Spike Recovery %	Detection Limit Moles OH-/Kg	Counting Error %
BOJY49	S97N000012	9.60E-02	n/a	n/a	100.6	<4.20E+01	n/a	n/a	3.50E-02	n/a
BOJY50	S97N000016	1.96E-01	n/a	n/a	100.6	<4.20E+01	n/a	n/a	9.30E-02	n/a
BOJY51	S97N000017	1.41E-01	1.48E-01	1.44E-01	100.6	<4.20E+01	4.8	n/a	6.40E-02	n/a

Cyanide Water Distillation
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Reagent Blank µg/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/g	Counting Error %
BOJY49	S97N000012	<4.51E-01	n/a	n/a	81.6	<1.10E-02	n/a	n/a	4.51E-01	n/a
BOJY50	S97N000016	<4.16E-01	n/a	n/a	81.6	<1.10E-02	n/a	n/a	4.16E-01	n/a
BOJY51	S97N000017	<5.82E-01	<5.39E-01	n/a	81.6	<1.10E-02	n/a	85.4	5.82E-01	n/a

TIC by Acid/Coulometry
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Reagent Blank µg/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/g	Counting Error %
BOJY49	S97N000012	2.91E+03	n/a	n/a	100.5	2.10E+00	n/a	n/a	5.00E+00	n/a
BOJY50	S97N000016	7.74E+02	n/a	n/a	100.5	2.10E+00	n/a	n/a	5.00E+00	n/a
BOJY51	S97N000017	1.19E+03	1.07E+03	1.13E+03	100.5	2.10E+00	10.6	95.8	5.00E+00	n/a

TOC by Persulfate/Coulometry
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Reagent Blank µg/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/g	Counting Error %
BOJY49	S97N000012	1.12E+03	n/a	n/a	95.0	1.45E+01	n/a	n/a	4.00E+01	n/a
BOJY50	S97N000016	3.14E+03	n/a	n/a	95.0	1.45E+01	n/a	n/a	4.00E+01	n/a
BOJY51	S97N000017	2.75E+03	2.85E+03	2.80E+03	95.0	1.45E+01	3.6	84.7	4.00E+01	n/a

Bromide by Ion Chromatograph
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	<2.63E+00	n/a	n/a	103.7	<1.25E-01	n/a	n/a	2.63E+00	n/a
BOJY50	S97N000018	<2.63E+00	n/a	n/a	103.7	<1.25E-01	n/a	n/a	2.63E+00	n/a
BOJY51	S97N000019	<2.63E+00	<2.62E+00	n/a	103.7	<1.25E-01	n/a	103.6	2.63E+00	n/a

Chloride-IC-Dionex 4000/4500
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	6.92E+01	n/a	n/a	100.6	<1.70E-02	n/a	n/a	3.57E-01	n/a
BOJY50	S97N000018	8.93E+01	n/a	n/a	100.6	<1.70E-02	n/a	n/a	3.57E-01	n/a
BOJY51	S97N000019	6.60E+01	6.72E+01	6.66E+01	100.6	<1.70E-02	1.8	-121.0	3.57E-01	n/a

Fluoride-IC-Dionex 4000/4500
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	<2.52E-01	n/a	n/a	103.7	<1.20E-02	n/a	n/a	2.52E-01	n/a
BOJY50	S97N000018	<2.52E-01	n/a	n/a	103.7	<1.20E-02	n/a	n/a	2.52E-01	n/a
BOJY51	S97N000019	<2.52E-01	<2.52E-01	n/a	103.7	<1.20E-02	n/a	100.8	2.52E-01	n/a

Nitrate by IC-Dionex 4000/4500
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	<2.92E+00	n/a	n/a	100.3	<1.39E-01	n/a	n/a	2.92E+00	n/a
BOJY50	S97N000018	<2.92E+00	n/a	n/a	100.3	<1.39E-01	n/a	n/a	2.92E+00	n/a
BOJY51	S97N000019	<2.92E+00	<2.92E+00	n/a	100.3	<1.39E-01	n/a	104.2	2.92E+00	n/a

Nitrite by IC-Dionex 4000/4500
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	<2.27E+00	n/a	n/a	106.4	<1.08E-01	n/a	n/a	2.27E+00	n/a
BOJY50	S97N000018	<2.27E+00	n/a	n/a	106.4	<1.08E-01	n/a	n/a	2.27E+00	n/a
BOJY51	S97N000019	<2.27E+00	<2.27E+00	n/a	106.4	<1.08E-01	n/a	99.6	2.27E+00	n/a

Phosphate-IC-Dionex 4000/4500
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	<2.52E+00	n/a	n/a	98.2	<1.20E-01	n/a	n/a	2.52E+00	n/a
BOJY50	S97N000018	<2.52E+00	n/a	n/a	98.2	<1.20E-01	n/a	n/a	2.52E+00	n/a
BOJY51	S97N000019	<2.52E+00	<2.52E+00	n/a	98.2	<1.20E-01	n/a	100.4	2.52E+00	n/a

Sulfate by IC-Dionex 4000/4500
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/ml	Duplicate Result µg/ml	Average Result µg/ml	Standard Recovery %	Reagent Blank µg/ml	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/ml	Counting Error %
BOJY49	S97N000010	1.11E+02	n/a	n/a	102.2	<1.38E-01	n/a	n/a	2.90E+00	n/a
BOJY50	S97N000018	1.23E+02	n/a	n/a	102.2	<1.38E-01	n/a	n/a	2.90E+00	n/a
BOJY51	S97N000019	9.34E+01	9.42E+01	9.38E+01	102.2	<1.38E-01	0.9	67.8	2.90E+00	n/a

Uranium by Phosphorescence
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/g	Instrument Uncertainty Relative %
BOJY49	S97N000011	1.66E+03	n/a	n/a	98.3	4.11E+00	n/a	n/a	5.30E-02	3.4
BOJY50	S97N000020	5.73E+03	n/a	n/a	98.3	4.11E+00	n/a	n/a	5.40E-02	3.3
BOJY51	S97N000021	2.03E+03	1.61E+03	1.82E+03	98.3	4.11E+00	23.1	n/a	5.10E-02	3.5

Mercury by CVAA (Perkin Elmer)
Direct

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Reagent Blank µg/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µg/g	Counting Error %
BOJY49	S97N000012	<9.40E-02	n/a	n/a	100.0	<3.00E-03	n/a	n/a	9.40E-02	n/a
BOJY50	S97N000016	3.88E-01	n/a	n/a	100.0	<3.00E-03	n/a	n/a	8.00E-02	n/a
BOJY51	S97N000017	3.42E-01	3.46E-01	3.44E-01	100.0	<3.00E-03	1.2	81.6	1.27E-01	n/a

Aluminium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery		Detection Limit µg/g
								Predigest %	Postdigest %	
BOJY49	S97N000011	2.79E+04	n/a	n/a	94.6	<5.00E-02	n/a	n/a	n/a	7.13E+01
BOJY50	S97N000020	9.29E+03	n/a	n/a	94.6	<5.00E-02	n/a	n/a	n/a	1.45E+01
BOJY51	S97N000021	9.15E+03	7.97E+03	8.56E+03	94.6	<5.00E-02	13.8	**-8.8**	99.0	6.96E+01

Antimony -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery		Detection Limit µg/g
								Predigest %	Postdigest %	
BOJY49	S97N000011	<8.56E+01	n/a	n/a	95.4	<6.00E-02	n/a	n/a	n/a	8.56E+01
BOJY50	S97N000020	<1.74E+01	n/a	n/a	95.4	<6.00E-02	n/a	n/a	n/a	1.74E+01
BOJY51	S97N000021	<8.35E+01	<8.61E+01	n/a	95.4	<6.00E-02	n/a	**71.8**	100.7	8.35E+01

Arsenic -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	**<1.43E+02**	n/a	n/a	101.8	<1.00E-01	n/a	n/a	n/a	1.43E+02
BOJY50	S97N000020	<2.90E+01	n/a	n/a	101.8	<1.00E-01	n/a	n/a	n/a	2.90E+01
BOJY51	S97N000021	**<1.39E+02**	**<1.43E+02**	n/a	101.8	<1.00E-01	n/a	**69.2**	101.9	1.39E+02

Barium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	1.13E+03	n/a	n/a	95.8	<5.00E-02	n/a	n/a	n/a	7.13E+01
BOJY50	S97N000020	2.30E+03	n/a	n/a	95.8	<5.00E-02	n/a	n/a	n/a	1.45E+01
BOJY51	S97N000021	1.96E+03	1.73E+03	1.84E+03	95.8	<5.00E-02	12.5	**71.2**	103.7	6.96E+01

Beryllium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	<7.13E+00	n/a	n/a	104.2	<5.00E-03	n/a	n/a	n/a	7.13E+00
BOJY50	S97N000020	<1.45E+00	n/a	n/a	104.2	<5.00E-03	n/a	n/a	n/a	1.45E+00
BOJY51	S97N000021	<6.96E+00	<7.17E+00	n/a	104.2	<5.00E-03	n/a	83.2	101.0	6.96E+00

Cadmium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	<7.13E+00	n/a	n/a	95.0	<5.00E-03	n/a	n/a	n/a	7.13E+00
BOJY50	S97N000020	6.37E+00	n/a	n/a	95.0	<5.00E-03	n/a	n/a	n/a	1.45E+00
BOJY51	S97N000021	8.79E+00	7.81E+00	8.30E+00	95.0	<5.00E-03	11.8	81.0	99.7	6.96E+00

Chromium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	9.16E+01	n/a	n/a	95.4	<1.00E-02	n/a	n/a	n/a	1.43E+01
BOJY50	S97N000020	3.96E+01	n/a	n/a	95.4	<1.00E-02	n/a	n/a	n/a	2.90E+00
BOJY51	S97N000021	1.24E+02	1.11E+02	1.18E+02	95.4	<1.00E-02	11.1	77.6	100.6	1.39E+01

Iron -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	1.54E+05	n/a	n/a	89.4	<5.00E-02	n/a	n/a	n/a	7.13E+01
BOJY50	S97N000020	3.02E+04	n/a	n/a	89.4	<5.00E-02	n/a	n/a	n/a	1.45E+01
BOJY51	S97N000021	2.38E+05	2.17E+05	2.28E+05	89.4	<5.00E-02	9.2	**-10400**	88.2	6.96E+01

Lead -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	1.75E+02	n/a	n/a	92.6	<1.00E-01	n/a	n/a	n/a	1.43E+02
BOJY50	S97N000020	1.22E+02	n/a	n/a	92.6	<1.00E-01	n/a	n/a	n/a	2.90E+01
BOJY51	S97N000021	3.25E+02	2.95E+02	3.10E+02	92.6	<1.00E-01	9.7	78.0	100.2	1.39E+02

Manganese -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	3.11E+02	n/a	n/a	93.4	<1.00E-02	n/a	n/a	n/a	1.43E+01
BOJY50	S97N000020	6.37E+02	n/a	n/a	93.4	<1.00E-02	n/a	n/a	n/a	2.90E+00
BOJY51	S97N000021	5.97E+02	5.14E+02	5.56E+02	93.4	<1.00E-02	14.9	**62.0**	100.1	1.39E+01

Nickel -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	6.97E+01	n/a	n/a	98.2	<2.00E-02	n/a	n/a	n/a	2.85E+01
BOJY50	S97N000020	3.38E+01	n/a	n/a	98.2	<2.00E-02	n/a	n/a	n/a	5.80E+00
BOJY51	S97N000021	1.13E+02	1.16E+02	1.15E+02	98.2	<2.00E-02	2.6	83.2	100.2	2.78E+01

Selenium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	**<1.43E+02**	n/a	n/a	91.6	<1.00E-01	n/a	n/a	n/a	1.43E+02
BOJY50	S97N000020	**<2.90E+01**	n/a	n/a	91.6	<1.00E-01	n/a	n/a	n/a	2.90E+01
BOJY51	S97N000021	**<1.39E+02**	**<1.43E+02**	n/a	91.6	<1.00E-01	n/a	**55.6**	97.4	1.39E+02

Silver -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	<1.43E+01	n/a	n/a	96.9	<1.00E-02	n/a	n/a	n/a	1.43E+01
BOJY50	S97N000020	<2.90E+00	n/a	n/a	96.9	<1.00E-02	n/a	n/a	n/a	2.90E+00
BOJY51	S97N000021	<1.39E+01	<1.43E+01	n/a	96.9	<1.00E-02	n/a	**68.1**	82.1	1.39E+01

Sodium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	2.19E+02	n/a	n/a	96.6	<1.00E-01	n/a	n/a	n/a	1.43E+02
BOJY50	S97N000020	3.11E+02	n/a	n/a	96.6	<1.00E-01	n/a	n/a	n/a	2.90E+01
BOJY51	S97N000021	2.90E+02	2.24E+02	2.57E+02	96.6	<1.00E-01	25.7	**73.6**	101.1	1.39E+02

Thallium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	**<2.85E+02**	n/a	n/a	90.2	<2.00E-01	n/a	n/a	n/a	2.85E+02
BOJY50	S97N000020	<5.80E+01	n/a	n/a	90.2	<2.00E-01	n/a	n/a	n/a	5.80E+01
BOJY51	S97N000021	**<2.78E+02**	**<2.87E+02**	n/a	90.2	<2.00E-01	n/a	77.8	99.1	2.78E+02

Vanadium -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	**< 7.13E+01**	n/a	n/a	95.2	<5.00E-02	n/a	n/a	n/a	7.13E+01
BOJY50	S97N000020	<1.45E+01	n/a	n/a	95.2	<5.00E-02	n/a	n/a	n/a	1.45E+01
BOJY51	S97N000021	**<6.96E+01**	**<7.17E+01**	n/a	95.2	<5.00E-02	n/a	82.0	99.9	6.96E+01

Zinc -ICP-Acid Digest
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µg/g	Duplicate Result µg/g	Average Result µg/g	Standard Recovery %	Preparation Blank µg/g	Duplicate Precision RPD	Spike Recovery Predigest %	Spike Recovery Postdigest %	Detection Limit µg/g
BOJY49	S97N000011	7.87E+02	n/a	n/a	88.6	<1.00E-02	n/a	n/a	n/a	1.43E+01
BOJY50	S97N000020	1.20E+03	n/a	n/a	88.6	<1.00E-02	n/a	n/a	n/a	2.90E+00
BOJY51	S97N000021	1.56E+03	1.31E+03	1.44E+03	88.6	<1.00E-02	17.4	**40.6**	93.1	1.39E+01

Laser Ablation/Mass Spectrometry
Analytical Results

ELEMENT SYMBOL	ATOMIC MASS	ISOTOPIC ABUNDANCE	S97N000016 conc. (µg/g)	S97N000017 conc. (µg/g)
Li	7	0.925	43	27
Be	9	1	1.9	1.0
B	10	0.199	440	320
B	11	0.801	450	340
Na	23	1	1400	3700
Mg	24	0.79	520	640
Mg	25	0.1	520	790
Mg	26	0.11	580	780
Al	27	1	33000	15000
Si	28	0.922	7400	8100
P	31	1	320	160
S	34	0.042	300	220
Ca	44	0.028	7100	5900
Ti	48	0.737	980	820
Ti	49	0.055	900	770
V	51	1	73	73
Cr	52	0.838	300	410
Cr	53	0.095	290	330
Mn	55	1	4200	1900
Fe	57	0.0214	200000	240000
Co	59	1	18	20
Ni	60	0.264	170	150
Ni	61	0.0116	180	130
Ni	62	0.0371	210	150
Cu	63	0.691	330	400
Zn	64	0.489	4300	3000
Cu	65	0.309	330	410
Zn	66	0.278	4400	2900
Zn	68	0.186	4200	3000
As	75	1	15	10
Fission Products (not isotopically corrected):				
Rb	85	na	0.4	0.4
Sr	88	na	98	61
Y	89	na	3.9	2.1
Zr. Sr	90	na	24	20
Zr	91	na	8	6
Zr, Mo, Nb	92	na	14	9
Nb, Mo, Zr	93	na	3.3	3.0
Mo, Zr	94	na	13	10
Mo	95	na	2	3
Mo, Ru, Zr	96	na	6	5.0
Mo	97	na	2	2
Mo	98	na	3.6	3.4
Tc, Ru	99	na	0.5	0.3
Ru, Mo	100	na	1.9	2.0
Ru	101	na	3	3

Analytical Results, continued

ELEMENT SYMBOL	ATOMIC MASS	ISOTOPIC ABUNDANCE	S97N000016 conc. (µg/g)	S97N000017 conc. (µg/g)
Ru, Pd	102	na	2.9	2.5
Rh	103	na	1.3	1.5
Pd, Ru	104	na	2.0	1.5
Pd	105	na	0.3	0.4
Pd	106	na	0.8	0.6
Ag	107	na	0.3	0.9
Pd	108	na	0.2	0.3
Ag	109	na	0.2	0.7
Cd	110	na	2.5	1.5
Cd	111	na	3	2
Cd	112	na	6.5	3.5
Cd	113	na	2.6	1.4
Cd	114	na	7.3	4.1
In	115	na	0.4	0.3
Sn	116	na	15	8
Sn	117	na	7	4
Sn	118	na	22	13
Sn	120	na	30	17
Sb	121	na	16	12
Sb	123	na	13	9
Ba	134	na	170	56
Ba, Cs	135	na	570	120
Ba	136	na	760	230
Ba, Cs	137	na	1000	250
Ba	138	na	2100	1100
La	139	na	7.7	4.5
Ce	140	na	9	6.7
Pr	141	na	5.5	4.1
Nd, Ce	142	na	6.7	4.3
Nd	143	na	4	3
Nd	144	na	5	4
Nd	145	na	4	2
Nd, Sm	146	na	3	2
Sm	147	na	2	1.3
Sm, Nd	148	na	1	1
Sm	149	na	0.1	0.1
Sm, Nd	150	na	1.6	1.3
Eu, Sm	151	na	0.3	0.1
Sm	152	na	0.7	0.6
Eu	153	na	0.4	0.3
Sm	154	na	0.3	0.3
Gd	155	na	0.3	0.2
Other isotopically corrected isotopes:				
Hf	179	0.138	0.7	0.2
Hf	180	0.351	0.9	0.2
W	182	0.263	12	9.0
W	183	0.143	15	8.2
W	184	0.307	12	8.8

Analytical Results, continued

ELEMENT SYMBOL	ATOMIC MASS	ISOTOPIC ABUNDANCE	S97N000016 conc. (µg/g)	S97N000017 conc. (µg/g)
W	186	0.286	12	8.7
Hg	198	0.102	3.7	1.6
Hg	199	0.169	3.4	1.6
Hg	200	0.231	2.7	1.5
Hg	201	0.132	3.3	1.5
Hg	202	0.297	2.4	1.6
Tl	205	0.705	0.5	0.3
Pb	206	0.241	700	640
Pb	207	0.221	650	570
Pb	208	0.524	610	620
Bi	209	1	0.3	0.3
Actinides (not isotopically corrected):				
Th	232	na	<0.1	0.2
U	234	na	2.8	0.6
U	235	na	340	77
U	236	na	23	7.1
Np	237	na	0.1	0.1
U	238	na	27000	5800
Pu	239	na	63	45
Pu	240	na	4.8	6.0
Pu	241	na	1.0	1.1
Pu	242	na	<0.1	0.1
Cm	248	na	0.2	<0.1

Alpha of Digested Solid
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	4.20E-01	n/a	n/a	96.0	<4.68E-04	n/a	n/a	1.00E-03	2.8
BOJY50	S97N000020	1.22E+00	n/a	n/a	96.0	<4.68E-04	n/a	n/a	1.00E-03	1.7
BOJY51	S97N000021	1.69E+00	1.56E+00	1.63E+00	96.0	<4.68E-04	8.0	114.1	1.00E-03	1.4

Beta of Solid Sample
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	1.26E+01	n/a	n/a	103.0	2.60E-02	n/a	n/a	5.00E-03	0.4
BOJY50	S97N000020	6.33E+00	n/a	n/a	103.0	2.60E-02	n/a	n/a	5.00E-03	0.6
BOJY51	S97N000021	1.96E+01	1.43E+01	1.70E+01	103.0	2.60E-02	31.3	105.4	5.00E-03	0.3

Strontium-89/90 High Level
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Carrier Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	1.30E+00	n/a	n/a	89.9	1.00E-03	n/a	90.7	1.00E-03	1.0
BOJY50	S97N000020	1.53E+00	n/a	n/a	89.9	1.00E-03	n/a	89.0	1.00E-03	0.9
BOJY51	S97N000021	1.68E+00	1.49E+00	1.59E+00	89.9	1.00E-03	12.0	92.1	1.00E-03	0.8

Am-241 by Extraction
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Tracer Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	2.04E-01	n/a	n/a	97.1	<1.52E-02	n/a	97.5	2.70E-02	2.1
BOJY50	S97N000020	4.90E-01	n/a	n/a	97.1	<1.52E-02	n/a	99.9	4.20E-02	1.7
BOJY51	S97N000021	7.98E-01	7.16E-01	7.57E-01	97.1	<1.52E-02	10.8	97.1	8.10E-02	1.8

Pu-238 by Ion Exchange
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	4.76E-02	n/a	n/a	n/a	<1.04E-02	n/a	n/a	1.80E-02	3.2
BOJY50	S97N000020	9.82E-02	n/a	n/a	n/a	<1.04E-02	n/a	n/a	4.00E-02	2.2
BOJY51	S97N000021	1.66E-01	1.55E-01	1.61E-01	n/a	<1.04E-02	6.9	n/a	6.20E-02	2.5

Pu-239/240 by TRU-SPEC Resin
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Tracer Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	2.25E-01	n/a	n/a	97.3	<1.04E-02	n/a	99.7	1.80E-02	1.8
BOJY50	S97N000020	8.03E-01	n/a	n/a	97.3	<1.04E-02	n/a	94.9	4.00E-02	1.3
BOJY51	S97N000021	1.02E+00	9.04E-01	9.62E-01	97.3	<1.04E-02	12.1	98.9	6.20E-02	1.4

Americium-241 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	2.21E-01	n/a	n/a	n/a	<2.37E-02	n/a	n/a	n/a	43.5
BOJY50	S97N000020	4.90E-01	n/a	n/a	n/a	<2.37E-02	n/a	n/a	n/a	15.2
BOJY51	S97N000021	8.75E-01	8.19E-01	8.47E-01	n/a	<2.76E-02	6.6	n/a	n/a	11.9

Cesium-134 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	<1.13E-02	n/a	n/a	n/a	<3.01E-03	n/a	n/a	1.10E-02	n/a
BOJY50	S97N000020	<7.01E-03	n/a	n/a	n/a	<3.01E-03	n/a	n/a	7.00E-03	n/a
BOJY51	S97N000021	<1.70E-02	<1.43E-02	n/a	n/a	<3.35E-03	n/a	n/a	1.70E-02	n/a

Cesium-137 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	3.82E+00	n/a	n/a	105.3	<8.88E-03	n/a	n/a	n/a	1.4
BOJY50	S97N000020	5.26E-01	n/a	n/a	105.3	<8.88E-03	n/a	n/a	n/a	4.0
BOJY51	S97N000021	2.13E+00	1.79E+00	1.96E+00	106.9	1.31E-01	17.3	n/a	n/a	2.1

Cobalt-60 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	1.13E+00	n/a	n/a	102.4	<4.07E-03	n/a	n/a	n/a	2.2
BOJY50	S97N000020	4.76E-01	n/a	n/a	102.4	<4.07E-03	n/a	n/a	n/a	3.4
BOJY51	S97N000021	4.52E+00	2.90E+00	3.71E+00	101.0	<3.19E-03	**43.7**	n/a	n/a	1.1

Europium-152 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	<2.51E-02	n/a	n/a	n/a	<1.79E-02	n/a	n/a	2.50E-02	n/a
BOJY50	S97N000020	<2.27E-02	n/a	n/a	n/a	<1.79E-02	n/a	n/a	2.30E-02	n/a
BOJY51	S97N000021	<4.04E-02	<3.30E-02	n/a	n/a	<1.58E-02	n/a	n/a	4.00E-02	n/a

Europium-154 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	<2.84E-02	n/a	n/a	n/a	<1.07E-02	n/a	n/a	2.80E-02	n/a
BOJY50	S97N000020	9.86E-02	n/a	n/a	n/a	<1.07E-02	n/a	n/a	n/a	17.7
BOJY51	S97N000021	**<5.66E-02**	1.13E-01	n/a	n/a	<1.16E-02	n/a	n/a	5.70E-02	n/a

Europium-155 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	<3.21E-02	n/a	n/a	n/a	<9.76E-03	n/a	n/a	3.20E-02	n/a
BOJY50	S97N000020	1.55E-01	n/a	n/a	n/a	<9.76E-03	n/a	n/a	n/a	14.5
BOJY51	S97N000021	1.06E-01	8.81E-02	9.71E-02	n/a	<1.10E-02	18.4	n/a	n/a	30.3

Radium-226 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	**<2.19E-01**	n/a	n/a	n/a	<6.57E-02	n/a	n/a	2.19E-01	n/a
BOJY50	S97N000020	**<1.21E-01**	n/a	n/a	n/a	<6.57E-02	n/a	n/a	1.21E-01	n/a
BOJY51	S97N000021	**<2.55E-01**	**<2.21E-01**	n/a	n/a	<7.47E-02	n/a	n/a	2.55E-01	n/a

Antimony-125 by GEA
Acid Digest

Customer Sample Number	Laboratory Sample Number	Sample Result µCi/g	Duplicate Result µCi/g	Average Result µCi/g	Standard Recovery %	Preparation Blank µCi/g	Duplicate Precision RPD	Spike Recovery %	Detection Limit µCi/g	Counting Error %
BOJY49	S97N000011	<4.52E-02	n/a	n/a	n/a	<9.71E-03	n/a	n/a	4.52E-02	n/a
BOJY50	S97N000020	<2.58E-02	n/a	n/a	n/a	<9.71E-03	n/a	n/a	2.58E-02	n/a
BOJY51	S97N000021	<4.95E-02	<4.51E-02	n/a	n/a	<1.20E-02	n/a	n/a	4.95E-02	n/a

CHAIN OF CUSTODY / RSA FORMS

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Bechtel Hanford Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

B97-072-01

Collector: Wendy Thompson 376-8031	Company Contact: Garth Duncan	Telephone No.: 373-7385	Project Coordinator: Weiss, RL	Data Turnaround: 30 Days
Project Designation: 105-N Basin Sediment Samples - Phase 1	Sampling Location: 105-N Basin		SAF No.: B97-072	
Ice Chest No.	Field Logbook No.: EL-1287		Method of Shipment: Hand delivery	
Shipped To: 222-S Laboratory	Offsite Property No.: N/A		Bill of Lading/Air Bill No.: N/A	

POSSIBLE SAMPLE HAZARDS/REMARKS
Radioactive
up to 400mR/hr, on sample jar

Special Handling and/or Storage: KEEP SECURED

Preservation	None										
Type of Container	P										
No. of Container(s)	1	WSK 2/11/97									
Volume	1000ml										
SAMPLE ANALYSIS	See item (1) in Special Instructions.										

50

Sample No.	Matrix *	Sample Date	Sample Time	
JJY49	Other Solid	2/11/97	1320	X

CHAIN OF POSSESSION — Sign/Print Names

Relinquished By	Date/Time	Received By	Date/Time
W.S. Thompson / Wendy Thompson	2/12/97 1235	Tim Knight	2.12.97 1235

SPECIAL INSTRUCTIONS

(1) ICP Metals - 6010A (SW-846); Lead - 7421- (GFAA); Mercury - 7471 - (CV); Selenium - 7740 - (GFAA); Thallium - 7841 - (GFAA); Percent Moisture; Percent Solids; Density; TIC - 415.1M; pH (Soil) - 9045; IC Anions - 9056; TOC - 9060; Unit Mass; Hydroxide Ion; Pest/PCBs - 8080 (TCL); Total Cyanide - 9010; Particle Size Distribution; Specific gravity; total dissolved solids; viscosity; Am_{241}; gross alpha; gross beta; gamma spectroscopy; isotopic Plutonium; Strontium-90; total uranium.

Matrix *

S	= Soil
SE	= Sediment
SO	= Solid
SL	= Sludge
W	= Water
O	= Oil
A	= Air
DS	= Drum Solids
DL	= Drum Liquids
T	= Tissue
WI	= Wipe
L	= Liquid
V	= Vegetation
X	= Other

LABORATORY SECTION	Received By	Title	Date/Time
FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

Feb. 12. 1997 11:32AM HNC 222S LAB ROOM 2F BACKSIDE No. 9932 P. 1/1

Bechtel Hanford Inc.	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	B97-072-02	Page 1 of 1

Collector: Wendy Thompson 376-8031	Company Contact: Garth Duncan	Telephone No.: 373-7385	Project Coordinator: Weiss, RL	Data Turnaround: 30 Days
Project Designation: 105-N Basin Sediment Samples - Phase 1	Sampling Location: 105-N Basin		SAF No.: B97-072	
Ice Chest No.: DOT-7A	Field Logbook No.: EL-1287		Method of Shipment: Hand delivery	
Shipped To: 222-S Laboratory	Offsite Property No.: N/A		Bill of Lading/Air Bill No.: N/A	

POSSIBLE SAMPLE HAZARDS/REMARKS
Radioactive 1000ml plastic Sample jar reads 120mR/hr contact 180mrad/hr beta

Special Handling and/or Storage
KEEP SECURED

SAMPLE ANALYSIS

Preservation	None												
Type of Container	P	2/24/97											
No. of Container(s)	1	WSF											
Volume	1000ml												
	See Item (1) in Special Instructions.												

Sample No.	Matrix *	Sample Date	Sample Time	
JY50	Other Solid	2/24/97	1240	X

CHAIN OF POSSESSION — Sign/Print Names

Relinquished By	Date/Time	Received By	Date/Time
Wendy Thompson	2/24/97 1830	[signature]	2/24/97 1830
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

SPECIAL INSTRUCTIONS

(1) ICP Metals - 6010A (SW-846); Lead - 7421 - (GFAA); Mercury - 7471 - (CV); Selenium - 7740 - (GFAA); Thallium - 7841 - (GFAA); Percent Moisture; Percent Solids; Density; TIC - 415.1M; pH (Soil) - 9045; IC Anions - 9056; TOC - 9060; Unit Mass; Hydroxide Ion; Pest/PCBs - 8080; (TCL); Total Cyanide - 9010; Particle Size Distribution; specific gravity; total dissolved solids; viscosity; Americium; gross alpha; gross beta; gamma spectroscopy; isotopic Plutonium; Strontium-90; total Uranium.
Analyze per LOI/SOW (#042474) and SAF BHI-00975

Matrix *
S = Soil
SE = Sediment
SO = Solid
SL = Sludge
W = Water
O = Oil
A = Air
DS = Drum Solids
DL = Drum Liquids
T = Tissue
WI = Wipe
L = Liquid
V = Vegetation
X = Other

LABORATORY SECTION	Received By	Title	Date/Time
FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

51

HNF-SD-WM-DP-240, REV. 0

Bechtel Hanford Inc.	CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST	B97-072-03	Page 1 of 1

Collector Wendy Thompson	Company Contact Garth Duncan	Telephone No. 373-7385	Project Coordinator Weiss, RL	Data Turnaround 30 Days
Project Designation 105-N Basin Sediment Samples - Phase 1	Sampling Location 105-N Basin		SAF No. B97-072	
Ice Chest No.	Field Logbook No. EL-1287		Method of Shipment Hand delivery	
Shipped To 222-S Laboratory	Offsite Property No. N/A		Bill of Lading/Air Bill No. N/A	

POSSIBLE SAMPLE HAZARDS/REMARKS
Radioactive Sample jar reads 900mR/hr and 2.1 Rad/hr (beta) on contact.

Special Handling and/or Storage
KEEP SECURED

Preservation	None										
Type of Container	P										
No. of Container(s)	1	WSF 3/7/97									
Volume	1000ml										
SAMPLE ANALYSIS	See item (1) in Special Instructions.										

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Sample No.	Matrix *	Sample Date	Sample Time	
B0JY51	Other Solid	3/7/97	2230	X

CHAIN OF POSSESSION	Sign/Print Names		
Relinquished By Wendy S Thompson	Date/Time 1300 3/10/97	Received By Jim Knight	Date/Time 1300 3/10/97
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

SPECIAL INSTRUCTIONS

(1) ICP Metals - 6010A (SW-846); Lead - 7421 - (GFAA); Mercury - 7471 - (CV); Selenium - 7740 - (GFAA); Thallium - 7841 - (GFAA); Percent Moisture; Percent Solids; Density; TIC - 415.1M; pH (Soil) - 9045; IC Anions - 9056; TOC - 9060; Unit Mass; Hydroxide Ion; Pest/PCBs - 8080 (TCL); Total Cyanide - 9010; Particle Size Distribution; Specific gravity; total dissolved solids; viscosity; Americium-241; gross alpha; gross beta; gamma spectroscopy; isotopic Plutonium; Strontium-90; total Uranium.

Matrix *

S	=	Soil
SE	=	Sediment
SO	=	Solid
SL	=	Sludge
W	=	Water
O	=	Oil
A	=	Air
DS	=	Drum Solids
DL	=	Drum Liquids
T	=	Tissue
WI	=	Wipe
L	=	Liquid
V	=	Vegetation
X	=	Other

LABORATORY SECTION	Received By	Title	Date/Time
FINAL SAMPLE DISPOSITION	Disposal Method	Disposed By	Date/Time

Mar. 11. 1997 8:23AM WHC 222S LAB ROOM 2F BACKSIDE No. 0743 P. 1/1

HNF-SD-WM-DP-240, REV. 0

REQUEST FOR SAMPLE ANALYSIS (RSA)

Joan Kessner

1. Sample Origin	2. Date Sampled	4. Requestor's Name	6. TPCN/Org. Code
105-N Basin (Phase I) 100 Area	2/11/97	Wendy Thompson	DB7261

3. Submitted By	5. Requestor's Phone/MSIN/FAX
Wendy S. Thompson	Wendy Thompson/N1-28 376-8851

7. Customer ID No.	8. Laboratory ID No.	9. Group ID No.	10. Volume of Sample	11. Matrix of Sample	12. Determination(s)	13. Expected Range
B0JY49			≈ 700ml	Sludge	See chain of Custody and LOI/SOW for analysis.	

HNF-SD-WM-DP-240, REV. 0

Sample is contained in a one-liter plastic bottle. About 700ml of sludge is in the container.

Caution: There may be smearable contamination present on the outside of the sample jar. The jar is double-bagged and the highest contact reading is about 400 mR/hr on the bottom of the container. The sludge may settle further during shipping and could have potentially higher readings.

HNF-SD-WM-DP-240, REV. 0

14. QC Required — Contact George Miller 373-4739

- ☐ Per 222-S Laboratory Quality Assurance Plan (WHC-SD-CP-QAPP-018)
- ☒ Other (list reference document or attach) Letter of Instruction /SAP

15. Chemical Constituents

- ☒ Unknown
- ☐ Known (MSDS required)

16. Special Storage Requirements

- ☐ No
- ☒ Yes

If Yes, Specify: Keep Secure; follow LOI/SOW

17. Do samples contain listed wastes?

- ☒ No
- ☐ Yes (If Yes, list as an attachment)

18. Special Instructions (Reporting format, holding times, etc.)

Analyze per SOW/LOI/SAP BHI-00975

BHI memo to FDH, dated 1/31/97, #042474

19. Requested Turnaround Time

- ☐ 2 Weeks
- ☐ 4 Weeks
- ☒ Other See LOI/SOW

20. Sample Received By: [signature] Date: 2-12-97 Time: 1235

21. Chain of Custody

- ☐ No
- ☒ Yes 53

Number: N/A

FEB. 12. 1997 11:34AM WHC 222S LAB ROOM 2F BACKSIDE NO. 9936 P. 1/1

REQUEST FOR SAMPLE ANALYSIS (RSA)

Joan Kessner

RSA No.

1. Sample Origin: 105-N Basin (Phase I) 100 Area

2. Date Sampled:

4. Requestor's Name: Wendy S. Thompson

6. TPCN/Org. Code: DB7261

3. Submitted By: Wendy S. Thompson

5. Requestor's Phone/MSIN/FAX: 376-8851 Wendy S. Thompson/N1-28

7. Customer ID No.	8. Laboratory ID No.	9. Group ID No.	10. Volume of Sample	11. Matrix of Sample	12. Determination(s)	13. Expected Range
BOJY50			≈ 700ml	Sludge	See chain of custody and LOI/SOW for analytical requirements.	

Caution: There is potential for smearable contamination to be present on the outside of the sample jar. The jar is double-bagged in plastic.

Inner sample jar (1000ml plastic) contains about 200ml settled solids with about 500ml liquid. Contact dose rate is 120mR/hr and 180mrad/hr beta.

14. QC Required

☐ Per 222-S Laboratory Quality Assurance Plan (WHC-SD-CP-QAPP-016)

☒ Other (list reference document or attach) Letter of Instruction / SAP

Contact George Miller 373-4739

15. Chemical Constituents

☒ Unknown

☐ Known (MSDS required)

16. Special Storage Requirements

☐ No

☒ Yes

If Yes, Specify: KEEP SECURED; FOLLOW LOI/SOW

17. Do samples contain listed waste?

☒ No

☐ Yes (If Yes, list as an attachment)

18. Special Instructions (Reporting format, holding times, etc.)

Analyze per SOW/LOI/SAP (BHI-00975).

BHI Memo to FDH, dated 1/31/97 (#042474)

19. Requested Turnaround Time

☐ 2 Weeks

☐ 4 Weeks

☒ Other

See LOI/SOW

20. Sample Received By:

Date: Time:

21. Chain of Custody

☐ No

☒ Yes

Number: N/A

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97000164

REQUEST FOR SAMPLE ANALYSIS (RSA)

RSA No.

1. Sample Origin: 100 Area 105-N BASIN (Phase I)

2. Date Sampled: 3/7/97

3. Submitted By: Wendy S. Thompson

4. Requestor's Name: Wendy S. Thompson

5. Requestor's Phone/MSIN/FAX: W.S. Thompson/N1-28 6-8031 FAX 6-88

6. TPCN/Org. Code: DB7261

7. Customer ID No.	8. Laboratory ID No.	9. Group ID No.	10. Volume of Sample	11. Matrix of Sample	12. Determination(s)	13. Expected Range
B0TY51	S97N000005		≈ 500ml	Sludge	See chain of custody and LOI/SOW/SAP for analytical requirements	

Caution: There is potential for smearable contamination to be present on the outside of the sample jar. The sample jar is bagged in plastic.

Inner sample jar (1000 ml plastic) contains about 300 ml of settled solids and 200ml of water on top.

Contact dose rate is 900 mR/hr and 2.1 Rad/hr (beta) on inner sample jar.

14. QC Required

Contact George Miller 3-4737

☐ Per 222-S Laboratory Quality Assurance Plan (WHC-SD-CP-QAPP-016)

☒ Other (list reference document or attach) Letter of instruction/SAP

15. Chemical Constituents

☒ Unknown

☐ Known (MSDS required)

16. Special Storage Requirements

☐ No

☐ Yes

If Yes, Specify:

17. Do samples contain listed waste?

☒ No

☐ Yes (If Yes, list as an attachment)

18. Special Instructions (Reporting format, holding times, etc.)

Analyze per SOW/LOI (BHI-~~00976~~ 00975) SAP 10/31/97

BHI memo to FDH dated 1/31/97 (#042474)

19. Requested Turnaround Time

☐ 2 Weeks

☐ 4 Weeks

☒ Other See LOI/SOW

20. Sample Received By: [signature] Date: 3/10/97 Time: 13:00

21. Chain of Custody

☐ No

☒ Yes

Number: N/A

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TEST PLAN
(ATTACHMENT 1)

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Numatec Hanford Corporation | **Internal Memo**

From: Process Chemistry 8C510-97-003
Phone: 373-6322 T6-09
Date: March 12, 1997
Subject: TEST PLAN FOR PROCESSING SEDIMENT SAMPLES FROM 105-N BASIN (Revision 1)

To: G. L. Miller T6-06

cc:

J. W. Chenault	T6-07
G. B. Griffin	T6-12
D. L. Herting	T6-07
J. R. Jewett	T6-07
J. M. Kunkel	T6-07
D. S. Mantooth	T6-03
L. F. Perkins Jr.	T6-14
C. M. Seidel	T6-14
R. T. Steele	T6-20
K. S. Tollefson	T6-12
G. J. Warwick	T6-12
JFO File/LB	

This test plan describes the processing methods to support the 105-N Basin Sediment Disposition project for the Environmental Restoration Contractor (ERC). This plan will be used by the Process Chemistry group to determine the settled and centrifuged densities of the sediment samples. This plan will also provide instructions for preparing settled and centrifuged subsamples for analysis by the 222-S Laboratory.

Samples will be collected from the 105-N Basin, 1310-N Pump House Valve Pit, the 1314-N Waste Pump Tank, the 105-N Lift Station Pump Well, and the 107-N Basin Recirculation Building. One or more 1 to 4-liter containers will be collected from each sample location. If multiple samples are collected from one location, the excess water will be removed and the remaining sample will be composited by Process Chemistry. Prior to arriving at 222-S Laboratory, a water sample will have been withdrawn through a 5 μm cartridge filter for analysis at another laboratory. The particulates collected on the filters will be washed into the appropriate composite sample by Process Chemistry.

Assumptions implicit in this procedure are:

- The sludge settles to a sharp layer within 24 hours, leaving clear water.
- The clear water is essentially free of particulates.

Hanford Operations and Engineering Contractor for the US Department of Energy

PROCEDURE

1.0 Combine Samples

1.1 If multiple sample containers are transported from an individual sample location, remove and save the excess water and combine the remaining samples into one container.

1.1.1 Allow the containers to sit undisturbed overnight.

1.1.2 For each container, remove as much water as possible by vacuum (i.e., slurp) without disturbing the sediment.

1.1.3 Slurp all of the remaining water and sediment into a single container.

1.2 If a filter was transported with the samples, wash as many particles from the filter as possible.

1.2.1 Remove cartridge filter from the filter housing.

1.2.2 Rinse cartridge filter with excess water collected in Step 1.1.

1.2.3 Add rinsate and any remaining sample in the filter housing to the composite sample.

1.2.4 Package filter and filter housing for return to the customer.

1.3 Allow the composite sample to sit undisturbed overnight.

1.4 Slurp as much water as possible from the container without disturbing the sediment.

NOTE: The unused sample collected in this test plan is not waste and should not be recorded on the waste inventory sheet. The unused sample will be returned to the point of origin. The unused sample from individual sample locations should be segregated into separate containers.

1.5 Collect excess water for return to the customer.

2.0 Determine Density of Settled Sediment

2.1 Record the tare weight (to ±0.001 g) of an appropriate number of uniquely labeled 50 mL centrifuge cones.

2.2 Transfer the water and sediment from the sample container into the centrifuge cones.

2.3 Allow the sediment to settle fully.

NOTE: The sediment will be assumed to have fully settled when the volume of sediment has not changed by 2.5 mL over a 24 hour period.

2.4 Remove the excess water from the centrifuge cones and collect for return to the customer.

CAUTION

The dose rates of the samples will increase as water is removed.

2.5 Verify the dose rates of the centifuge cones are within the appropriate radiation work permit (RWP) limits.

2.6 Record the final volumes of the settled sediment to the nearest mL.

2.7 Record the final weights of the settled sediment and centrifuge cones to ±0.001 g.

2.8 Obtain photographs or videos of any layers present in the settled sediment.

NOTE: If viscosity and particle size distribution analyses are required, the project coordinator may request a larger subsample of settled sediment.

2.9 Notify project coordinator of the total volume of settled sediment.

2.10 Obtain 20 mL (or an amount requested by the project coordinator) of well mixed sediment in a labelled vial for analyses specified by the project coordinator.

3.0 Determine Density of Centrifuged Sediment

3.1 Centrifuge the remaining sediment for roughly one hour.

CAUTION

The dose rates of the samples will increase as water is removed.

3.2 Verify the dose rates of the centifuge cones are within the appropriate radiation work permit (RWP) limits.

3.3 Decant the water from the centrifuge cones into labelled bottles for the analyses specified by the project coordinator.

3.4 Record the final volume of the centrifuged sediment in each cone to the nearest mL.

3.5 Record the final weights of the centrifuged sediment and cones to ±0.001 g.

3.6 Obtain photographs or videos of any layers present in the centrifuged sediment.

3.7 Homogenize the sediment in the centrifuge cones using a spatula.

3.8 Scoop the centrifuged sediment from all cones into labelled bottles for analyses specified by the project coordinator.

WASTE MANAGEMENT

The excess water from the samples will be returned to the point of origin. Any additions to the waste collection bottles (e.g., rinse water) will be recorded on the appropriate Development/Trouble Shooting Container Inventory Sheet per LAP-106-100 *Waste Stream Fact Sheet Development and Issuance (Predesignation of Waste)* and maintained as described in LO-110-128 *Use and Change Trap Bottles, Wall Traps, and Waste Collection Bottles*. The sediment collected from this test plan will be submitted for analysis by 222-S Laboratory. Any unused sediment will be returned to the point of origin.

If the Letter of Instruction or other documentation indicates a listed waste component, solid waste material (gloves, paper, etc.) generated during the course of this test plan will be assumed to be mixed waste and handled as described in LO-100-151 *Segregate and Manage Solid Laboratory Wastes*. If no listed waste components are identified in the customer's documents, the solid waste material will be managed as low-level radioactive waste per LO-100-151.

SAFETY

The dose rates of the samples will likely represent the most significant safety concern. The sample dose rates are expected to allow RWP S-401 to be used for all activities described in these instructions. If the sample dose rates exceed the limitations of RWP S-401, the testing will be transferred to a hot cell or a special RWP will be written. The approval designators for this work has been determined to be "ES".

J. F. O'Rourke, Advanced Engineer
Process Chemistry
Numatec Hanford Corporation

Approval by:

G. L. Miller, Project Coordinator
222-S Production
Rust Federal Services of Hanford, Inc.

D. S. Penfield, Industrial Hygiene
222-S Industrial Safety and Health
Rust Federal Services of Hanford, Inc.

K. S. Tollefson, Manager
Environmental Compliance
Rust Federal Services of Hanford, Inc.

LASER ABLATION/MASS SPECTROMETRY DATA FOR 105-N BASIN (ATTACHMENT 2)

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NHC
Numatec
Hanford Corporation
An SGN/Cogema, Inc. Company

Internal Memo

From: Analytical Technology
Phone: 372-2653 T6-50
Date: April 15, 1997
Subject: LASER ABLATION/MASS SPECTROMETRY DATA FOR 105-N BASIN SAMPLES (PHASE I)

To: G. L. Miller T6-06

cc:	J. Y. Bourges	T6-07	G. L. Troyer	T6-50
	B. A. Crawford	T6-50	W. I. Winters	T6-50
	C. M. Seidel	T6-14	JWB File/LB	

Attached is a narrative and tabulated data for the Laser Ablation/Mass Spectrometry analysis of recent 105-N Basin samples (S97N000016 and S97N000017). The data for these samples were recorded on April 1, 1997 and April 2, 1997. If you have any questions regarding the results, please contact me at 372-2653.

J. W. Ball, Ph.D.
Senior Scientist

pad

Attachments

Laser Ablation/Mass Spectrometry Analysis of 105-N Basin Samples
Analytical Narrative

Jon W. Ball
Numatec Hanford Corporation
April 13, 1997

Background

Laser Ablation/Mass Spectroscopy (LA/MS) is an elemental/isotopic measurement technique that can detect most elements in the periodic table with sub-ppm detection limits. The LA/MS method determines the abundance of elemental/isotopic constituents in a direct solid sample without the need for wet chemistry sample preparation. As a result, LA/MS can achieve lower absolute limits of detection compared to solution ICP-AES and ICP-MS analysis and can avoid analyte contamination and loss during sample dissolution steps.

The LA/MS system at 222-S is based on commercial instruments and subsystems including an Inductively Coupled Plasma/Mass Spectrometer (ICP/MS) instrument and a pulsed laser source. The commercial ICP/MS system consists of a VG Elemental PlasmaQuad[1] II Plus. The major system components include the following: a laser (Nd:YAG) which produces energetic optical pulses suitable for ablating material from a sample; laser beam transfer and focusing optics; a sample ablation chamber; an ablation plume pickup and transfer line with a flowing Ar carrier gas; an Inductively Coupled Plasma (ICP) torch; and a Mass Spectrometer (MS). System operation is outlined below:

- The ablation laser is triggered to produce an energetic optical pulse that strikes the sample surface.
- The interaction of the laser pulse with the sample material causes a small plume of material to be ablated from the sample.
- The plume of sample material is entrained in the carrier gas flowing over the sample and is carried into the transfer line.
- The carrier gas transports the plume material from the ablation cell to the ICP torch.
- The energetic plasma in the ICP torch dissociates ablation plume particles into atomic species and ionizes the resulting atoms.
- The ionized atoms enter the MS and are analyzed to determine the number of atoms at each atomic weight for the sample.

[1] PlasmaQuad is a registered trademark of VG Elemental

Experimental

LT-506-102 was used to collect the data. Data for sample S97N000017 was collected on 04/01/97. Data for sample S97N000016 was collected on 04/02/97. Sample S97N000012 must undergo a rerun and is not reported here (insufficient data was collected and could not be reduced). The data problems for sample S97N000012 were not noted until the data was being reduced.

The raw data is in binary format and is not available in a readable format without extensive file conversions.

Five replicates for each sample were recorded. Each replicate consisted of a four mm square area that was raster scanned for two minutes. The data that is recorded for each sample is an average of the five replicates.

Calibration of the instrument was achieved by monitoring the response collected from a certified glass standard (WV205). A mass response calibration curve (signal/ppm versus mass) was constructed and used to approximate the concentrations of the sample analytes.

Quality Control

LT-506-102 is not a quantitative analytical method. As a result, appropriate QC has not yet been established for this technique. The data provided in this report are semi-quantitative only. This method should be used to screen samples to determine approximate and relative isotopic composition, not absolute concentrations.

Results

The results for samples S97N000016 and S97N000017 are listed in the attached table. Results are reported for all masses that were detected above 0.1 ppm (100 ppb). For each mass, the most probable element (or elements in cases of isobaric interferences) are listed.

For masses 7-75 amu and 179-209 amu, the concentrations were corrected for isotopic abundances. Therefore, the concentrations listed represent the approximate concentrations of the corresponding element in the samples. For some elements, concentrations were computed for more than one isotope. Because the values are isotopically corrected, these calculations should yield approximately the same concentrations. For example, it can be seen that the total Zn concentrations for sample S97N000017 based on the 64, 66, and 68 isotopes were determined to be 3000 ppm, 2900 ppm, and 3000 ppm, respectively. Another good example can be found for the total copper determinations based on the Cu-63 and Cu-65 isotopes.

There are a few cases where isotopes of low abundance were used to compute total elemental concentrations. Because these species are present at trace levels, greater signal variance can occur and possibly lead to greater deviations in the element concentrations. An example of this can be seen in the comparison of the total chromium calculations for sample

S97N000017 using the Cr-52 and Cr-53 isotopes. The isotopic abundances for Cr-52 and Cr-53 are 0.838 and 0.095, respectively. Even though the total Cr concentrations using these isotopes varied slightly (410 ppm and 330 ppm), the calculations are reasonable considering an order of magnitude difference in the isotopic abundances that were used.

Since the Cu results were high for both samples (>300 ppm), it is impossible to determine if trace Ni-63 was present. It can be concluded, however, that Ni-63 is not present in a significant quantity (>10 ppm). If this were the case, the total Cu calculations based on the two Cu isotopes would not agree so closely.

Masses 85-155 amu were not isotopically corrected since this region contained fission products as well as naturally occurring isotopes. The concentrations listed for these masses represent the concentrations of the individual isotopes (e.g. Sm-149) instead of the elements (such as total Sm). Isotopic abundance corrections are not valid unless the isotope is known to be solely natural. It can be assumed that the maximum fission product concentrations are approximately 5-10 ppm. Y-89 is likely present solely as a fission product (2-4 ppm) since it is not expected to be a natural or added component in the fuel or surrounding environment. A similar conclusion can be made for La-139 and Pr-141. Using fission product yield curves and natural isotopic subtractions, one can extract the fission product concentrations more accurately. Those calculations, however, were beyond the scope of these analyses.

One interesting conclusion that can be argued regarding the fission products is that the Sn was natural. Any fission product Sn that may have been present was below the instrument detection limit. This conclusion can be made by comparing the responses for the Sn isotopes to their known isotopic abundances. For example, the concentrations in sample S97N000016 for the Sn-116, 117, 118, and 120 isotopes were 15, 7, 22, and 30 ppm, respectively. The ratios (116:117:118:120) of these isotopes, normalized to mass 120, were 0.5:0.23:0.73:1 for sample S97N000016. The actual ratios of natural Sn isotopes (also normalized to mass 120) are 0.44:0.24:0.74:1.

The actinides were not isotopically corrected either. It may be noted that the U-238 concentrations between the two samples (S97N000016 and S97N000017) varied by a factor of five. It is possible that the area of the sample scanned in sample S97N000016 contained a very concentrated pocket of uranium. Even though the concentrations vary, the isotopic ratios of U-234, U-235, and U-238 (normalized to U-238) in the two samples agreed very closely: 0.013:0.00086:1 (U-234:U-235: U-238) for sample S97N000016 and 0.013:0.0012:1 for sample S97N000017. Although LA/MS is a semi-quantitative technique, it generates very accurate isotopic abundance data.

An unexpected mass was detected at 248 amu at the 0.2 ppm level for sample S97N000016. Cm-248 was listed as a possible isotope since it has a long half life. It is possible, however, that a molecular species such as an oxide formed and is responsible for the peak at mass 248. As a result, the exact identity of that component of the mass spectrum is not known.

S0001-2225

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

APR 1997
RECEIVED
Data
Log In

April 9, 1997

Ms. Joan H. Kessner
Bechtel Hanford Inc.
1022 Lee Blvd.
Richland, WA 99352

Dear Ms. Kessner:

PACIFIC NORTHWEST NATIONAL LABORATORY ACL ANALYTICAL RESULTS FOR PCB ANALYSIS OF THREE 105-N BASIN SLUDGE SAMPLES

Attached is the final report containing PCB results for three 105-N Basin samples submitted to the Pacific Northwest National Laboratory, Analytical Chemistry Laboratory by Rust Federal Services of Hanford, Inc.

The final report includes the following:

Results summary with narrative, 4 pages
Attachment A, Chain of Custody
Attachment B, Analytical Request
Attachment C, Bench Sheets
Attachment D, Raw Data

If you have any questions or require clarification or assistance, please contact me at your earliest convenience at the number below.

Very truly yours,

Kristine J. Kuhl-Klinger

Kristine J. Kuhl-Klinger
Acting Manager
Analytical Chemistry Laboratory

KJK/bn

Attachments
cc: CM Seidel, RFS

Battelle Boulevard ■ P.O. Box 999 ■ Richland, WA 99352

Telephone (509) 372-0398 ■ Email kj_kuhl-klinger@pnl.gov ■ Fax (509) 373-9675

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS REPORT

SAMPLE ANALYSIS REPORTED

Three 105 N Basin sludge samples were analyzed for PCBs as Aroclor mixtures by the ACL Organic Group as specified in ASR 3866 including test instructions dated March 26, 1997. The analysis was performed using dual column confirmation gas chromatography/ electron capture detection (GC/ECD) and is the subject of this report. A cross reference of client identification to the ACL identification number for the pertinent samples is given in the following table.

Client Sample Number	ACL Sample Number
BOJY49/ S97N00009	97-02534
BOJY50/ S97N00022	97-02535
BOJY51/ S97N00023	97-02536

SAMPLE DESCRIPTION, HANDLING, AND PREPARATION

Preparation of the 105 N Basin sludge samples was performed on April 2, 1997 in a radiological fume hood. The preparation used was a methylene chloride/acetone solvent extraction aided by ultrasonication.

Preparation Procedure	PNL-ALO-347 rev 1, with modifications from the test plan "Analysis of Basin Sludges for Polychlorinated Biphenyls", dated March 25, 1997.
Preparation location	Lab 306, 325 building
Preparation type	sonication with solvent
Sample extract storage	2° C in darkness

ANALYSIS METHOD

GC/ECD procedure	PNL-ALO-346 rev 0, with modifications from the test plan "Analysis of Basin Sludges for Polychlorinated Biphenyls", dated March 25, 1997.
GC/ECD instrumentation	HP-5890II dual on-column injection, DB-17 and DB-1701 columns dual ECD gas chromatograph. Property number WD11127
Location	Lab 325, 325 building

QUALITY CONTROL

The test plan modifications were made to the procedures to allow for a more pertinent calibration and analysis for PCBs as Aroclor mixtures. Due to radiological issues and limited sample, the extraction portion of the procedure is scaled down appropriately. In addition, rather than perform a determination of instrument linearity using pesticides, the test plan specifies the use of an Aroclor for a multi-point calibration. The continuing calibration also consists of an Aroclor mixture. Quantitation was performed using a primary column and the secondary column was used for confirmation of identification. A detailed description of the specific procedure requirements is available in the test plan. The following summarizes the QC requirements and adherence:

QC Parameter	Comments
Target Compounds	Detection levels are based on sample size and the determination of IDLs from multiple injections of a low standard. Met requirements
Surrogate Recoveries	Surrogate spiking was performed on all samples using TCX and DCB. No control limits have been established for these compounds on these matrices. A summary of the surrogate recoveries is provided in Table II. Surrogate recoveries were judged acceptable based on previous experience with similar matrices.
Matrix Spike Recovery	Aroclor 1254 spiking (1 ug) was performed at an adequate frequency, however, the quantity of PCB present (80-162 ug) was substantially greater than the material spiked. Spike recoveries could not be obtained.
Method Blank Summary	A method blank was extracted and met requirements
Initial Detection Limit Determination	Multiple analysis of a low concentration standard. Met requirements
Initial Calibration	Aroclor 1254 was used for calibration. Met requirements.
Carry-over evaluation	Instrument blanks were run after the highest concentration standard in the initial calibration and following each continuing calibration. Met requirements.
Continuing Calibration Verifications	Met requirements

Laboratory bench sheets, data, and reports are maintained in the ACL/LSO records center in the 325 building.

RESULTS

As shown in Table I, Aroclor 1254 was identified in all of the sludge samples. In addition, Aroclors 1016/1242 and 1221 were observed in samples 97-02534 and 97-02536. No distinction is made between Aroclors 1016 and 1242 due to their similarities. Late eluting chromatographic peaks were observed in samples 97-02535 and 97-02536 indicating higher molecular weight material is present in the samples. Aroclors are present in sufficient concentration in sample 97-02534, >10 ug/mL in the sample residue, to perform GC/MS confirmation. The 8.0 mL of sample residue held in reserve for GC/MS confirmation will be further concentrated to 0.8 mL for this analysis. Results of the GC/MS confirmation analysis will be provided later.

DISCUSSION

Materials which eluted late in the chromatographic analysis of undiluted residues from 97-02535 and 97-02536 interfered with the DCB surrogate. Substantial carry over of these compounds was observed. The method blank and 97-02534 were analyzed prior to these samples and were uneffected and good recoveries were obtained. The 97-02534 MS and MSD analysis were performed after injection of 97-02535 and 97-02536 samples. Therefore, many of the late eluting materials carried over and caused interference with analysis of the DCB surrogate for the MS and MSD samples as well. To try to identify these late eluting materials, samples 97-02535 and 97-02536 will be concentrated. The amount of Aroclors present in these samples may be marginal for GC/MS confirmation, however, a better understanding of the late eluting materials may be obtained.

Surrogate spiking was performed on all samples using TCX and DCB. No control limits have been established for these compounds on these matrices. However, based on previous experience with similar matrices, surrogate recoveries were judged acceptable. USEPA advisory limits set at 20-150% further indicate surrogate recoveries for these samples is acceptable.

The RPD requirement for the matrix spike and matrix spike duplicate analysis (samples 97-02534 MS and MSD) was +/- 30%. Spike recovery of Aroclor 1254 was impossible to obtain for these samples due to the overwhelming presence of Aroclor 1254 already present in the sample. Therefore, the RPDs reported are representative of the differences in amount of Aroclors present in the samples, not the amount spiked. These RPDs represent sample handling and homogeneity variations as well as analytical variance. Therefore, the analytical RPD limitation of +/-30% no longer applies.

The results indicate these samples are heterogenic. This is supported by observations made of the sample appearance and behavior during sample preparation. Sample 97-02534 appeared heterogenic and had a mixed color and texture with variable particle shape and size. Additionally, the extract initially produced was turbid. Exchange into hexane produced a clarified liquid with a precipitated residue.

The results for Aroclors 1016/1242 and 1221 were quantitated using a single point calibration, whereas Aroclor 1254 used a multipoint calibration. Therefore, slight concentration variations will likely have a greater effect on the RPDs for Aroclors 1016/1242 and 1221 than for Aroclor 1254. In addition, no further attempt was made to analyze the samples at dilutions which would obtain responses closer to the standards. Analysis at dilutions to obtain similar responses to the standards for Aroclors 1016/1242 and 1221 would have subsequently overwhelmed the detector with Aroclor 1254. This was determined to be unnecessary as the amount of Aroclors 1016/1242 and 1221 was minor compared to the amount of Aroclor 1254 present. Further analysis could include a multipoint calibration for the other Aroclors to reduce this problem. Since the responses obtained for sample 97-0234 were similar to those for the Aroclor 1016/1242 and 1221 standards, these results best represent the amount of these Aroclors present. Aroclors 1016/1242 and 1221 in the MS and MSD samples are likely underestimated.

ANALYST _____ DATE 4-9-97 REVIEWER _____ DATE 4/9/97

Table I, Results of 105 N Basin Sludge Analysis for PCBs

Laboratory ID	Sample ID	Data File Identification	Aroclors Detected	Concentration (ug/g)	RPD [1]
METHOD BLANK	METHOD BLANK	04037A06.D	none detected	<0.500	
97-02534	BOJY49/ S97N00009	04047A07.D	1016/1242	21.0	96.3
		04047A07.D	1221	47.0	153
		04047A07.D	1254	162	32.8
97-02534 MS	BOJY49/ S97N00009	04037A10.D	1016/1242	6.35	40.6
		04037A10.D	1221	3.30	82.3
		04047A10.D	1254	123	0.82
97-02534 MSD	BOJY49/ S97N00009	04037A11.D	1016/1242	4.78	55.3
		04037A11.D	1221	5.56	70.1
		04047A11.D	1254	80	34.4
97-02535	BOJY50/ S97N00022	04037A08.D	1254	0.741	
97-02536	BOJY51/ S97N00023	04037A09.D	1016/1242	1.26	
		04037A09.D	1221	1.00	
		04037A09.D	1254	4.60	

(1) RPD for triplicate analysis = [(sample result - average result)/average result] * 100

Table II, Summary of Surrogate Recoveries, Analysis of 105 N Basin Sludge for PCBs

Laboratory ID	Data File Identification	TCX Recovery (%)	DCB Recovery (%)
METHOD BLANK	04037A06.D	89.7	88.5
97-02534	04037A07.D	92.7	98.0
97-02534 MS	04037A10.D	92.0	67.7
97-02534 MSD	04037A11.D	90.3	38.5 [2]
97-02535	04037A08.D	88.6	36.9 [2]
97-02536	04037A09.D	92.4	30.3 [2]

(2) Materials which eluted late in the chromatographic analysis interfered with this surrogate. The MS ans MSD analysis were performed after 97-02535 and 97-02536. Many of the late eluting materials carried over since surrogate recoveries were obtained from undiluted samples.

Westinghouse Hanford Company

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

C.O.C. No.

Page 1 of 1

Collector: 222-S Laboratory	Contact/Requestor: Marty Martin/Franciska Steen	Telephone No.: 372-2495 MSIN: T6-06 FAX: 372-1878
SAF No.	Sample Origin: 222-S 2B	Purchase Order/Charge Code: DB7261
Project Title: N-Basin Sludge Samples	Logbook No.	Ice Chest No.: n/a Temp.: n/a
Shipped To (Lab): 325 PNNL	Method of Shipment	Bill of Lading/Air Bill No.
Protocol	Date Turnaround: n/a	Offsite Property No.

Sample No.	Lab ID	*	Date	Time	No./Type Container	Sample Analysis	Preservative
BOJY49	S97N00009	SO			1/20mL	sample wt. 4.4 grams	n/a
BOJY50	S97N00022	SO			1/20mL	sample wt. 1.87 grams	n/a
BOJY51	S97N00023	SO			1/20 mL	sample wt. 2.27 grams	n/a

POSSIBLE SAMPLE HAZARDS/REMARKS (List all known wastes) MSDS ☐ Yes ☒ No

SPECIAL INSTRUCTIONS Hold Time

Ship samples to 325 Lab Door 207 (West Side)
PNNL attention Rick T. Steele.

Relinquished By (Print / Sign)	Date/Time	Received By (Print / Sign)	Date/Time
FRANCISKA H. STEEN, Franciska Steen	3/26/97 1000	MARTY L MARTIN	3-26-97/1000
MARTY L MARTIN	3-26-97/1315	DON PETERSON	3-26-97/13:15
DON PETERSON	3-26-97/14:06	Ty Burkendorf	3-26-97/14:06

Matrix*

S = Soil		DS = Drum Solids	
SE = Sediment		DL = Drum Liquids	
SO = Solid		T = Tissue	
SL = Sludge		WI = Wipe	
W = Water		L = Liquid	
O = Oil		V = Vegetation	
A = Air		X = Other	

FINAL SAMPLE DISPOSITION: Disposal Method (e.g., Return to customer, per lab procedure, used in process) Disposed By Date/Time

All samples containing hazardous materials shall be picked up by requestor and returned to parent container or site of origin.

DISTRIBUTION: White - Remain with Samples Color - Customer

BC-6000-828 (12/95)

A00-001

RADIOACTIVE SHIPMENT RECORD

3. Page 1 of 1 — 38877

1. SHIP TO
Company: PNNL
Address: 325 BLDG / 300 AREA
City, State, Zip: DOOR 208 WEST SIDE
Attention: RICK STEELE
Phone: 372-0038

2. SHIP FROM U.S. DEPT. OF ENERGY C/O
Company: RFSH
Address: 2355 STEVENS DR 1KZBLR
City, State, Zip: RICHLAND WA 99352
Contact: HARTY L HARTIN
Phone: 373-1795

4. Ship [X] Prepaid [ ] Collect
Via: [X] Motor ~~Rail~~ [ ] Air Psgr [ ] Excl. Use [ ] Air Cargo [ ] UPS Surface [ ] Mail [X] Site Carrier
SHIPMENT AUTHORIZATION NUMBER: 97-3-027

5. HM Proper Shipping Name: _____ Radioactive Material,

	excepted package - empty packaging	7	UN2910
	excepted package - instruments or articles	7	UN2910
	excepted package - limited quantity of material	7	UN2910
	excepted package - articles manufactured from natural or depleted uranium or natural thorium	7	UN2910
	Special Form, n.o.s.	7	UN2974
	Low Specific Activity, n.o.s.	7	UN2912
X	n.o.s.	7	UN2982
	Fissile, n.o.s.	7	UN2918
	(other) _____		

6. Markings Applied
Package Orientation [X]
Gross Weight [X]
Radioactive - LSA [ ]
Type A [X]
Type B [ ]

7. For Normal Form
Identify
Physical Form: [ ] Liquid [ ] Gas [X] Solid
Chemical Form: [ ] Metal [ ] Oxide [X] Elemental [ ] Nitrate [ ] Mixture
Other _____

8. Additional RAM Desc.
Limited Quantity Radioactive Material [ ] N/A
Highway Route Controlled Quantity [ ]

9. Placards Applied [ ] Yes [X] No
If Rail Specify Placards N/A
Route Plan [ ] Yes [X] No

11a. TYPE PACKAGE
Strong Tight [ ]
Type A [X]
Type B [ ]
Type B(U) [ ]
Type B(M) [ ]

11b. CONSTRUCTION
[ ] Box, FB
[ ] Wood
[ ] Steel
[ ] Drum SAFESHIP
[ ] Cask REUSABLE
(Other) OVERPACK

11c. FISSILE CLASS
Non-Fissile [ ]
Fissile ~~Exempt~~ EXCEPTED [X]
Fissile I [ ]
Fissile II [ ]
Fissile III [ ]
Gms Fissile <15

11d. Labels Applied
Empty [ ]
Radioactive White I [X]
Radioactive Yellow II [ ]
Radioactive Yellow III [ ]
Subsidiary Hazard N/A [ ]

10. EMERGENCY RESPONSE
Telephone (509) 373-3800
Emergency Response Guide(s): 163

Warning -- Fissile Class III Shipment. Do Not Load More Than N/A Packages Per Vehicle. In Loading and Storage Areas, Keep at Least 20 Feet From Other Packages Bearing Radioactive Labels.

12.

No. Pkgs.	Model Package	COC/Spec	Serial No.	Seal No.	Isotopes	T.I.	Curies/Pkg	Gr. Wt.
1	DOT 7A	TYPE A	222537 000056	LEAD WIRE	KR85, CO60, SR90, RU106,	N/A	0.231 GBq	52 LBS
					SB125, CS134, CS137, CE144,			
					U234, U235, U238, NP237, PU238,			
					PU239, PU240, PU241, AM241			
					TOTALS	N/A	0.231 GBq	52 LBS

(Shipper may describe package in detail on one of the unused lines above)

13. This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable federal, state, local and international regulations for the transportation of hazardous materials.
Certifier's Signature On behalf of DOE-RL: [signature] | Date: 3-26-97 | Organization: HAZ MAT CONTROL 2225 | Complete Cost Code (Inc. End Function): DB7261

14. Surface Dose Rate of Package: [X] <0.5 or ____ mrem/hr (N + β γ)
Dose Rate at 1 Meter from Surface of Package: [X] <0.5 or ____ mrem/hr (N + β γ)
Smears of Outer Container: [X] < 22 dpm β γ /cm² [X] < 2.2 dpm α /cm² [ ] < Tbl. 2-2 HSRCM Onsite Limits
TRUCK LOAD OR EXCLUSIVE USE: Surface [X] < 200 mrem/hr (N + β γ); @ 6 feet [X] < 10 mrem/hr (N + β γ); @ Cab or sleeper [X] < 2 mrem/hr (N + β γ)
Additional Data and Instructions (inc. Readings on Internal Packaging)
Signature - Radiation Monitoring: [signature] | Bldg. 222-5 | Survey No. 241592 | Date 3-26-97

15. PICKUP OF SHIPMENT: Vehicle 259 | Driver DON PETERSON
RECEIPT: Signature [signature] | Date 3-26-97

16. Shipment has been inspected and verified to be in compliance with DOT regulations.
Authorized Signature: [signature] | Printed Name: M.A. SAMS | Date 3-26-97

17. AIR TRANSPORT CERTIFICATION
CARGO AIRCRAFT: [ ] Cargo Aircraft Only Labels Applied
PASSENGER AIRCRAFT: [ ] 1. Ltd Qty [ ] 2. <3 T.I. [ ] 3. Research/Medical Diagnosis [ ] 4. Human Medical Research
Pkg. Dimensions: NA

18. OFFSITE AUTHORIZATION
B/L: MAS0326974 | Date Shipped: 3-26-97 | Routing: DYNCORP | ETA: 3-26-97
Surveyed By: [signature] | Date: [signature] | Approved for Shipment Offsite: [signature] | Date: 3-26-97

A00-004

Page 1 of 1 Chain of Custody Number: NB-01

BATTELLE, PACIFIC NORTHWEST LABORATORIES
ANALYTICAL CHEMISTRY LABORATORY (ACL)

ACL CHAIN OF CUSTODY

Project No.: 20063/ED7328 Originating Technical Group: SAL

General Sample Description: N Basin Sludge Samples

Test Instruction or ASR No. (as applicable): N/A

Analysis Requested and/or Technical Group: PCBs

Prep Method Description: None

ACL SAMPLE NUMBER	SAMPLE DESCRIPTION	COMMENTS
N/A	BOJY49/Lab ID S97N00009	
N/A	BOJY50/Lab ID S97N00022	
N/A	BOJY51/Lab ID S97N00023	

Sender: [signature] 3/31/97 (signature/date) Receiver: MJ Steele 3-31-97 (signature/date)

Original - Project File

03/28/97 FRI 07:31 FAX 3734884

03/27/97 THU 08:15 FAX

46505-46510

002

MWL

EJH

MJS

MAR 2 3 1997

Analytical Chemistry Laboratory (ACL) Analytical Services Request (ASR)

(Cover Page ... information applicable to all samples in series)

Requested By: Cary Seidel (Print Name) Cary M Seidel 3/27/97 (Signature/Date) 2-0846 (Phone) T6-14 (MSIN)

Requester - Please Complete All Fields In This Section, Unless Specified "Optional" or ASR is a Revision

Request ID (optional): _____

PNL Project Number (if known): ~~20063~~ 27677 3/31

Work Order/Pkg.: Multiple

Protocol Requirement: __None ✓RCRA __CERCLA, or

Other (specify): _____

Hold Time Requirement: __None __RCRA __CERCLA, or

Other (specify): Meet Turnaround

TPA Support: ✓No, or

Milestone No.: _____

QA Plan: ✓MCS-033, or

Other ACL QA Plan (specify): _____

Additional QA Requirements: __No, or

Reference Doc.: See Attached

ACL COC Req'd (PNL-ALO-010): __No ✓Yes

Sample Storage Requirements: ✓No __Refrigerate, or

Other (specify): _____

Date Sampled (optional): N/A

Time Sampled (optional): N/A

Matrix: __Samples vary (specify on Request Page), or

Liquid: __Aqueous __Organic __Multi-phasic

Solid: __Soil ✓Sludge or ✓Sediment __Glass

__Filter __Smear __Metal __Organic __Other Solids

Solid/Liquid Mixture: __ Gas: __

Biological: __Tissue __Urine __Feces

Process Knowledge: ✓Sample Information Check List, or

Reference Doc.: _____

Sample Disposition ...

Untreated Sample(s): __Return __Dispose ✓Store, or

Reference Doc.: _____

Prep'd Sample(s): __Dispose __Return ✓Store, or

Reference Doc.: _____

Additional Instructions: __No, or

Reference Doc.: See Attached

Date Report Req'd: 4/9/97

Send Report to: Joan Kessner BHT & CARY SEIDEL

MSIN: _____ Phone: _____

Fax (optional): _____

For ACL Use Only ... Do Not Complete This Section

Date Delivered: 3/26/97

Time Delivered (optional): 2:00 pm

Deliv. By (if known): Dan Peterson

Received By: Ty Buckendorf

Resp. ACL Mgr.: KJ Kuhl-Klinger

Signature/Date: KJ Kuhl-Klinger 3/26/97

Job Group (optional): _____

Sample Group (optional): 105N BASIN

PNL Impact Level: __1 ✓2 __3

DQ Review Req'd: __No ✓Yes

ACL Waste: ✓No __

PP&C Due Date (optional): ~~Hold~~ MC 4/7/97

Prep. Due Date (optional): 4/2/97

Anal. Due Date (optional): 4/7/97

ASR Number: 3866 Revision: __

ACL Numbers: 97-02534-02536

B00-001

Analytical Chemistry Laboratory (ACL) Analytical Services Request (ASR)
(Request Page ... information specific to individual samples)

ACL Number (for ACL use only)	Client Sample Number (list each sample separately)	Sample Description	Analyses Requested	Test Name (for ACL use only)	Library
97-02534	BOJY49/997N00009	105N BASIN SLUDGE	PCB ONLY - SEE TEST PLAN ATTACHED	PCB/PREP	ORGANIC *
	~~BOJY50/997N00020~~			PCB/PEST	↓ *
	~~BO~~ RC 3/26/97				
97-02535	BOJY50/997N00022	105N BASIN SLUDGE	As Above	PCB/PREP	Organic *
				PCB/PEST	↓ *
97-02536	BOJY51/997N00023	105N BASIN SLUDGE	As Above	PCB/PREP	ORGANIC *
				PCB/PEST	Organic *

ASR Number (for ACL use only): 3846

Page 1 of 1

B00-002

Analysis of 105 N Basin Sludge for PCBs
Effective 3/26/97
Test Instructions
Prepared by: Kristine Kuhl-Klinger

Scope:
The scope of work for this project is to prepare, analyze and report results for three (3) sludge samples from 105 N Basin for PCBs. This work will be conducted under full chain of custody, through to final disposition.

All work is to be conducted in accordance with the attached Test Plan. A method blank and MS/MSD are required for this batch of samples. The RPD for the MS/MSD must fall within ± 30%. The percent recovery for the MS/MSD must fall within 2 sigma of the established accuracy of the method. The target practical quantitation limit for results is 10 ppm, a lower PQL is acceptable. Any instances of QC failure must be immediately brought to the attention of the Project Manager. QC performance shall be discussed in the narrative.

A QC review is required for this work and a full data deliverable package is to be compiled and submitted. A narrative shall accompany the results and raw data submitted to the PM.

Results shall be forwarded as soon as they become available by the Project Manager. The full deliverable is due to the client on or before April 9, 1997. The laboratory is therefore required to submit all chain of custody records, preparation sheets, raw data, results (including QC) and a narrative to the PM on or before 4/7/97. This time period shall include the technical review. No overtime is permitted without the express and written permission of the PM.

Original sample material and all extracts will be held for 60 days following report submission to the client. Thereafter, the samples and extracts shall be disposed of. This material shall not be commingled with any other laboratory residues in order to permit more effective final disposition.

Analysis of Basin Sludges for Polychlorinated Biphenyls

PNNL Technical Approach
Eric Hoppe
March 25, 1997

Summary:

The PNNL ACL Organic Analysis Laboratories approach to analysis of PCBs in Basin samples is based upon existing USEPA methodologies. The only modifications necessary are due to the amount of sample available and consequently the procedure is scaled down. The modifications reduce the initial sample size and proportionably lower the amount of surrogate or spike compounds that are added. This is done in order to match the concentrations in the sample to those in the USEPA procedures. To match the concentration of these compounds in the final extract, this volume is reduced as well.

Extraction of Sludge Samples:

Extraction is performed on approximately 1 gram samples. Extractions will be performed in radiological fume hoods to the extent possible to reduce the complications associated with extractions performed in a glove box or remote handling facilities.

Ultrasonic extraction has been chosen as the method for the sludge samples. It is known that very non-polar species, such as PCBs, can be difficult to extract from materials with a great deal of surface area or organic matter. The sample will be solvent contacted and sonicated three times rather than once as is done in the USEPA CLP or SW-846 3550 medium level methods. Once again, this set of samples will be extracted employing a slightly reduced sample size of 1 to 2 grams rather than 2 grams in the USEPA SW-846 3550 method. The USEPA CLP methods specify 1 gram in the 1988 SOW, however, no provision is made for medium level extractions in the 1991 SOW. Sodium sulfate is added to the sample as a drying agent followed by the addition of 1 ug of each of the surrogate compounds TCX and DCB. Samples designated for spiking will have 1 ug of aroclor 1254 added. The samples will be extracted using a methylene chloride/acetone (1:1) solvent mixture and subjected to high intensity sonication. The solvent will be removed and the extraction process repeated twice more. The resulting extracts will be combined and concentrated to 10 mL. From the 10 mL extract, 2 mL will be removed and exchanged into hexane. This will be used for GC/ECD analysis. The remaining 8 mL of solvent will be refrigerated and later reduced to 0.8 mL for confirmation by GC/MS if needed.

Analysis of Basin Sludges for Polyclorinated Biphenyls

Analysis:

As with the USEPA methods, analysis will be performed using a dual capillary gas chromatograph and dual electron capture detector instrument. This allows for simultaneous analysis and confirmation of the Basin residue. The method identifies and determines the concentrations of PCBs as aroclor mixtures by direct comparison to the instrument calibration using authentic aroclor mixtures.

Prior to these analysis, the GC/ECD instrument will have an initial 5 point calibration performed for aroclor 1254 over a concentration range of at least one order of magnitude. The quantitation column RSD will not exceed 15% over the range of the initial calibration. An instrument blank will be run immediately following the highest standard to access potential carry over contamination. Carry over will not exceed 1.0%. A single point calibration will be performed for aroclors 1016/1260, 1221, 1232, 1242, and 1248 at or near the continuing calibration standard concentration if linearity is previously demonstrated using aroclor 1254. Immediately following the initial calibration, and every ten samples thereafter, a continuing calibration standard and continuing calibration blank will be analyzed. Quantitation of samples using the initial calibration will continue as long as the RSD for the continuing calibration does not exceed 25% and retention times do not vary by more than +/-0.10 minutes from the initial calibration for all calibration compounds. Another initial calibration will be performed when, following system maintenance, the quantitation column continuing calibration fails. A set of sample analysis will always be preceded and completed using a passing continuing calibration standard. No surrogate or spike control criteria have been established for this matrix so no limitation for re-extraction or re-analysis currently exist.

References:

USEPA Contract Laboratory Program, Statement of Work of Organic Analysis, Multi-Media, Multi-Concentration, 1988.

USEPA Contract Laboratory Program, Statement of Work of Organic Analysis, Multi-Media, Multi-Concentration, OLM01.8, August 1991.

SW-846, Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, Method 8082, Polychlorinated Biphenyls (PCBs) by Capillary Column Gas

03/26/97 11:17 ☎509 373 4517 NO 291 003

Analysis of Basin Sludges for Polyclorinated Biphenyls

Chromatography. rev 0. January 1995.

Battelle. Analytical Chemistry (ACL) Procedure Compendium. Methods PNL-ALO-120. 345. 346. 347. Analytical method for extraction and analysis of Pesticides/PCBs and Semivolatile compounds.

Concurrences:

Kristine J. Kuhl-Klinger. Project Manager — Date 3/26/97

Ofelia P. Brect. Quality Operations — Date 3/27/97

Approval:

Cary M. Seidel. RFSH Project Manager — Date 3/26/97

Joan H. Kessner. BHI Program Manager — Date 3/26/97

S 0001-2225

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

April 14, 1997

APR 1997
RECEIVED
Data
Log In

Ms. Joan H. Kessner
Bechtel Hanford Inc.
1022 Lee Boulevard
Richland, WA 99352

Dear Ms. Kessner:

ANALYTICAL RESULTS FOR PCB GC/MS CONFIRMATION ANALYSIS OF THREE 105-N BASIN SLUDGE SAMPLES

Reference 1: Pacific Northwest National Laboratory ACL Analytical Results for PCB Analysis of Three 105-N Basin Sludge Samples. Letter report from Kristine J. Kuhl-Klinger to Joan H. Kessner, dated 4//9/97.

Attached please find the final report containing GC/MS confirmation results for three 105-N Basin samples submitted to the Pacific Northwest National Laboratory, Analytical Chemistry Laboratory by Rust Federal Services of Hanford, Inc. This report represents a follow-on to the report indentified in Reference 1 above.

The final report includes the following:

Results summary with narrative, 8 pages
Attachment A, Raw Data

Analysis included quantitation for Aroclor 1254. Review of the Aroclor 1254 results included here indicate reasonable agreement with that from the PCB by GC/ECD results for the three samples originally submitted in Reference 1. Additionally, the results for sample BOJY49, matrix spike and matrix spike duplicate agree very well with the GC/ECD analysis. Aroclor 1221 was detected as a TIC.

Battelle Boulevard ■ P.O. Box 999 ■ Richland, WA 99352

Telephone (509) 372-0398 ■ Email kj_kuhl-klinger@pnl.gov ■ Fax (509) 373-9675

If you have any questions or require clarification or assistance, please contact me at your earliest convenience.

Very truly yours,

Kristine J. Kuhl-Klinger
Acting Manager,
Analytical Chemistry Laboratory

KJK/bn
Attachments

cc: C.M. Seidel, RFS

SEMIVOLATILE ORGANIC COMPOUND ANALYSIS REPORT

SAMPLE ANALYSIS REPORTED

Analysis of N-Basin sludge sample extracts for confirmation of PCBs (and also semivolatile organic compounds) as specified in the test instructions, using gas chromatography/mass spectrometry (GC/MS) is the subject of this report.

Table 1.0
A cross reference of ACL and customer sample identification

ACL Lab Number	Sample ID
97-02534	S97N00009/BOJY49
97-02535	S97N00022/BOJY50
97-02536	S97N00023/BOJY51

SAMPLE DESCRIPTION, HANDLING AND PREPARATION

Preparation of sample extracts for SVOA was performed April 9, 1997 in the organic analysis preparation laboratory. The samples were originally extracted with methylene chloride and acetone for the analysis of PCBs using GC/ECD. A portion of the extract was retained for GC/MS confirmation.

ANALYSIS METHOD

GC/MS procedure	PNL-ALO-345 rev. 1
GC/MS instrumentation	HP-5890II/5972A GC/MS, Property # WB47238, WD25623
GC/MS location	Lab 325, 325 building

QUALITY CONTROL

The quality control (QC) features in the analytical procedure were followed as described below. The following lists the CLP-like forms, which are filed with the raw data, that relate to QC and summarizes the data and QC results.

QC Parameter	Comments
Target Compounds	Detection levels are based upon the sample size. Met requirements (see discussion). These reports are similar to CLP forms 1B & C.
TIC Compounds	Met requirements. These reports are similar to CLP form 1F.
Surrogate Recovery	No surrogate spiking was performed for the semivolatile analysis.
Matrix Spike Recovery	No matrix spiking was performed for the semivolatile analysis.
Method Blank Summary	A method blank was put through the extraction procedure and it met requirements. The information in Table 2 is similar to that on a CLP form 4B.

DFTPP Tuning Criteria	Mass spectrometer tuning and 12 hour clock met requirements (see Table 2.). These reports are similar to CLP form 5B.
Initial Calibration	Met requirements. A 5 point calibration for Aroclor 1254 was performed in addition to the SVOA calibration. These reports are similar to CLP forms 6B & C.
Continuing Calibration	Met requirements. A separate Aroclor 1254 calibration standard (from a different source) was analyzed in addition to the 5 point calibration. These reports are similar to CLP form 7B & C.
Internal Standard Compound Area and RT Summary	Met requirements. These reports are similar to CLP form 8B & C.

DATA

The data and calibration files are archived on magnetic tape and in hard copy form in the 325 building LSO office files. Table 2 correlates the pertinent files with the calibration and sample data.

Table 2.0
Analytical Sequence

Data File	Date/Time	Laboratory ID.	Sample ID.	Comment	Date Prepared
6121301.d	12/13/96 16:42	DFTPP	DFTPP	MS tune check	12/12/96
6121302.d	12/13/96 17:34	SSTD020	ICV 20 ng/uL	initial calibration	12/12/96
6121304.d	12/13/96 18:17	SSTD050	ICV 50 ng/uL	initial calibration	12/12/96
6121306.d	12/13/96 21:00	SSTD080	ICV 80 ng/uL	initial calibration	12/12/96
6121308.d	12/13/96 22:44	SSTD120	ICV 120 ng/uL	initial calibration	12/12/96
6121310.d	12/14/96 00:28	SSTD160	ICV 160 ng/uL	initial calibration	12/12/96
7040901.d	04/09/97 16:48	DFTPP	DFTPP	MS tune check	04/09/97
7040902.d	04/09/97 17:39	SSTD050	CCV	calibration check	04/09/97
7040903.d	04/09/97 18:31	AR1254	100 ng/uL.	Resteck standard	04/09/97
7040904.d	04/09/97 19:23	AR1254	50 ng/uL.	EPA standard	04/09/97
7040905.d	04/09/97 20:14	AR1254	100 ng/uL.	EPA standard	04/09/97
7040906.d	04/09/97 21:06	AR1254	250 ng/uL.	EPA standard	04/09/97
7040907.d	04/09/97 21:57	AR1254	500 ng/uL.	EPA standard	04/09/97
7040908.d	04/09/97 22:49	AR1254	1000 ng/uL.	EPA standard	04/09/97
7040909.d	04/09/97 23:41	SBLK	Method Blank.	prep. blank	04/09/97
7040910.d	02/22/97 00:33	97-02536	S97N00023/BOJY51	sample	04/09/97
7040911.d	02/22/97 01:25	97-02535	S97N00022/BOJY50	sample	04/09/97
7040912.d	02/22/97 02:16	97-02534	S97N00009/BOJY49	sample	04/09/97
7040913.d	02/22/97 03:07	97-02534	MS	sample spike	04/09/97
7040914.d	02/22/97 03:59	97-02534	MSD	sample spike dupl.	04/09/97

Laboratory data is maintained as follows:

- preparation bench sheet: filed with data in the ACL/LSO records center
- GC/MS data, sample report: filed with data in the ACL/LSO records center

RESULTS

Target Compounds: Bis(2-ethylhexyl)phthalate was found in all samples. Butylbenzylphalate was found in samples 97-02534 and 97-02536. PCB Aroclor 1254 was found samples 97-02534 and 97-02536; a trace amount was detected in sample 97-02535. The PCB calibration procedure is described below. No target compounds were found in the method blank.

Table 3.0 summarizes the target compound data found in the data package forms.

Tentatively Identified Compounds (TIC): Table 3.0 summarizes the TIC data found in the data package forms. The peak area for each TIC is compared to the most closely eluting internal standard (for which the concentration is known) to estimate the TIC concentrations. Concentrations of TICs are estimates based on a relative response factor of one. Identification of each TIC is made using a computerized search of the NIST mass spectral data base library in an attempt to match the mass spectra. Any TICs reported as Unknown did not have satisfactory matches with the data base. The samples and blank contained aldol condensation products such as 4-hydroxy-4-methyl-2-pentanone, which is to be expected since acetone was used in the extraction. Sample 97-02534 contained the greatest number of TICs, which included many hydrocarbons, acids, esters, phosphate esters, alkyl phthalate esters, PCBs, and polychlorinated terphenyls. Unfortunately, the 75,000 compound NIST mass spectral database search did not give any matches for the polychlorinated terphenyls, and it appears that the database does not include these compounds. No satisfactory library search matches were found for these compounds. Tentative identification of these is based on mass spectral interpretation which is described below. Polychlorinated terphenyls are found in mixtures such as Kanechlor 500 [61788-33-8], Aroclor 5442 [12642-23-8], and Aroclor 5460 [11126-42-4]. Unfortunately, without comparison to a reference material, no product identification can be made. Biphenyl and three isomers of monochlorobipenyl were found in sample 97-02534. These compounds are components of Aroclor 1221.

MASS SPECTRAL INTERPRETATION

Calculated molecular ion patterns for hepta-, octa- and nona-chloroterphenyls based on naturally occurring carbon, hydrogen and chlorine isotopes and representative spectra are given as follows:

Empirical formula: $C_{18}H_7Cl_7$

mass	%
468	44.3
469	8.9
470	100.0
471	20.0
472	97.0
473	19.2
474	52.5
475	10.3
476	17.2
477	3.3
478	3.4
479	0.6
480	0.4
481	0.1

Empirical formula: $C_{18}H_6Cl_8$

mass	%
502	34.3
503	6.9
504	88.5
505	17.7
506	100.0
507	19.8
508	64.8
509	12.7
510	26.3
511	5.1
512	6.9
513	1.3
514	1.2
515	0.2
516	0.1

Empirical formula: $C_{18}H_5Cl_9$

mass	%
536	26.8
537	5.4
538	77.5
539	15.5
540	100.0
541	19.9
542	75.4
543	14.9
544	36.7
545	7.2
546	12.0
547	2.3
548	2.6
549	0.5
550	0.4
551	0.1

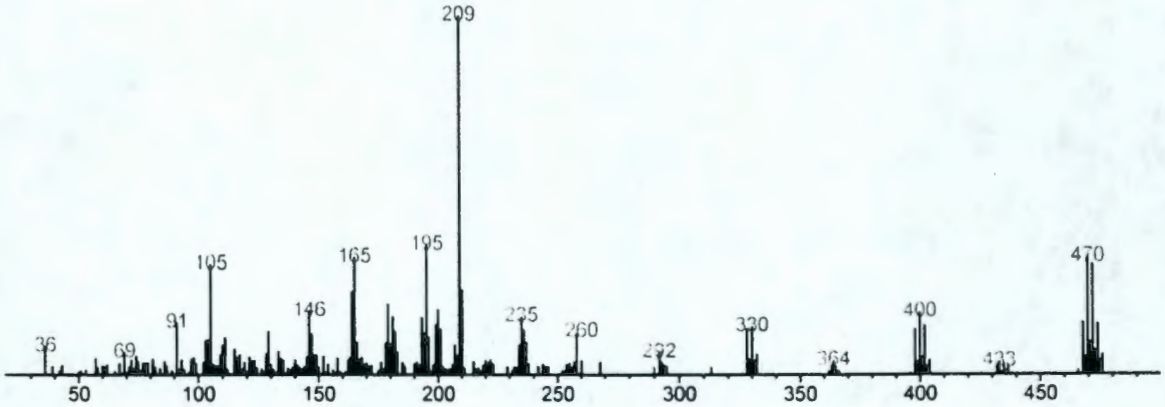

Figure 1 peak at 37.76 minutes (sample 97-02534)

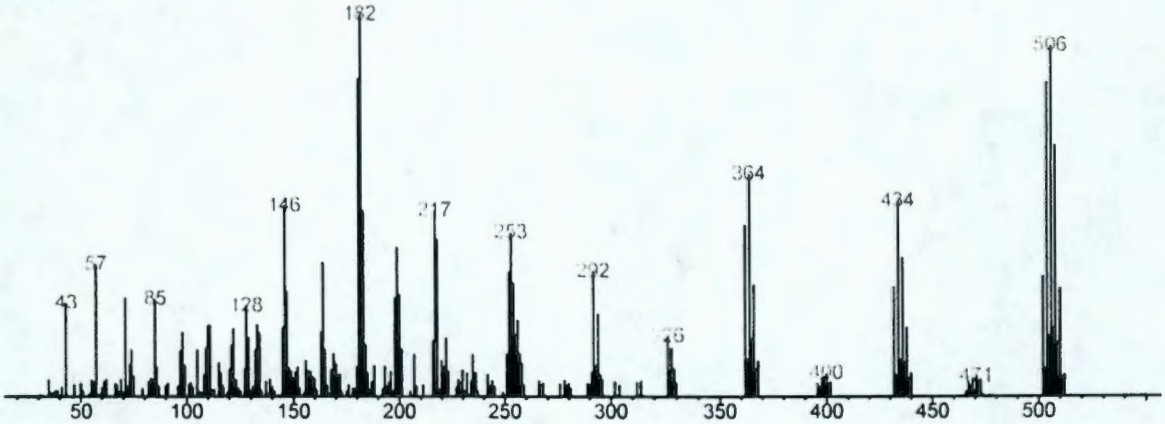

Figure 2 peak at 38.66 minutes (sample 97-02534)

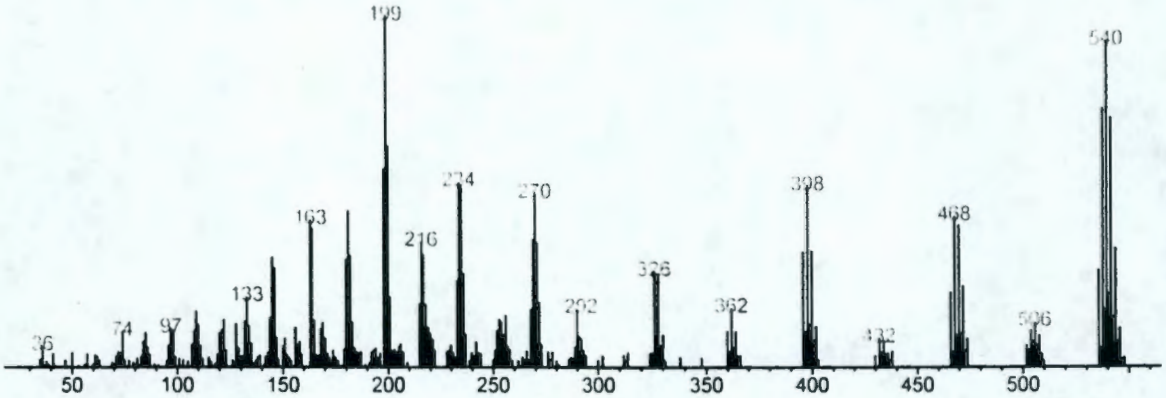

Figure 3 peak at 41 minutes (sample 97-02534)

DISCUSSION

The samples were analyzed at a sample size dilution which gives a nominal quantitation limit of 10000 ppb for the semivolatile compounds, however the actual detection limit for those target analytes is much lower.

Using a nominal estimated detection limit of 0.5-1.0 nanogram on-column for each compound, and based on the sample size and other factors, detection levels of between 500 and 1000 ppb were achieved for all target compounds. The nominal quantitation limit for the PCB Aroclor 1254 is much higher since this is a multicomponent material. Using the 50 nanogram per microliter calibration standard, the nominal quantitation limit is 50,000 ppb for Aroclor 1254, however as is the case with the single component SVOA analytes, the true minimum detectable quantity is substantially lower. Additionally, the actual quantitation limit for each sample is based on the sample size and final extract volume. An 8 milliliter portion of the extraction solvent was concentrated to 0.8 milliters. The sample aliquot size was approximately 1 gram (exact weights were used for determination of the quantitation limit and concentrations given in the data forms). A five point calibration was performed for Aroclor 1254. The only standard solution of Aroclor 1254 available, of sufficiently high concentration to prepare the entire calibration range, was an EPA reference material with an past due expiration date. As a check, the calibration data was compared to a single point standard prepared from a less concentrated Aroclor 1254 stock solution(Restek Corp.) that was current and had vendor supplied certifications. Both standards proved to be virtually identical.

Initial calibration, continuing calibration, MS tuning verification, and internal standard area forms are found within the data package.

ANALYST _____ Date 4/14/97 REVIEWER _____ Date 4-14-97

Table 3.0 Target and TIC compounds (ug/Kg)

			7040909.d	7040910.d	7040911.d	7040912.d
			Method Blank	97-02536	97-02535	97-02534
Compound	CAS Reg No.	RT	SBLK	BOJY51/ S97N00023	BOJY50/ S97N00022	BOJY49/ S97N00009
Butylbenzylphthalate	85-68-7			3300		770
Bis(2-Ethylhexyl)phthalate	117-81-7			13000	2100	40000
AROCLOR 1254				7800	140	160000
Hydroperoxide, 1-methylethyl	3031-75-2	4.83		2200		
2-Pentanone, 4-hydroxy-4-methyl-	123-42-2	5.76	91000	130000	150000	80000
Ethylbenzene	100-41-4	6.37				12000
Benzene, 1,3-dimethyl-	108-38-3	6.71				51000
Benzene, 1,2-dimethyl-	95-47-6	7.48				33000
Benzene, (1-methylethyl)-	98-82-8	8.48				1600
Biphenyl	92-52-4	18.27				4800
1,1'-Biphenyl, 3-chloro-	2051-61-8	20.17				21000
1,1'-Biphenyl, 2-chloro-	2051-60-7	21.29				1700
1,1'-Biphenyl, 4-chloro-	2051-62-9	21.42				5500
Benzene, (1,1-dimethyldecyl)-	27854-40-6	22.11				1900
Ethanone, 1-(2-methylphenyl)-	577-16-2	22.69				1800
1,1'-Biphenyl, 2,4'-dichloro-	34883-43-7	23.12				3800
Benzoic acid, 3-[(trimethylsilyl)oxy]-,	27798-50-1	24.14				3600
1,1'-Biphenyl, pentachloro-	25429-29-2	28.19				1700
1,1'-Biphenyl, 2,2',3',4,6-Pentachloro-	60233-25-2	28.25				2400
1,1'-Biphenyl, 2,3',4,5,5'-pentachloro-	68194-12-7	28.44				3000
1,1'-Biphenyl, 2,2',4,4',6-Pentachloro-	39485-83-1	28.80				2600
1,1'-Biphenyl, 2,2',3,3',6-pentachloro-	52663-60-2	29.40				1600
1,1'-Biphenyl, 3,3',4,4',5,5'-hexachloro	32774-16-6	30.27				4500
Stilbene, 4-amino- (E)-	4309-66-4	31.16				2600
Phosphoric acid, triphenyl ester	115-86-6	31.29				19000
Stilbene, 4-amino- (E)-	4309-66-4	31.48				2400

Table 3.0 cont.

Benzoic acid, 2-[(trimethylsilyl)oxy]-,	18001-14-4	31.65				4100
Hexanoic acid, 2-ethyl-, oxybis(2,1-etha	18268-70-7	31.88				2500
Benzoic acid, 2-[(trimethylsilyl)oxy]-,	18001-14-4	31.92				5300
p-Heptylaniline	37529-27-4	32.81				1500
1,2-Benzenedicarboxylic acid, isodecyl o	1330-96-7	35.78				5100
1,2-Benzenedicarboxylic acid, diisodecyl	26761-40-0	35.88				6200
Unknown alkyl phthalate		36.05				8300
1,2-Benzenedicarboxylic acid, isodecyl o	1330-96-7	36.13				9300
Phthalic acid, diisooctyl ester	1330-91-2	36.31				4700
Trimethylcarbazole + Unknown polychlorinated terphenyl	64844-51-5	37.75				2600
Unknown polychlorinated terphenyl		38.66				3900
Unknown polychlorinated terphenyl		40.09				8500
Unknown polychlorinated terphenyl		40.62				4100
Unknown polychlorinated terphenyl		40.99				7300
Unknown polychlorinated terphenyl		41.26				8600
Unknown polychlorinated terphenyl		42.19				11000
Unknown polychlorinated terphenyl		42.47				4900