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WSRC-RP--90-0812

DE91 006520

## Analysis of Stream Bed Sediments of Four Mile Creek (U)

August 13, 1990

J. S. Haselow, Environmental Sciences

Approved By:

D. B. Moore, Section Manager  
Environmental Sciences

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WESTINGHOUSE SAVANNAH RIVER COMPANY  
SAVANNAH RIVER LABORATORY  
SAVANNAH RIVER SITE  
AIKEN, SC 29808

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Prepared for the U. S. Department of Energy under Contract No. DE-AC09-89SR18035

**MASTER** *JMB*

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## Analysis of Stream Bed Sediments of Four Mile Creek

### INTRODUCTION

Until 1988, solutions containing nitric acid, sodium hydroxide, low levels of radionuclides (mostly tritiated water) and some metals were discharged to unlined seepage basins at the F and H Areas of the Savannah River Site (SRS) as part of normal operations (Killian et al., 1987a,b). The basins are now being closed according to the Resource Conservation and Recovery Act (RCRA). As part of the closure, a Part B Post-Closure Care Permit is being prepared. The Part B permit requires information on contaminant concentrations in stream bed sediments in the adjacent Four Mile Creek, which are reported herein.

The area that includes the basins is bounded to the north and west by Upper Three Runs Creek, and to the south by Four Mile Creek (Figure 1). These tributaries of the Savannah River are drains for the shallow groundwater system in the area. Constituents entering the basins seep to the underlying water table. Once in the water table, most of the constituents flow horizontally to the south in the water table towards Four Mile Creek (FMC). However, a relatively small fraction of the constituents enter a lower water-bearing formation that flows towards Upper Three Runs Creek. Numerical simulations of flow in the hydrologic system underlying the basins indicate that travel times for unretarded constituents from the basins to FMC is on the order of 10 years, and about 70 years from the basins to Upper Three Runs Creek (GeoTrans, 1988). Discharges to the basins started in the 1950's. Therefore, a steady-state profile for unretarded constituents (e.g. tritium) has developed between the basins and FMC, and it is unlikely that constituents emanating from the basins have reached Upper Three Runs Creek.

### METHODS

The Four Mile Creek streambed sediments were collected with a mini-dredge thrown from the shore line. Samples were collected from the middle of the stream, and care was taken to minimize turbidity. Once collected, the sediments were gravity-drained in the field and placed in an ice-cooler. Thereafter, all the samples were taken to a controlled laboratory and stored at approximately 3°C. A small sample was collected and then analyzed for alpha, beta, and gamma concentrations to determine the level of shipping required. (The screening indicated that the samples were nonradioactive according to Department of Transportation standards.) The samples were shipped to MetaTrace Inc. for analyses. MetaTrace air dried all of the samples (except those for tritium analysis) before analysis. The analytical methods that were used are given in Appendix A on the raw data reports provided by MetaTrace.

The locations of the six samples that were collected are shown in Figure 1. These samples are coded as FMCSSED1 through FMCSSED6 (Four Mile Creek SEDiment sample number). FMCSSED1 was collected upstream of the Separations Area and FMCSSED6 was collected downstream of the Separations Area (and just upstream of C Reactor). FMCSSED2 was collected at an impacted point near H Area; FMCSSED3 was collected at a point between and F&H Area, and FMCSSED4 was collected at an impacted point at F Area. The other samples were collected between these points. A brief description of the sampling points is provided in Table 1.

## RESULTS

The results obtained are summarized in Table 2 and are indicative of particulate transport of constituents. The concentration of constituents are greater downstream, than midstream and upstream. The particles transporting the constituents are concentrating downstream, which is especially evident at sampling point FMCSSED6. FMCSSED6 is at the sampling point where the water is flowing most slowly, and as a result small particles settle out of the stream.

The concentrations of constituents in the FMC streambed are compared to background soils concentrations in the Upland unit at the SRS (Looney et al., 1990). Even though the soils in the Upland Unit may not be representative of streambed sediments. Of the metals analyzed, cadmium and copper concentrations are the only constituents above the maximum background soils values. However, copper was not discharged to the basins (Killian et al., 1987a,b), and during a recent survey along the FMC seepline, copper concentrations were not determined to be elevated (Haselow et al., 1990).

Of the radionuclides analyzed, gross alpha, gross beta,  $^{90}\text{Sr}$ , and  $^{238}\text{U}$  are above maximum background soil values in at least one sample. Cesium-137, Cobalt-60, Americium-241, Radium-226, and Technetium-99 may also be elevated, but there is not a background value to compare for these constituents. Tritium concentrations in the soils are not reported in Table 2 because tritium moves essentially as water and would not be incorporated in the soil matrix. However, tritium concentrations are reported in Appendix A, but should be interpreted cautiously.

Neither chloride or nitrate are elevated in the streambed sediments as compared to background soils values.

## ACKNOWLEDGEMENTS

Ray Cheeseman assisted with the collection and shipment of the samples. Dawn Kaback, Ralph Nichols, Beth Wheat and Brian Looney

provided helpful editorial comments. In addition, Brian Looney provided technical advise for this project. The author appreciates the efforts of these people.

Table 1. Description of sampling points.

<u>Sample Code</u>	<u>Description</u>
FMCSSED1	Crossing of Four Mile Creek and Road E-1. Stream is slowly flowing and has significant iron-oxide (rust). Coarse sand sediments.
FMCSSED2	Crossing of Four Mile Creek and Road 4. Stream is clear relatively fast moving. Coarse sand.
FMCSSED3	Directly down-gradient from H-Area Seepage Basins. About 200 yards west of FMC and Road 4. Stream is clear and relatively fast moving. Coarse sand.
FMCSSED4	Crossing of FMC and Road C. Stream is clear and relatively fast moving. Coarse sand.
FMCSSED5	Crossing of FMC and Road C-4. Stream is clear and relatively fast moving. Sample hard to collect because of rip-rap on bottom of stream. Sample did not contain rocks. Poorly sorted medium to coarse sands with organic material.
FMCSSED6	Crossing of FMC and Road A-6. Stream was more turbid and slower flowing. Silty organic rich sediments.

Table 2. Analytical results for Four Mile Creek streambed sediments.

PARAMETER	FMCS1	FMCS2	FMCS3	FMCS4	FMCS5	FMCS6
<b>Metals (ppm)</b>						
Aluminum	2320	1110	1980	993	6890	9390
Arsenic	6.53	<0.60	1.02	1.60	4.39	6.53
Cadmium	<0.8	<0.8	<0.80	<0.80	2.54	5.06
Chromium	5.38	3.29	4.94	2.47	11.8	17.8
Copper	<2.8	<2.80	3.50	<2.80	20.3	17.0
Lead	3.04	0.93	2.04	1.51	7.26	9.23
Mercury	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	<3.4	<3.40	<3.40	<3.40	11.6	13.8
Selenium	<0.6	<0.60	<0.60	<0.60	<0.60	<0.60
Sodium	31.8	34.8	40.7	66.1	57.6	57.3
Zinc	7.59	9.65	17.3	16.0	86.8	109
<b>Radionuclides (pCi/gm)</b>						
Gross Alpha	<5	<4	<4	<4	38	40
Gross Beta	7.3	8.3	16	10	160	210
Cesium 134	<1	<1	<1	<1	<1	<1
Cesium 137	<1	18	23	3.1	130	210
Cobalt 60	<1	<1	<1	<1	3.5	2.7
Iodine 129	<1	<1	<1	<1	<1	<1
Americium 241	1.0	1.4	<1	<1	3.0	1.8
Plutonium 238	<1	<1	<1	<1	<1	<1
Pu 239/240	<1	<1	<1	<1	<1	<1
Neptunium 237	<1	<1	<1	<1	<1	<1
Radium 226	1.2	<1	1.6	<1	12	18
Strontium 89	<1	<1	<1	<1	<1	<1
Strontium 90	<1	<1	<1	<1	9.5	5.4
Technetium 99	<1	<1	<1	<1	9.3	10
Uranium 238	<1	<1	<1	<1	12	4.1
<b>Anions (ppm)</b>						
Chloride	1.97	1.54	2.35	1.02	4.62	3.52
Nitrate	0.81	1.11	0.68	0.38	0.43	0.33

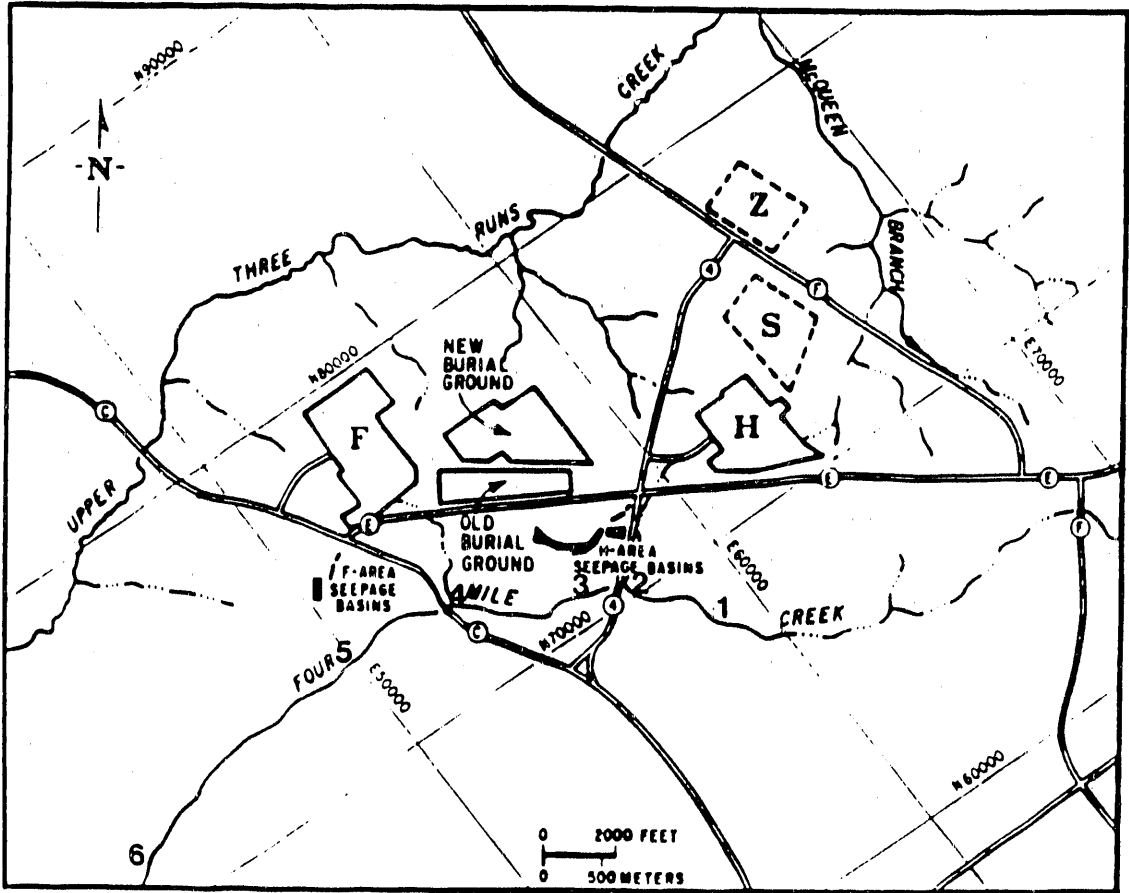


Figure 1. Location of the General Separations Area.

REFERENCES

GeoTrans, 1988. Characterization of Groundwater Flow and Transport in the General Separations Area Savannah River Plant, report for E.I. du Pont and de Nemours, Savannah River Laboratory, Aiken, SC.

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APPENDIX A

WESTINGHOUSE/SAVANNAH RIVER  
SAVANNAH RIVER SITE  
AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: METALS  
METHOD: 200 SERIES  
MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC UG/G	Qual.	DETECTION LIMIT UG/G	DILUTION
650-001	FMC-SED-1	Aluminum	05/22/90	NA	06/27/90	2320		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	0.98	B	0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	ND		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	5.38		1.00	1.0
		Copper	05/22/90	NA	06/27/90	ND		2.80	1.0
		Lead	05/22/90	NA	06/25/90	3.04		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	ND		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	31.8	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	7.59		0.80	1.0		
650-001 DUP	FMC-SED-1	Aluminum	05/22/90	NA	06/27/90	3130		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	0.99	B	0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	ND		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	6.76		1.00	1.0
		Copper	05/22/90	NA	06/27/90	ND		2.80	1.0
		Lead	05/22/90	NA	06/25/90	3.30		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	ND		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	30.4	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	4.11		0.80	1.0		
650-002	FMC-SED-2	Aluminum	05/22/90	NA	06/27/90	1110		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	ND		0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	ND		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	3.29		1.00	1.0
		Copper	05/22/90	NA	06/27/90	ND		2.80	1.0
		Lead	05/22/90	NA	06/25/90	0.93		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	ND		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	34.8	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	9.65		0.80	1.0		

\* NOTES: NA=NOT APPLICABLE; ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
SAVANNAH RIVER SITE  
AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: METALS  
METHOD: 200 SERIES  
MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC UG/G	DETECTION		
							Qual.	LIMIT UG/G	DILUTION
650-003	FMC-SED-3	Aluminum	05/22/90	NA	06/27/90	1980		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	1.02	B	0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	ND		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	4.94		1.00	1.0
		Copper	05/22/90	NA	06/27/90	3.50	B	2.80	1.0
		Lead	05/22/90	NA	06/25/90	2.04		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	ND		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	40.7	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	17.3		0.80	1.0		
650-004	FMC-SED-4	Aluminum	05/22/90	NA	06/27/90	993		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	1.60	B	0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	ND		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	2.47		1.00	1.0
		Copper	05/22/90	NA	06/27/90	ND		2.80	1.0
		Lead	05/22/90	NA	06/25/90	1.51		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	ND		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	66.1	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	16.0		0.80	1.0		
650-005	FMC-SED-5	Aluminum	05/22/90	NA	06/27/90	6890		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	4.39		0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	2.54		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	11.8		1.00	1.0
		Copper	05/22/90	NA	06/27/90	20.3		2.80	1.0
		Lead	05/22/90	NA	06/25/90	7.26		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	11.6		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	57.6	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	86.8		0.80	1.0		

\* NOTES: NA=NOT APPLICABLE; ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: METALS  
 METHOD: 200 SERIES  
 MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC UG/G	DETECTION LIMIT		
							Qual.	UG/G	DILUTION
650-006	FMC-SED-6	Aluminum	05/22/90	NA	06/27/90	9390		8.80	1.0
		Arsenic	05/22/90	NA	06/26/90	6.53		0.60	1.0
		Cadmium	05/22/90	NA	06/27/90	5.06		0.80	1.0
		Chromium	05/22/90	NA	06/27/90	17.8		1.00	1.0
		Copper	05/22/90	NA	06/27/90	17.0		2.80	1.0
		Lead	05/22/90	NA	06/25/90	9.23		0.40	1.0
		Mercury	05/22/90	NA	06/27/90	ND		0.10	1.0
		Nickel	05/22/90	NA	06/27/90	13.8		3.40	1.0
		Selenium	05/22/90	NA	06/25/90	ND		0.60	1.0
		Sodium	05/22/90	NA	06/27/90	57.3	B	5.80	1.0
Zinc	05/22/90	NA	06/27/90	109		0.80	1.0		
BLANK	QC-metaTRACE	Aluminum	NA	NA	06/27/90	8.92	B	8.80	1.0
		Arsenic	NA	NA	06/26/90	ND		3.00	1.0
		Cadmium	NA	NA	06/27/90	ND		0.80	1.0
		Chromium	NA	NA	06/27/90	ND		1.00	1.0
		Copper	NA	NA	06/27/90	ND		2.80	1.0
		Lead	NA	NA	06/25/90	ND		0.40	1.0
		Mercury	NA	NA	06/27/90	ND		0.20	1.0
		Nickel	NA	NA	06/27/90	ND		3.40	1.0
		Selenium	NA	NA	06/25/90	ND		3.00	1.0
		Sodium	NA	NA	06/27/90	12.7	B	5.80	1.0
Zinc	NA	NA	06/27/90	1.10	B	10.0	1.0		
						%			
						RECOVERY			
LCS	QC-metaTRACE	Aluminum	NA	NA	06/27/90	100 %			
		Arsenic	NA	NA	06/26/90	98 %			
		Cadmium	NA	NA	06/27/90	94 %			
		Chromium	NA	NA	06/27/90	96 %			
		Copper	NA	NA	06/27/90	98 %			
		Lead	NA	NA	06/25/90	94 %			
		Mercury	NA	NA	06/27/90	95 %			
		Nickel	NA	NA	06/27/90	94 %			
		Selenium	NA	NA	06/25/90	108 %			
		Sodium	NA	NA	06/27/90	103 %			
Zinc	NA	NA	06/27/90	93 %					

\* NOTES: NA=NOT APPLICABLE; ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
SAVANNAH RIVER SITE  
AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O 32

CATEGORY: RADIOCHEMICAL  
PARAMETER: Gross Alpha/Beta  
METHOD: EPA 900.0  
MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL.	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	Gross Alpha	05/22/90	NA	06/23/90	ND		5	1.0
		Gross Beta	05/22/90	NA	06/23/90	7.3	+/- 4.5	-	1.0
650-002	FMC-SED-2	Gross Alpha	05/22/90	NA	06/23/90	ND		4	1.0
		Gross Beta	05/22/90	NA	06/23/90	8.3	+/- 4.0	-	1.0
650-003	FMC-SED-3	Gross Alpha	05/22/90	NA	06/23/90	ND		4	1.0
		Gross Beta	05/22/90	NA	06/23/90	16	+/- 4	-	1.0
650-004	FMC-SED-4	Gross Alpha	05/22/90	NA	06/23/90	ND		4	1.0
		Gross Beta	05/22/90	NA	06/23/90	10	+/- 4	-	1.0
550-005	FMC-SED-5	Gross Alpha	05/22/90	NA	06/23/90	38	+/- 7	-	1.0
		Gross Beta	05/22/90	NA	06/23/90	160	+/- 20	-	1.0
650-006	FMC-SED-6	Gross Alpha	05/22/90	NA	06/23/90	40	+/- 7	-	1.0
		Gross Beta	05/22/90	NA	06/23/90	<10	+/- 30	-	1.0
650-006 DUP	FMC-SED-6	Gross Alpha	05/22/90	NA	06/23/90	40	+/- 7	-	1.0
		Gross Beta	05/22/90	NA	06/23/90	210	+/- 30	-	1.0
BLANK	QC-metaTRACE	Gross Alpha	NA	NA	06/23/90	ND		1	1.0
		Gross Beta	NA	NA	06/23/90	ND		1	1.0

TARGET	FOUND	% RECOVERY
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STD 3563	QC-metaTRACE	Gross Alpha	8.8	7.4	84
		Gross Beta	8.9	6.7	75

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O.32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Americium 241  
 METHOD: AM-01  
 MATRIX: SOIL

REPORT DATE: 07/13/90

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metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL.	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/03/90	ND		1	1.0
650-001 DUP	FMC-SED-1	05/22/90	NA	07/03/90	1.0	+/- 0.3	-	1.0
650-002	FMC-SED-2	05/22/90	NA	07/03/90	1.4	+/- 0.3	-	1.0
650-003	FMC-SED-3	05/22/90	NA	07/03/90	ND		1	1.0
650-004	FMC-SED-4	05/22/90	NA	07/03/90	ND		16	1.0
650-005	FMC-SED-5	05/22/90	NA	07/03/90	3.0	+/- 0.8	-	1.0
650-006	FMC-SED-6	05/22/90	NA	07/03/90	1.8	+/- 0.9	-	1.0
BLANK	QC-metaTRACE	NA	NA	07/03/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 755	QC-metaTRACE		8.8	6.1	69			

NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
SAVANNAH RIVER SITE  
AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O.32

CATEGORY: RADIOCHEMICAL  
PARAMETER: Gamma Count  
METHOD: EPA 901.1  
MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL.	DETECTION LIHIT pCi/G	DILUTION
650-001	FMC-SED-1	Cesium 134	05/22/90	NA	06/26/90	ND		1	1.0
		Cesium 137	05/22/90	NA	06/26/90	ND		1	1.0
		Cobol 60	05/22/90	NA	06/26/90	ND		1	1.0
650-002	FMC-SED-2	Cesium 134	05/22/90	NA	06/26/90	ND		1	1.0
		Cesium 137	05/22/90	NA	06/26/90	18	+/- 2	-	1.0
		Cobol 60	05/22/90	NA	06/26/90	ND		1	1.0
650-003	FMC-SED-3	Cesium 134	05/22/90	NA	06/27/90	ND		1	1.0
		Cesium 137	05/22/90	NA	06/27/90	23	+/- 3	-	1.0
		Cobol 60	05/22/90	NA	06/27/90	ND		1	1.0
650-004	FMC-SED-4	Cesium 134	05/22/90	NA	06/27/90	ND		1	1.0
		Cesium 137	05/22/90	NA	06/27/90	3.1	+/- 0.4	-	1.0
		Cobol 60	05/22/90	NA	06/27/90	ND		1	1.0
650-005	FMC-SED-5	Cesium 134	05/22/90	NA	06/28/90	ND		1.6	1.0
		Cesium 137	05/22/90	NA	06/28/90	130	+/- 20	-	1.0
		Cobol 60	05/22/90	NA	06/28/90	3.5	+/- 0.4	-	1.0
650-006	FMC-SED-6	Cesium 134	05/22/90	NA	06/28/90	ND		1.2	1.0
		Cesium 137	05/22/90	NA	06/28/90	210	+/- 30	-	1.0
		Cobol 60	05/22/90	NA	06/28/90	2.7	+/- 0.3	-	1.0
650-006 DUF	FMC-SED-6	Cesium 134	05/22/90	NA	06/29/90	ND		1.2	1.0
		Cesium 137	05/22/90	NA	06/29/90	210	+/- 30	-	1.0
		Cobol 60	05/22/90	NA	06/29/90	2.7	+/- 0.3	-	1.0
BLANK	QC-metaTRACE	Cesium 134	NA	NA	07/02/90	ND		1	1.0
		Cesium 137	NA	NA	07/02/90	ND		1	1.0
		Cobol 60	NA	NA	07/02/90	ND		1	1.0

TARGET	FOUND	% RECOVERY
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STD QC-metaTRACE Radium 226 50 50 104

\* NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
SAVANNAH RIVER SITE  
AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O 32

CATEGORY: RADIOCHEMICAL  
PARAMETER: Iodine 129 by Gamma Count  
METHOD: EPA 901.1  
MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pci/G	QUAL.	DETECTION LIMIT pci/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	06/26/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	06/26/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	06/27/90	ND		1.5	1.0
650-004	FMC-SED-4	05/22/90	NA	06/27/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	06/28/90	ND		5.6	1.0
650-006	FMC-SED-6	05/22/90	NA	06/28/90	ND		4.3	1.0
650-006 DUP	FMC-SED-6	05/22/90	NA	06/29/90	ND		4.3	1.0
BLANK	QC-metaTRACE	NA	NA	07/02/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD	QC-metaTRACE		50	52	104			

\* NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED



WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Neptunium 237  
 METHOD: EPA 907  
 MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL.	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/08/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	07/08/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	07/08/90	ND		1	1.0
650-004	FMC-SED-4	05/22/90	NA	07/08/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	07/08/90	ND		1	1.0
650-006	FMC-SED-6	05/22/90	NA	07/08/90	ND		1	1.0
650-006 DUP	FMC-SED-6	05/22/90	NA	07/08/90	ND		1	1.0
BLANK	QC-metaTRACE	NA	NA	07/08/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 757	QC-metaTRACE		18	18.3	102			

\* NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Plutonium 238, 239, 240  
 METHOD: EERF - 00.09  
 MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL.	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
650-002	FMC-SED-2	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
650-003	FMC-SED-3	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
650-004	FMC-SED-4	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
650-005	FMC-SED-5	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
650-006	FMC-SED-6	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
650-006 DUP	FMC-SED-6	PU 238	05/22/90	NA	06/28/90	ND		1	1.0
		PU 239/240	05/22/90	NA	06/28/90	ND		1	1.0
BLANK	QC-metaTRACE	PU 238	NA	NA	06/28/90	ND		1	1.0
		PU 239/240	NA	NA	06/28/90	ND		1	1.0

TARGET	FOUND	% RECOVERY
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STD 754	QC-metaTRACE	PU 239	94.3	93.7	99
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WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Radium 226  
 METHOD: EPA 903.0  
 MATRIX: SOIL

REPORT DATE: 07/11/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/10/90	1.2	+/- 0.2	-	1.0
650-002	FMC-SED-2	05/22/90	NA	07/10/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	07/10/90	1.6	+/- 0.2	-	1.0
650-004	FMC-SED-4	05/22/90	NA	07/10/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	07/10/90	12	+/- 2	-	1.0
650-006	FMC-SED-6	05/22/90	NA	07/10/90	18	+/- 2	-	1.0
650-006 DUP	FMC-SED-6	05/22/90	NA	07/10/90	18	+/- 2	-	1.0
BLANK	QC-metaTRACE	NA	NA	07/10/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 762	QC-metaTRACE		10.6	12.5	118			

\* NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Strontium 89  
 METHOD: EPA 905  
 MATRIX: SOIL

REPORT DATE: 07/13/90

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metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/12/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	07/12/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	07/12/90	ND		1	1.0
650-004	FMC-SED-4	05/22/90	NA	07/12/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	07/12/90	ND		1	1.0
650-006	FMC-SED-6	05/22/90	NA	07/12/90	ND		1	1.0
650-006 DUP	FMC-SED-6	05/22/90	NA	07/12/90	ND		1	1.0
BLANK	QC-metaTRACE	NA	NA	07/12/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 765	QC-metaTRACE		12.8	9.4	73			

NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Strontium 90  
 METHOD: EPA 905  
 MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/12/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	07/12/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	07/12/90	ND		1	1.0
650-004	FMC-SED-4	05/22/90	NA	07/12/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	07/12/90	9.5	+/- 1.0	-	1.0
650-006	FMC-SED-6	05/22/90	NA	07/12/90	5.4	+/- 0.6	-	1.0
650-006 DUP	FMC-SED-6	05/22/90	NA	07/12/90	5.2	+/- 0.6	-	1.0
BLANK	QC-metaTRACE	NA	NA	07/12/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 765	QC-metaTRACE		8.7	7.4	85			

NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Technetium 99  
 METHOD: HA SL300E - TC - 01  
 MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/10/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	07/10/90	ND		1	1.0
650-002 DUP	FMC-SED-2	05/22/90	NA	07/10/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	07/10/90	ND		1	1.0
650-004	FMC-SED-4	05/22/90	NA	07/10/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	07/10/90	9.3	+/- 1.0	-	1.0
650-006	FMC-SED-6	05/22/90	NA	07/10/90	10	+/- 1	-	1.0
BLANK	QC-metaTRACE	NA	NA	07/10/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 770	QC-metaTRACE		17.6	22.8	130			

NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Tritium  
 METHOD: LA9763-R230  
 MATRIX: SOIL

REPORT DATE: 05/04/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	07/11/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	07/11/90	29	+/- 3	-	1.0
650-003	FMC-SED-3	05/22/90	NA	07/11/90	86	+/- 9	-	1.0
650-003 DUP	FMC-SED-3	05/22/90	NA	07/11/90	84	+/- 9	-	1.0
650-004	FMC-SED-4	05/22/90	NA	07/11/90	190	+/- 20	-	1.0
650-005	FMC-SED-5	05/22/90	NA	07/11/90	650	+/- 70	-	1.0
650-006	FMC-SED-6	05/22/90	NA	07/11/90	380	+/- 40	-	1.0
BLANK	QC-metaTRACE	05/22/90	NA	07/11/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 771	QC-metaTRACE		459	389	85			

NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED

WESTINGHOUSE/SAVANNAH RIVER  
 SAVANNAH RIVER SITE  
 AIKEN, SOUTH CAROLINA 29808

PROJECT NUMBER: 121-03 R.O. 32

CATEGORY: RADIOCHEMICAL  
 PARAMETER: Uranium 238  
 METHOD: EERF00.09  
 MATRIX: SOIL

REPORT DATE: 07/13/90

metaTRACE ID	CLIENT ID	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	CONC pCi/G	QUAL.	DETECTION LIMIT pCi/G	DILUTION
650-001	FMC-SED-1	05/22/90	NA	06/29/90	ND		1	1.0
650-002	FMC-SED-2	05/22/90	NA	06/29/90	ND		1	1.0
650-003	FMC-SED-3	05/22/90	NA	06/29/90	ND		1	1.0
650-004	FMC-SED-4	05/22/90	NA	06/29/90	ND		1	1.0
650-005	FMC-SED-5	05/22/90	NA	06/29/90	12	+/- 2	-	1.0
650-006	FMC-SED-6	05/22/90	NA	06/29/90	4.1	+/- 0.5	-	1.0
650-006 DUP	FMC-SED-6	05/22/90	NA	06/29/90	3.0	+/- 0.3	-	1.0
BLANK	QC-metaTRACE	NA	NA	06/29/90	ND		1	1.0
			TARGET	FOUND	% RECOVERY			
STD 754	QC-metaTRACE		562	740	132			

NOTES: NA=NOT APPLICABLE, ND=NOT DETECTED



WESTINGHOUSE/SAVANNAH RIVER  
SAVANNAH RIVER SITE  
AIKEN, SOUTH CAROLINA 29808

PROJECT #: 121-03 R.O.32

METHOD: EPA 300.0

MATRIX: SOIL

REPORT DATE: 07/13/90

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metaTRACE ID	CLIENT ID	PARAMETER	DATE SAMPLED	DATE ANALYZED	CONC UG/G	DETECTION	
						LIMIT UG/G	DILUTION
650-001	FMC-SED-1	Chloride	05/22/90	06/27/90	1.97	1.25	5
		Nitrate	05/22/90	06/27/90	0.81	0.02	5
650-002	FMC-SED-2	Chloride	05/22/90	06/27/90	1.54	1.25	5
		Nitrate	05/22/90	06/27/90	1.11	0.02	5
650-003	FMC-SED-3	Chloride	05/22/90	06/27/90	2.35	1.25	5
		Nitrate	05/22/90	06/27/90	0.68	0.02	5
650-004	FMC-SED-4	Chloride	05/22/90	06/27/90	1.02	1.25	5
		Nitrate	05/22/90	06/27/90	0.38	0.02	5
650-005	FMC-SED-5	Chloride	05/22/90	06/27/90	4.62	1.25	5
		Nitrate	05/22/90	06/27/90	0.43	0.02	5
650-006	FMC-SED-6	Chloride	05/22/90	06/27/90	3.02	1.25	5
		Nitrate	05/22/90	06/27/90	0.33	0.02	5
650-006 DUP	FMC-SED-6	Chloride	05/22/90	06/27/90	3.52	1.25	5
		Nitrate	05/22/90	06/27/90	0.23	0.02	5
BLANK	QC-metaTRACE	Chloride	NA	06/27/90	ND	1.25	5
		Nitrate	NA	06/27/90	ND	0.02	5
					% RECOVERY		
LCS	QC-metaTRACE	Chloride	NA	06/27/90	95 %		
		Nitrate	NA	06/27/90	110 %		
ICV	QC-metaTRACE	Chloride	NA	06/27/90	96 %		
		Nitrate	NA	06/27/90	102 %		

**- END -**

**DATE FILMED**

02 / 27 / 91