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PCS-17/18

FINAL RADIOLOGICAL SURVEY REPORT FOR REMEDIATION ACTIVITIES IN THE WEST (PARK) AREA

FOR

THE NAVAL AIR STATION, JACKSONVILLE, FLORIDA

Under Contract No. N62467-93-D-0936

Prepared by
Bechtel Environmental, Inc.
Oak Ridge, Tennessee

February 1996
Revision 0
Bechtel Job No. 22567

Prepared: E/Walker — Senior Scientist — 2-6-96 Date

Approved: _____ Project Manager — _____ Date

CONTENTS

CONTENTS ii

1.0 INTRODUCTION 1

2.0 REMEDIATION OF PSC-17/18 WEST (PARK) AREA 3

3.0 RADIOLOGICAL CHARACTERIZATION-EXCAVATION AREAS 6

3.1 GAMMA MEASUREMENTS 6

3.2 SOIL SAMPLE ANALYSIS 6

4.0 CONCLUSIONS 13

5.0 REFERENCES 14

ATTACHMENT A – GAMMA SURVEYS 15

ATTACHMENT B – SOIL SAMPLE ANALYSIS 16

1.0 INTRODUCTION

In response to results of a planned radiological characterization of PSC-17/18 (Ref. 1), Bechtel Environmental, Inc., performed remediation activities to remove radioactive materials that contained isotopic concentrations in excess of regulatory standards (Ref. 2). The remediation planning was based on estimated quantities and distributions from surface radiation surveys, borehole gamma radiation logging, and radiochemical analysis of soil and sediment samples.

Based on the walkover surveys and hot spot identification, an initial estimate was made of the areal extent of the contamination. In the west park area of the PSC, the area of contamination from surface hot spot measurements was estimated to be 22,600 ft^2. This is shown on Figure 1.1. Supplemental subsurface measurements in five borehole locations indicated additional elevated activity outside this estimate area. Further, the subsurface measurements indicated that some of the elevated activity may be covered with clean fill material, shielding it from surface detection. Based on these observations, the estimated area of contamination was increased to 72,656 ft^2. Using the borehole profiles, it was assumed that excavation would average 1.5 feet over the area of contamination. This resulted in an estimated excavation volume of 108,984 ft^3 (~4,000 yd^3).

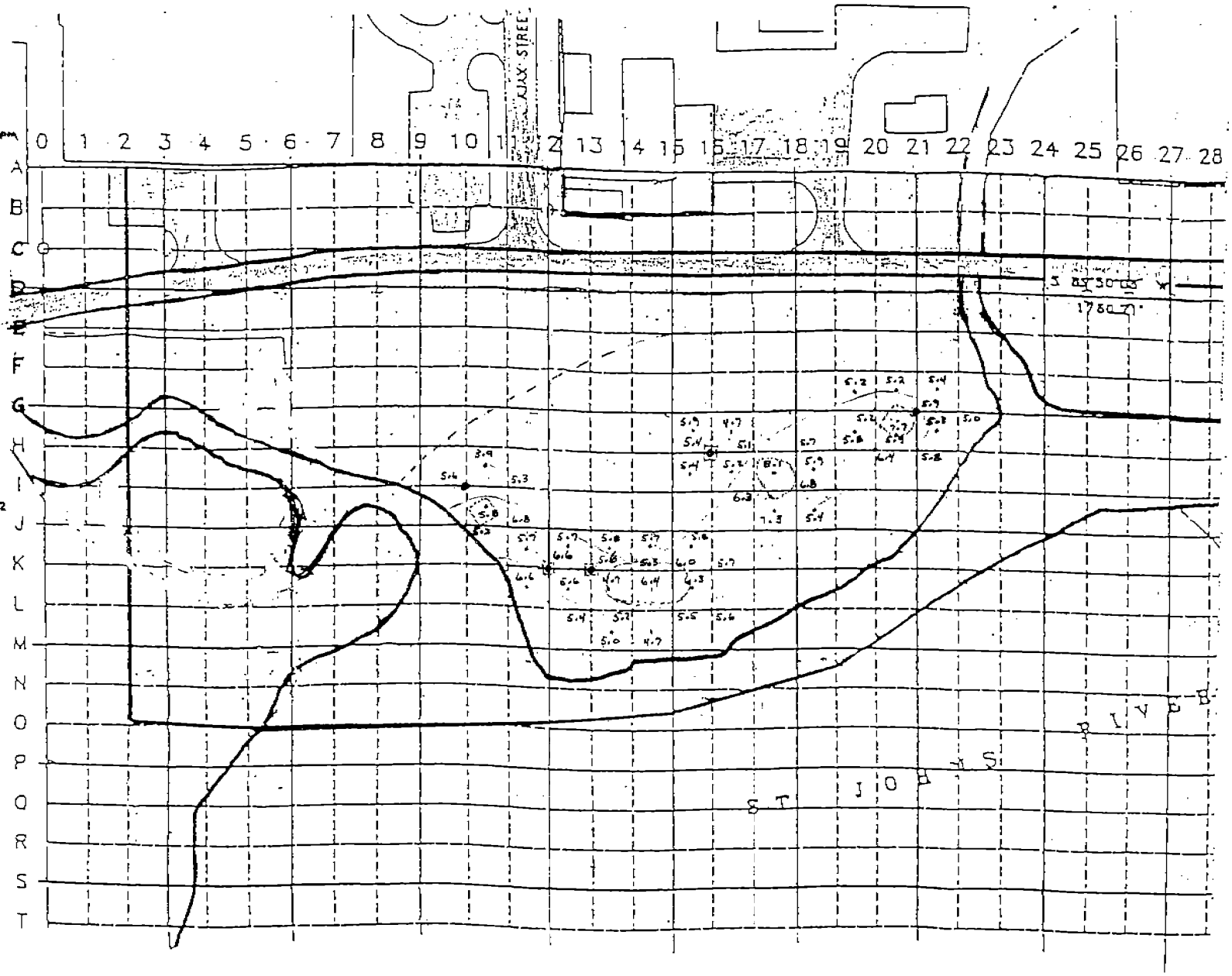
It was recognized that this estimate was based on limited subsurface measurements and there could be a high degree of uncertainty associated with the estimate. This was considered in the excavation plan to ensure that the contaminated material would be completely removed with a minimum of contaminated waste produced requiring disposal.

FIGURE 3.1 POST REMEDIATION RADIOLOGICAL MEASUREMENTS

BOREHOLE LOCATION	GAMMA x 10^3 CPM SURFACE	-2'
I10	5.6	9.5
K12	6.6	8.7
K13	5.4	7.8
H16	6.4	8.8
G21	5.7	8.8

BKGD = 5.1-5.6K CPM

BOREHOLE LOCATION	RA-226 pCi/gm	TH-232 pCi/gm
I10 (JX00470)	2.0	1.1
K12 (JX00471)	3.5	1.4
K13 (JX00472)	0.99	0.54
H16 (JX00473)	1.9	0.70
G21 (JX00474)	1.1	0.82



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2.0 REMEDIATION OF PSC-17/18 WEST (PARK) AREA

The remediation plan specified that excavation be completed with a minimum of volume generation. Excavation started at the location of surface hot spots to a depth of 6-12 inches. Readings were taken on the excavation surfaces and excavation proceeded in any direction where in situ gamma measurements exceeded 4,700 counts per minute above background. Excavation continued until measurements were below that level.

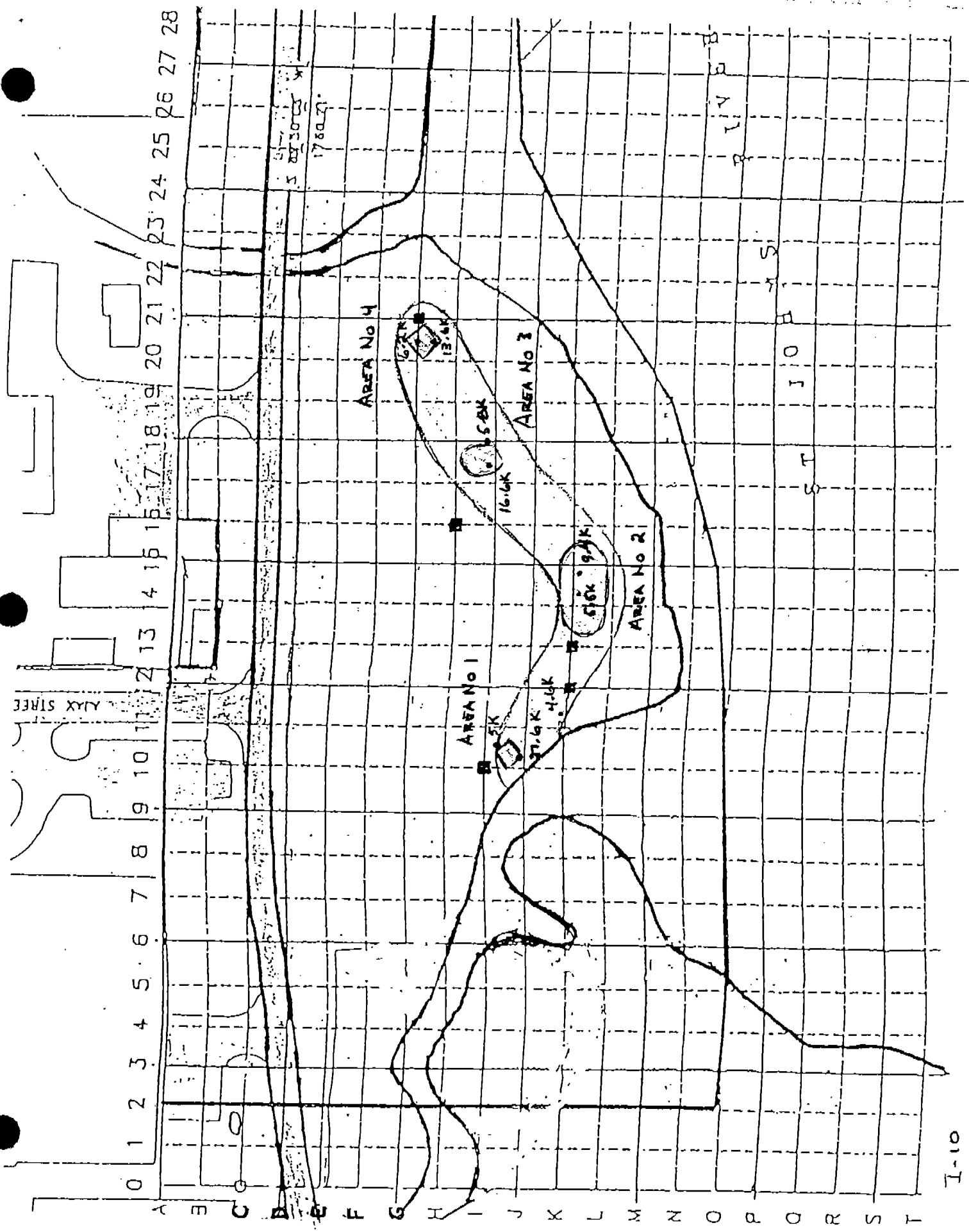
Using this approach, it was discovered that subsurface contamination was very localized, and in general had been identified as surface hot spots during the characterization. The only exception was borehole H16, whose subsurface activity was removed by excavating approximately one foot square. The entire park was remediated by excavating four small areas and two boreholes. These excavations are summarized in Table 2.1. The excavation locations are shown on Figure 2-1. The total excavation volume for this section of the PSC was approximately 250 yd^3, approximately 6.5% of the original estimate.

Upon completion of the removal actions, the excavated soil and debris was transported to the laydown area on PSC-26.

Table 2.1: Excavation in PSC-17/18 West Area

Location	Dimensions	Area	Average Depth
A1	11 ft × 13 ft	143 ft^2	3 ft
A2	70 ft × 20 ft	1,400 ft^2	18 inches
A3	23 ft × 30 ft	690 ft^2	5 ft
A4	18 ft × 17 ft	306 ft^2	3 ft
Borehole I10	3 ft × 3 ft	9 ft^2	1 ft
Borehole H16	3 ft × 3 ft	9 ft^2	1 ft

FIGURE 2-1 EXCAVATION AREAS, PSC-17/18 WEST 008636



3.0 RADIOLOGICAL CHARACTERIZATION-EXCAVATION AREAS

At the completion of the excavation activities, each excavation area was 100% scanned using a 2" × 2" NaI gamma detector to identify residual hot spots. If all scan readings were within 4,750 cpm above local background, the area was analyzed by in situ grid measurements of gamma activity and composite samples taken from each grid within the excavation.

3.1 GAMMA MEASUREMENTS

The grid measurements, to characterize each excavation location, were made at the same grid intersection points used during characterization (Ref. 1). The grid intersection measurements were supplemented with a measurement in the center of the affected grid. Using the 2" × 2" NaI detector, one minute counts were taken on contact with the surface, at one foot above the surface, and at three feet above the surface. The contact readings were used to assess success in meeting criteria. The elevated readings were inspected to determine if surface readings may have been influenced by local hot spots. The results of these in situ measurements are summarized in Table 3.1. The contact readings, in relationship to the excavation areas, are shown on Figure 3.1. The highest reading observed was in the center of grid H-I/17-18, which is the center of excavation area No. 3. The reading was approximately 3,000 cpm above background, still within the measurement guideline for this project of 4,750 cpm above background equivalent to 5 pCi Ra-226/gm soil.

The five boreholes used during characterization were remeasured at completion of excavation. Comparison with characterization results are shown in Table 3.2. Due to source-detector geometry differences between surface and borehole measurements, the borehole response is expected to be higher for a uniform source distribution. The theoretical flux profile within boreholes of various depths is shown on Figure 3.2. For a two foot borehole, the response at the bottom of the hole will be a factor of 1.5 greater than the surface response. Inspection of the post remediation measurements indicate a uniform source distribution at approximately background level.

3.2 SOIL SAMPLE ANALYSIS

After the scan surveys of the excavation areas indicated that removal of the activity appeared complete, composite soil samples were taken from each grid within the excavation. Only excavation area No. 2 was sufficiently large to require more than one sample. The samples were analyzed for radium-226 and thorium-232 content by gamma spectrometry. The results of these analyses are summarized in Table 3.3. The background concentrations for the NAS-JAX site were found to be (Ref. 3):

	Min.	Max.	Avg.
Ra-226	0.37 pCi/gm	0.99 pCi/gm	0.59 pCi/gm
Th-232	0.47 pCi/gm	1.08 pCi/gm	0.72 pCi/gm

Considering the natural background of the site, none of the samples exceeded the soil criteria of 5 pCi/gm above background.

Table 3.1: Post Excavation Grid Surveys - Gamma (cpm)

Grid	Background	Contact	1 Foot	3 Feet
I10	5168	5614	5592	5423
I11	5467	5328	5277	5366
H-I/10-11	5467	3887	4300	4476
J10	5467	5331	4952	4797
J11	5467	6768	6307	5922
I-J/10-11	5467	5803	5898	5791
J-K/11-12	5467	5658	6021	6049
J-K/12-13	5467	5659	5578	5296
J-K/13-14	5467	5764	5447	5378
J-K/14-15	5467	5662	5621	5436
J-K/15-16	5467	5800	5773	5492
K12	5168	6593	6471	6311
K13	5143	5452	3563	3313
K14	5143	5313	5389	5201
K15	5143	5985	5939	5861
K16	5467	5727	5422	5344
K-L/11-12	5467	6641	5803	5711
K-L/12-13	5467	5632	5546	5518
K-L/13-14	5143	4683	4216	3703
K-L/14-15	5143	6357	5788	5722
K-L/15-16	5467	6318	5945	5704
L13	5467	5392	5504	5167
L14	5467	5175	4891	4753
L15	5143	5510	5257	5262
L16	5467	5595	5258	5149
L-M/13-14	5467	5032	4452	4698
L-M/14-15	5467	4743	4540	4543
G-H/15-16	5467	5868	5727	5625
G-H/16-17	5467	4704	4801	4989
H16	5168	5425	5350	5290
H17	5143	5086	5063	4902
H-I/15-16	5467	5385	5402	5186
H-I/16-17	5467	5244	5362	5375
H-I/17-18	5143	8139	7533	6716
H-I/18-19	5467	5881	5601	5579
H18	5143	5674	5662	5386
I17	5143	6323	6144	5954
I18	5143	6824	6151	5901
I-J/17-18	5467	7305	6961	6324
I-J/18-19	5467	5369	5555	5687
F-G/19-20	5467	5231	5310	5196
F-G/20-21	5143	5214	5195	5247
F-G/21-22	5143	5379	5281	5134

Grid	Background	Contact	1 Foot	3 Feet
G20	5467	5179	5222	5179
G21	5143	5681	5537	5398
G22	5143	5045	4889	4776
G-H/19-20	5467	5792	5614	5507
G-H/20-21	5467	5892	5990	5716
G-H/21-22	5467	5312	5215	5195
H20	5606	5758	5628	5409
H21	5606	6432	6265	5860

FIGURE 1-1: BORE HOLE MEASUREMENTS - SAMPLE ANALYSIS

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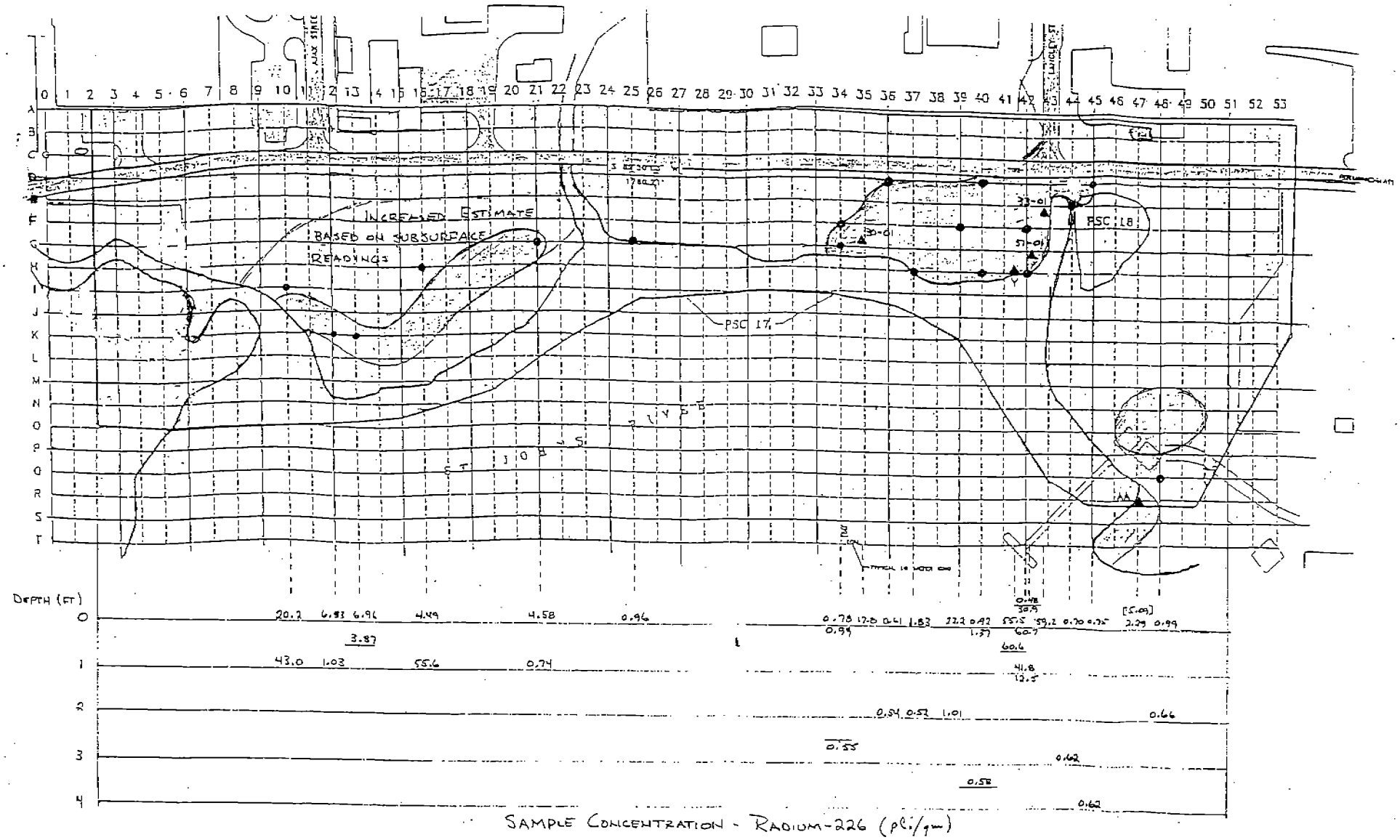

Table 3.2: Borehole Measurements—Gamma Logging

Borehole	Depth (ft)	Characterization (cpm)	Post-remediation (cpm)
I10	Surface	37,400	5,600
	1.0	96,200	-
	2.0	22,900	9,500
K12	Surface	12,700	6,600
	1.0	13,700	-
	2.0	7,800	8,700
K13	Surface	14,000	5,400
	0.5	26,100	-
	1.0	-	-
	2.0	-	7,800
H16	Surface	26,900	5,400
	1.0	156,900	-
	2.0	55,200	8,800
G21	Surface	15,300	5,700
	1.0	28,900	-
	2.0	11,300	8,800

K+E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

FIGURE 3-2

GAMMA FLUX PROFILES IN VARIOUS DEPTH BOREHOLES

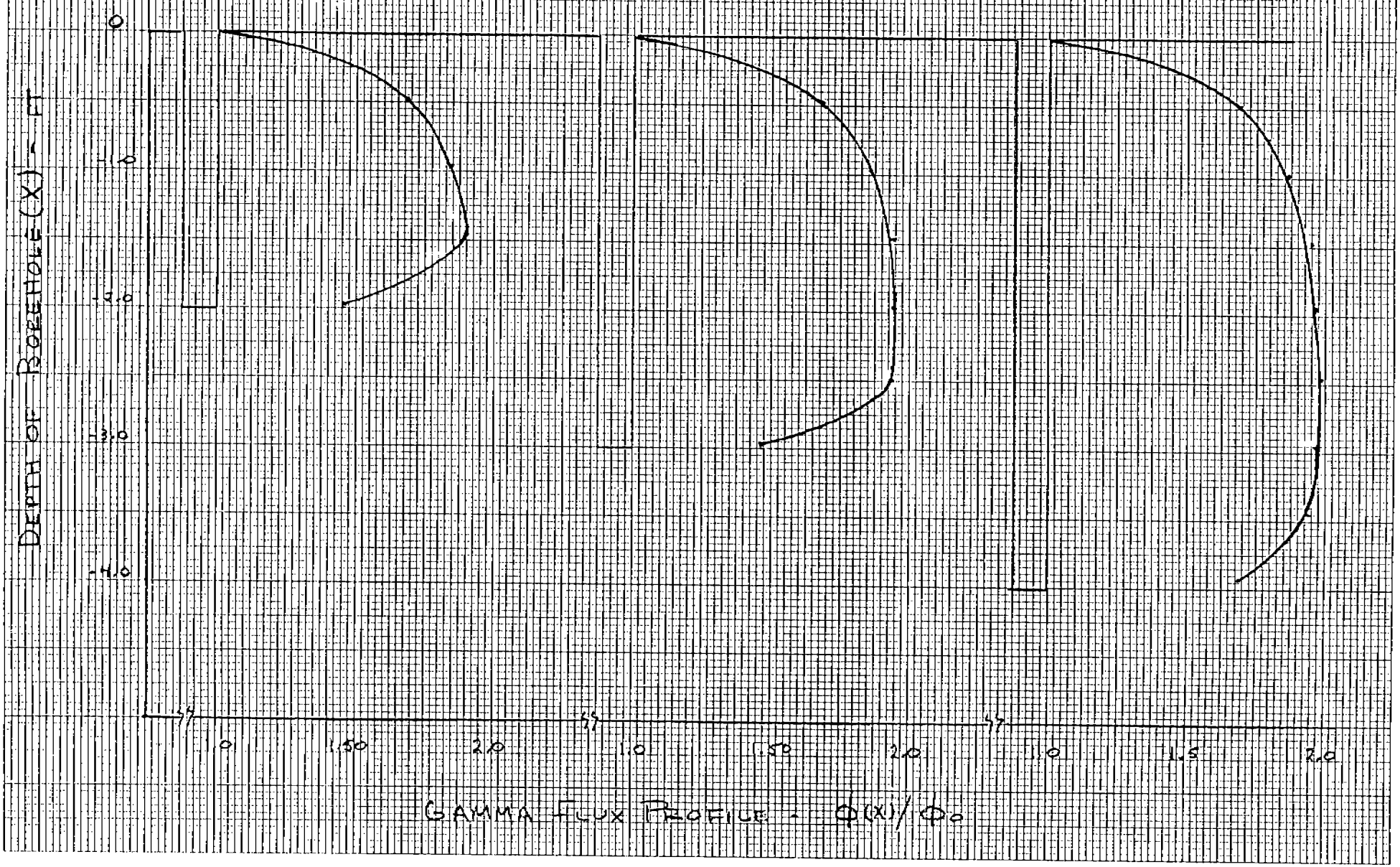

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Table 3.3: Soil Sample Analysis of PSC-17/18 West End

Grid	Location	Ra-226 (pCi/gm)	Th-232 (pCi/gm)	Total (pCi/gm)
I-J/10-11	Area No. 1	1.1	0.78	1.9
K-L/13-14	Area No. 2 (West)	2.2	1.2	3.4
K-L/13-14	Duplicate	1.8	1.1	2.9
K-L/14-15	Area No. 2 (East)	0.84	0.94	1.8
H-I/17-18	Area No. 3	1.1	0.85	2.0
G-H/20-21	Area No. 4	0.95	0.73	1.7
I10	Borehole	2.0	1.1	3.1
K12	Borehole	3.5	1.4	4.9
K13	Borehole	0.99	0.54	1.5
H16	Borehole	1.9	0.70	2.6
G21	Borehole	1.1	0.82	1.9

4.0 CONCLUSIONS

From the results of the radiological studies performed to support the remedial excavations in the park area that is located in the west side of PSC-17/18, the following conclusions and decisions are offered.

1. The actual extent of elevated activity was confined to small, localized areas that were detectable from the surface scans.

2. The contamination was likely spread from operations involving disposal of sand blast beads in PSC-18 to the east of this area. The contamination does not appear to be the result of conscious disposal in this area.

3. The remedial excavations to remove the contaminated materials have successfully lowered the radiation levels and the residual radium-226 and thorium-232 concentrations in the remaining soil are below the guidelines for this project for unrestricted use.

Based on these conclusions, backfilling of the excavated areas with clean borrow soil should proceed.

5.0 REFERENCES

1. Walker, E. "PSC-17/18 Radiological Survey Report for the Naval Air Station, Jacksonville, FL," prepared by Bechtel Environmental, Inc., Oak Ridge, TN, for U.S. Navy Dept., Southern Division–Naval Facilities Engineering Command, Oct. 25, 1995.

2. Environmental Protection Agency, 40CFR192, "Health and Environmental Standards for Uranium and Thorium Mill Tailings," January 5, 1983.

3. Bauer, V. Hermann (Bechtel Environmental, Inc.) to B. K. Moring (Southern Division–Naval Facilities Engineering Command), "Radiological Background Determination for the NAS Jacksonville Site," dated Jan. 11, 1995.

ATTACHMENT A – GAMMA SURVEYS

Sample results for K12, 13, I10, H16 and g 21 should be ready (preliminary) 1-26-96. I will see to it that you are given a copy of the data.

Ed here is the info on the grid survey. This complements the map, just in case the numbers area a bit hard to read, what days they were taken, the background for that day, meter efficiency, and 10 minute background at the trailer. The same meter was used for each data point, Ludlum 44-10, S/N 151.

Centers of grids are noted as you suggested, H-I/17-18, CNT is the center of the excavations. PP is "play pen". Readings in PP are from bottom of excavation, 1' above bottom of excavation and so forth.

	BKGD - SITE
11/15	5.3
11/20	5.1
1/10	5.2
1/23	5.5
1/31	5.6

11-15-96

Site 18 background was 5309 cpm.
44-10 efficiency was 0.091
10 minute trailers background was 4728.3 cpm

CNT PP 1	7730	7199	6563

11-20-95

Site 18 area background was 5143 cpm.
Meter efficiency was 0.091.
10 minute trailer background was 4382.8 cpm.

	Grid Point	Ground	1'	3'
✓	I17	6323	6144	5954
✓	H17	5086	5063	4902
✓	H18	5674	5662	5386
✓	I18	6824	6151	5901
✓	H-I/17-18	8139	7533	6716
	CNT PP3	7203	7304	7003
✓	F-G/20-21	5214	5195	5247
✓	F-G/21-22	5379	5281	5134
✓	G21	5681	5537	5398
✓	G22	5045	4889	4776
	CNT PP 4	7683	6885	6111
✓	K13	5452	3563	3313
✓	K14	5313	5389	5201
✓	K15	5985	5939	5861
✓	L15	5510	5257	5262
✓	K-L/13-14	4683	4216	3703 (1)

✓ K-L/14-15	6357	5788	5722 (2)

1-10-96

Site 18 background was 5168 cpm
44-10 efficiency was 0.086.
10 minute trailer background was 4486.9.

G21 *	5908	5825	5795
✓ H16	5425	5350	5290
K13 *	5610	5545	5501
✓ K12	6593	6471	6311
✓ I10	5614	5592	5423

1-23-96

Site 18 background was 5467 CPM
44-10 efficiency was 0.088
10 minute trailer background was 4310.0

✓ H-I/10-11	3887	4300	4476
✓ I11	5328	5277	5366
✓ I-J/10-11	5803	5898	5791
✓ J10	5331	4952	4797
✓ J11	6768	6307	5922

I10 2' BELOW SURFACE - 9525

✓ J-K/11-12	5658	6021	6049
✓ J-K/12-13	5659	5578	5296
✓ J-K/13-14	5764	5447	5378
✓ J-K/14-15	5662	5621	5436
✓ J-K/15-16	5800	5773	5492
✓ K16	5727	5422	5344
✓ K-L/11-12	6641	5803	5711
✓ K-L/12-13	5632	5546	5518
✓ K-L/15-16	6318	5945	5704
✓ L13	5392	5504	5167
✓ L14	5175	4891	4753
✓ L16	5595	5258	5149
✓ L-M/13-14	5032	4452	4698
✓ L-M/14-15	4743	4540	4543

K12 2' BELOW SURFACE - 8701
K13 2' BELOW SURFACE - 7847

* REPEAT MEASUREMENTS

✓ G-H/15-16	5868	5727	5625
✓ G-H/16-17	4704	4801	4989
✓ H-I/15-16	5385	5402	5186
✓ H-I/16-17	5244	5362	5375
H16	2' BELOW SURFACE - 8780		
✓ I-J/17-18	7305	6960	6324
✓ I-J/18-19	5369	5555	5687
✓ H-I/18-19	5881	5601	5579
✓ F-G/19-20	5231	5310	5196
✓ G20	5179	5222	5179
✓ G-H/19-20	5792	5614	5507
✓ G-H/20-21	5892	5990	5716
✓ G-H/21-22	5312	5215	5195
G21 2' BELOW SURFACE - 8756			

(1) West half of PP 2
(2) East half of PP 2

FAX

008636

Date 1-31-96

Number of pages including cover sheet 1

TO: ED Walker

Phone

Fax Phone

CC:

FROM: Bechtel Environmental, Inc.
CHILD STREET LOCATION
NAS JACKSONVILLE FL
32212

Tom

Phone (904) 771-4711

Fax Phone (904) 771-6669

REMARKS: ☐ Urgent ☐ For your review ☐ Reply ASAP ☐ Please Comment

GRID Point	Ground	1'	3'
H 21	5758	5628	5409
H 20	6432	6265	5860

Meter 151, Eff - 0.087
10 min trailer Bkg - 4203.1 cpm
Area Backgrnd - 5605.7 cpm

ATTACHMENT B – SOIL SAMPLE ANALYSIS

Sampling/grid points

The following is for all of the sampling we have done for radiological remediation

Sample NO.	Grid location
JX0044001	GH/20-21 (PLAY PEN 4)
JX0044101	HI/18 (Play pen 3)
JX0044201	KL/14-15 (East half of play pen 2)
JX0044301	KL/13-14 (West half of Play pen 2)
JX0044401	Duplicate of 443
JX0044501	IJ/10-11 (Play pen 1)

These samples were taken in the center of the Play pens, so the coordinates are not ion the center of the grid.

JX0045401	D34	JX0048501	E41
JX0045501	E34	JX0048601	F41
JX0045601	F34/35	JX0048701	D42/43
JX0045701	G37/38	JX0048801	Dup. E39
JX0045801	G39		
JX0045901	F29		
JX0046001	D35		
JX0046101	E35		
JX0046201	NOT USED		
JX0046301	D36		
JX0046401	E36		
JX0046501	F/G-36		
JX0046601	D37		
JX0046701	E37		
JX0046801	F37		
JX0046901	DUPLICATE OF E36		
JX0047001	I10 Grab sample		
JX0047101	K12 "		
JX0047201	K13 "		
JX0047301	H16 "		
JX0047401	G21 "		
JX0047501	Equipment rinsate		
JX0047601	D38		
JX0047701	E38		
JX0047801	D39		
JX0047901	E39		
JX0048001	F39		
JX0048101	D40		
JX0048201	E40		
JX0048301	F40		
JX0048401	D41		

22567-213-0001-0161-003-01

008636

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Laboratory Certifications

STATE	GEL	EPI
FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 AREA No. 4

Sample ID	: JX00440 SFS
Lab ID	: 9511463-01
Matrix	: SFS
Date Collected	: 11/20/95
Date Received	: 11/28/95
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Radiological												
Evaporative Loss @ 105 C		9.4		1.0	1	wt%	1.0	JTO	11/30/95	1600	76598	1
Gamma PHA - 10 items												
Cesium-137	J	0.04	+/- 0.0228	0.03	0.10	pCi/g	1.0	SCM	11/29/95	1025	76582	2
Potassium-40	J	2.8	+/- 0.471	0.30	5	pCi/g	1.0					
Radium-226	J	0.95	+/- 0.173	0.20	1	pCi/g	1.0	SCM	12/08/95	1831	76582	2
Radium-228	U	0	+/- 0	0.50	1	pCi/g	1.0					
Thorium-228	J	0.74	+/- 0.0548	0.04	5	pCi/g	1.0	SCM	11/29/95	1025	76582	2
Thorium-230	J	0.66	+/- 0.0754	0.06	5	pCi/g	1.0					
Thorium-232	J	0.73	+/- 0.0543	0.04	5	pCi/g	1.0					
Thorium-234	J	2.2	+/- 1.08	0.90	15	pCi/g	1.0					
Uranium-235	U	0.08	+/- 0.14	0.20	5	pCi/g	1.0					
Uranium-238	J	2.2	+/- 1.08	0.90	15	pCi/g	1.0					

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

22567-213-0001-0161-003-01

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GENERAL ENGINEERING LABORATORIES

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Laboratory Certifications

STATE	GEL	EPI
FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394

Report Date: December 14, 1995

Sample ID : JX00440 SFS

M = Method	Method-Description

Data reported in mass/mass units is reported as 'dry weight'.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at (803) 769-7391.

Analytical Report Specialist

8

P O Box 30712 • Charleston, SC 29417 • (803) 556-8171 • Fax (803) 766-1178 *9511463-01*

Printed on recycled paper.

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Laboratory Certifications

STATE	GEL	EPI
FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 AREA No. 3

Sample ID	: JX00441 SFS
Lab ID	: 9511463-02
Matrix	: SFS
Date Collected	: 11/20/95
Date Received	: 11/28/95
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Radiological												
Evaporative Loss @ 105 C		12.1		1.0	1	wt%	1.0	JTO	11/30/95	1600	76598	1
Gamma PHA - 10 items												
Cesium-137		0.12	+/- 0.043	0.04	0.10	pCi/g	1.0	SCM	11/29/95	1026	76582	2
Potassium-40	J	3.0	+/- 0.476	0.40	5	pCi/g	1.0					
Radium-226		1.1	+/- 0.132	0.10	1	pCi/g	1.0	SCM	12/08/95	1832	76582	2
Radium-228	J	0.91	+/- 0.199	0.20	1	pCi/g	1.0					
Thorium-228	J	0.86	+/- 0.056	0.05	5	pCi/g	1.0	SCM	11/29/95	1026	76582	2
Thorium-230	J	1.0	+/- 0.0829	0.06	5	pCi/g	1.0					
Thorium-232	J	0.85	+/- 0.0556	0.05	5	pCi/g	1.0					
Thorium-234	J	3.0	+/- 1.28	0.90	15	pCi/g	1.0					
Uranium-235	U	0.20	+/- 0.178	0.20	5	pCi/g	1.0					
Uranium-238	J	3.0	+/- 1.28	0.90	15	pCi/g	1.0					

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

9

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NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	999887779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995

Sample ID : JX00441 SFS

M = Method	Method-Description

Data reported in mass/mass units is reported as 'dry weight'.

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NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 AREA No. 2 (EAST)

Sample ID	: JX00442 SFS
Lab ID	: 9511463-03
Matrix	: SFS
Date Collected	: 11/20/95
Date Received	: 11/28/95
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Radiological												
Evaporative Loss @ 105 C		5.3		1.0	1	wt%	1.0	JTO	11/30/95	1600	76598	1
Gamma PHA - 10 items												
Cesium-137	J	0.07	+/- 0.0274	0.04	0.10	pCi/g	1.0	SCM	11/29/95	1027	76582	2
Potassium-40	J	3.1	+/- 0.515	0.40	5	pCi/g	1.0					
Radium-226	J	0.84	+/- 0.0889	0.06	1	pCi/g	1.0	SCM	12/08/95	1835	76582	2
Radium-228	J	0.83	+/- 0.126	0.10	1	pCi/g	1.0					
Thorium-228	J	0.95	+/- 0.06	0.05	5	pCi/g	1.0	SCM	11/29/95	1027	76582	2
Thorium-230	J	0.84	+/- 0.0934	0.06	5	pCi/g	1.0					
Thorium-232	J	0.94	+/- 0.0594	0.05	5	pCi/g	1.0					
Thorium-234	J	2.1	+/- 1.29	1.1	15	pCi/g	1.0					
Uranium-235	U	0.20	+/- 0.166	0.20	5	pCi/g	1.0					
Uranium-238	J	2.1	+/- 1.29	1.1	15	pCi/g	1.0					

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
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11

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FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
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Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995

Sample ID : JX00442 SFS

M = Method	Method-Description

Data reported in mass/mass units is reported as 'dry weight'.

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FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 AREA No. 2 (WEST)

Sample ID	: JX00443 SFS
Lab ID	: 9511463-04
Matrix	: SFS
Date Collected	: 11/20/95
Date Received	: 11/28/95
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Radiological												
Evaporative Loss @ 105 C		15.0		1.0	1	wt%	1.0	JTO	11/30/95	1600	76598	1
Gamma PHA - 10 items												
Cesium-137		0.12	+/- 0.0379	0.04	0.10	pCi/g	1.0	SCM	11/29/95	1028	76582	2
Potassium-40	J	2.2	+/- 0.544	0.40	5	pCi/g	1.0					
Radium-226		2.2	+/- 0.169	0.10	1	pCi/g	1.0	SCM	12/08/95	2009	76582	2
Radium-228		1.2	+/- 0.265	0.20	1	pCi/g	1.0					
Thorium-228	J	1.3	+/- 0.191	0.06	5	pCi/g	1.0	SCM	11/29/95	1028	76582	2
Thorium-230	J	2.2	+/- 0.306	0.07	5	pCi/g	1.0					
Thorium-232	J	1.2	+/- 0.19	0.06	5	pCi/g	1.0					
Thorium-234	J	3.4	+/- 1.57	1.3	15	pCi/g	1.0					
Uranium-235	U	0.20	+/- 0.19	0.30	5	pCi/g	1.0					
Uranium-238	J	3.4	+/- 1.57	1.3	15	pCi/g	1.0					

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
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SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995

Sample ID : JX00443 SFS

M = Method	Method-Description

Data reported in mass/mass units is reported as 'dry weight'.

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NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 AREA No. 2 (WEST) - DUP.

Sample ID	: JX00444 SFS
Lab ID	: 9511463-05
Matrix	: SFS
Date Collected	: 11/20/95
Date Received	: 11/28/95
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Radiological												
Evaporative Loss @ 105 C		15.2		1.0	1	wt%	1.0	JTO	11/30/95	1600	76598	1
Gamma PHA - 10 items												
Cesium-137		0.12	+/- 0.0189	0.03	0.10	pCi/g	1.0	SCM	11/29/95	1029	76582	2
Potassium-40	J	2.7	+/- 0.389	0.30	5	pCi/g	1.0					
Radium-226		1.8	+/- 0.151	0.10	1	pCi/g	1.0	SCM	12/08/95	2012	76582	2
Radium-228		1.1	+/- 0.273	0.20	1	pCi/g	1.0					
Thorium-228	J	1.1	+/- 0.0545	0.05	5	pCi/g	1.0	SCM	11/29/95	1029	76582	2
Thorium-230	J	1.7	+/- 0.0862	0.04	5	pCi/g	1.0					
Thorium-232	J	1.1	+/- 0.054	0.04	5	pCi/g	1.0					
Thorium-234	J	3.0	+/- 0.888	0.80	15	pCi/g	1.0					
Uranium-235	J	0.18	+/- 0.137	0.20	5	pCi/g	1.0					
Uranium-238	J	3.0	+/- 0.888	0.80	15	pCi/g	1.0					

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
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SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995

Sample ID : JX00444 SFS

M = Method	Method-Description

Data reported in mass/mass units is reported as 'dry weight'.

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SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 AREA No. 1

Sample ID	: JX00445 SFS
Lab ID	: 9511463-06
Matrix	: SFS
Date Collected	: 11/20/95
Date Received	: 11/28/95
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Radiological												
Evaporative Loss @ 105 C		16.1		1.0	1	wt%	1.0	JTO	11/30/95	1600	76598	1
Gamma PHA - 10 items												
Cesium-137		0.17	+/- 0.0346	0.04	0.10	pCi/g	1.0	SCM	11/29/95	1030	76582	2
Potassium-40	J	3.5	+/- 0.496	0.30	5	pCi/g	1.0					
Radium-226		1.1	+/- 0.188	0.09	1	pCi/g	1.0	SCM	12/08/95	2024	76582	2
Radium-228	J	0.76	+/- 0.237	0.20	1	pCi/g	1.0					
Thorium-228	J	0.79	+/- 0.0544	0.05	5	pCi/g	1.0	SCM	11/29/95	1030	76582	2
Thorium-230	J	1.1	+/- 0.0848	0.06	5	pCi/g	1.0					
Thorium-232	J	0.78	+/- 0.0539	0.05	5	pCi/g	1.0					
Thorium-234	J	1.9	+/- 1.04	1.2	15	pCi/g	1.0					
Uranium-235	J	0.17	+/- 0.145	0.20	5	pCi/g	1.0					
Uranium-238	J	1.9	+/- 1.04	1.2	15	pCi/g	1.0					

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
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U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

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Laboratory Certifications

STATE	GEL	EPI
FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: December 14, 1995 Page 2 of 2

Sample ID : JX00445 SFS

M = Method	Method-Description

Data reported in mass/mass units is reported as 'dry weight'.

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CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
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Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 26, 1996 BOREHOLE I10

Sample ID	: JX00470 SFS
Lab ID	: 9601452-16
Matrix	: SFS
Date Collected	: 01/17/96
Date Received	: 01/24/96
Priority	: Urgent
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Radiological													
Evaporative Loss @ 105 C		10.0		1.0	1	wt%	1.0	JTO	01/25/96	1200	79481	1	N
Gamma PHA - 10 items													
Cesium-137	J	0.06	+/- 0.0316	0.04	0.10	pCi/g	1.0	SCM	01/25/96	1735	79420	2	N
Potassium-40	J	2.3	+/- 0.427	0.30	5	pCi/g	1.0						
Radium-226		2.0	+/- 0.879	0.70	1	pCi/g	1.0						
Radium-228	J	0.92	+/- 0.146	0.20	1	pCi/g	1.0						
Thorium-228	J	1.1	+/- 0.0708	0.05	5	pCi/g	1.0						
Thorium-230	J	0.71	+/- 0.0961	0.06	5	pCi/g	1.0						
Thorium-232	J	1.1	+/- 0.0702	0.05	5	pCi/g	1.0						
Thorium-234	U	0.40	+/- 1.12	1.1	15	pCi/g	1.0						
Uranium-235	U	0.20	+/- 0.112	0.20	5	pCi/g	1.0						
Uranium-238	U	0.40	+/- 1.12	1.1	15	pCi/g	1.0						

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

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CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 26, 1996

Sample ID : JX00470 SFS

GEL Laboratory Certifications		EPI Laboratory Certifications	
AL - 41040	AZ - AZ0514	AL - 41050	AZ - AZ0514
CA - 2089	CT - PH-0169	CA - I-1023/2056	CT - PH-0175
DE - SC012	FL - E87156/87294	FL - E87472/87458	MS - 29417
ME - SC012	MS - 10120	NY - 11502	RI - 138
NC - 233	NY - 11501	SC - 10582	TN - 02934
RI - 135	SC - 10120	UT - E-227	VA - 00111
TN - 02934	UT - E-251	WA - C225	NJ - 79002
VA - 00151	WA - C223	PA - 68-485	
WI - 999887790			

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CERTIFICATE OF ANALYSIS

Client: Bechtel
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Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 31, 1996 BOREHOLE K12

Sample ID	: JX00471 SFS
Lab ID	: 9601452-17
Matrix	: SFS
Date Collected	: 01/17/96
Date Received	: 01/24/96
Priority	: Urgent
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Radiological													
Evaporative Loss @ 105 C		21.0		1.0	1	wt%	1.0	JTO	01/25/96	1200	79481	1	N
Gamma PHA - 10 items													
Cesium-137		0.13	+/- 0.0403	0.04	0.10	pCi/g	1.0	SCM	01/31/96	1059	79420	2	N
Potassium-40	J	3.4	+/- 0.684	0.50	5	pCi/g	1.0						
Radium-226		3.5	+/- 0.155	0.08	1	pCi/g	1.0						
Radium-228		1.0	+/- 0.18	0.20	1	pCi/g	1.0						
Thorium-228	J	1.4	+/- 0.085	0.07	5	pCi/g	1.0						
Thorium-230	J	3.5	+/- 0.155	0.08	5	pCi/g	1.0						
Thorium-232	J	1.4	+/- 0.0838	0.07	5	pCi/g	1.0						
Thorium-234	J	4.9	+/- 1.86	1.5	15	pCi/g	1.0						
Uranium-235	U	0.20	+/- 0.159	0.30	5	pCi/g	1.0						
Uranium-238	J	4.9	+/- 1.86	1.5	15	pCi/g	1.0						

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

Data reported in mass/mass units is reported as 'dry weight'.

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Client: Bechtel
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Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 31, 1996

Sample ID : JX00471 SFS

GEL Laboratory Certifications		EPI Laboratory Certifications	
AL - 41040	AZ - AZ0514	AL - 41050	AZ - AZ0514
CA - 2089	CT - PH-0169	CA - I-1023/2056	CT - PH-0175
DE - SC012	FL - E87156/87294	FL - E87472/87458	MS - 29417
ME - SC012	MS - 10120	NY - 11502	RI - 138
NC - 233	NY - 11501	SC - 10582	TN - 02934
RI - 135	SC - 10120	UT - E-227	VA - 00111
TN - 02934	UT - E-251	WA - C225	NJ - 79002
VA - 00151	WA - C223	PA - 68-485	
WI - 999887790			

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Valerie S. Davis

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CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
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Contact: Ms. Lori Keller
Project Description: Cecil Field/TX

cc: BECH00394 Report Date: January 26, 1996 BOREHOLE K13

Sample ID	: IX00472 SFS
Lab ID	: 9601452-18
Matrix	: SFS
Date Collected	: 01/17/96
Date Received	: 01/24/96
Priority	: Urgent
Collector	: Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Radiological													
Evaporative Loss @ 105 C		15.0		1.0	1	wt%	1.0	JTO	01/25/96	1200	79481	1	N
Gamma PHA - 10 items													
Cesium-137		0.14	+/- 0.0381	0.04	0.10	pCi/g	1.0	SCM	01/25/96	1735	79420	2	N
Potassium-40	J	3.0	+/- 0.451	0.30	5	pCi/g	1.0						
Radium-226	J	0.99	+/- 0.729	0.60	1	pCi/g	1.0						
Radium-228	J	0.54	+/- 0.143	0.10	1	pCi/g	1.0						
Thorium-228	J	0.54	+/- 0.0622	0.06	5	pCi/g	1.0						
Thorium-230	J	0.62	+/- 0.0864	0.06	5	pCi/g	1.0						
Thorium-232	J	0.54	+/- 0.0617	0.05	5	pCi/g	1.0						
Thorium-234	U	0.70	+/- 0.953	1.0	15	pCi/g	1.0						
Uranium-235	U	0.06	+/- 0.0892	0.20	5	pCi/g	1.0						
Uranium-238	U	0.70	+/- 0.953	1.0	15	pCi/g	1.0						

M = Method	Method Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
J indicates presence of analyte between DL (Detect Limit) and RL (Report Limit)
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

Data reported in mass/mass units is reported as 'dry weight'.

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CERTIFICATE OF ANALYSIS

Client:	Bechtel PO Box 350 Oak Ridge, Tennessee 37831-0350
Contact:	Ms. Lori Keller
Project Description:	Cecil Field/JX

cc: BECH00394 Report Date: January 26, 1996

Sample ID : JX00472 SFS

GEL Laboratory Certifications		EPI Laboratory Certifications	
AL - 41040	AZ - AZ0514	AL - 41050	AZ - AZ0514
CA - 2089	CT - PH-0169	CA - I-1023/2056	CT - PH-0175
DE - SC012	FL - E87156/87294	FL - E87472/87458	MS -29417
ME - SC012	MS - 10120	NY - 11502	RI - 138
NC - 233	NY - 11501	SC - 10582	TN - 02934
RI - 135	SC - 10120	UT - E-227	VA - 00111
TN - 02934	UT - E-251	WA - C225	NJ - 79002
VA - 00151	WA - C223	PA - 68-485	
WI - 999887790			

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Victoria Davis at (803) 769-7391.

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CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 26, 1996 BOREHOLE H16

Sample ID : JX00473 SFS
Lab ID : 9601452-19
Matrix : SFS
Date Collected : 01/17/96
Date Received : 01/24/96
Priority : Urgent
Collector : Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Radiological													
Evaporative Loss @ 105 C		5.0		1.0	1	wt%	1.0	JTO	01/25/96	1200	79481	1	N
Gamma PHA - 10 items													
Cesium-137	J	0.07	+/- 0.0272	0.03	0.10	pCi/g	1.0	SCM	01/25/96	1735	79420	2	N
Potassium-40	J	2.8	+/- 0.461	0.30	5	pCi/g	1.0						
Radium-226		1.9	+/- 0.764	0.60	1	pCi/g	1.0						
Radium-228	J	0.73	+/- 0.167	0.20	1	pCi/g	1.0						
Thorium-228	J	0.70	+/- 0.0546	0.04	5	pCi/g	1.0						
Thorium-230	J	0.94	+/- 0.0965	0.06	5	pCi/g	1.0						
Thorium-232	J	0.70	+/- 0.0541	0.04	5	pCi/g	1.0						
Thorium-234	J	1.1	+/- 0.928	1.0	15	pCi/g	1.0						
Uranium-235	U	0.05	+/- 0.0925	0.20	5	pCi/g	1.0						
Uranium-238	J	1.1	+/- 0.928	1.0	15	pCi/g	1.0						

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
The qualifiers in this report are defined as follows:
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Client: Bechtel
PO Box 350
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Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 26, 1996

Sample ID : JX00473 SFS

GEL Laboratory Certifications		EPI Laboratory Certifications	
AL - 41040	AZ - AZ0514	AL - 41050	AZ - AZ0514
CA - 2089	CT - PH-0169	CA - I-1023/2056	CT - PH-0175
DE - SC012	FL - E87156/87294	FL - E87472/87458	MS - 29417
ME - SC012	MS - 10120	NY - 11502	RI - 138
NC - 233	NY - 11501	SC - 10582	TN - 02934
RI - 135	SC - 10120	UT - E-227	VA - 00111
TN - 02934	UT - E-251	WA - C225	NJ - 79002
VA - 00151	WA - C223	PA - 68-485	
WI - 999887790			

This data report has been prepared and reviewed [illegible] standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at (803) 769-7391.

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CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Cecil Field/JX

cc: BECH00394 Report Date: January 26, 1996 BOREHOLE G21

Sample ID : JX00474 SPS
Lab ID : 9601452-20
Matrix : SPS
Date Received : 01/24/96
Priority : Urgent
Collector : Client

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Radiological													
Evaporative Loss @ 105 C		17.0		1.0	1	wt%	1.0	JTO	01/25/96	1200	79481	1	N
Gamma PHA - 10 items													
Cesium-137	J	0.09	+/- 0.0337	0.04	0.10	pCi/g	1.0	SCM	01/25/96	1735	79420	2	N
Potassium-40	J	2.3	+/- 0.503	0.30	5	pCi/g	1.0						
Radium-226		1.1	+/- 0.585	0.60	1	pCi/g	1.0						
Radium-228	J	0.88	+/- 0.149	0.10	1	pCi/g	1.0						
Thorium-228	J	0.83	+/- 0.0531	0.04	5	pCi/g	1.0						
Thorium-230	J	0.65	+/- 0.0849	0.06	5	pCi/g	1.0						
Thorium-232	J	0.82	+/- 0.0546	0.04	5	pCi/g	1.0						
Thorium-234	U	0.60	+/- 0.949	0.90	15	pCi/g	1.0						
Uranium-235	U	0.05	+/- 0.0838	0.20	5	pCi/g	1.0						
Uranium-238	U	0.60	+/- 0.949	0.90	15	pCi/g	1.0						

M = Method	Method-Description
M 1	GL-OA-E-020
M 2	HASL 300

Notes:
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Contact:	Ms. Lori Keller
Project Description:	Cecil Field/JX

co: BECH00394 Report Date: January 26, 1996

Sample ID : JX00474 SPS

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ME - SC012	MS - 10120	NY - 11502	RI - 138
NC - 233	NY - 11501	SC - 10582	TN - 02934
RI - 135	SC - 10120	UT - E-227	VA - 00111
TN - 02934	UT - E-251	WA - C225	NJ - 79002
VA - 00151	WA - C223	PA - 68-485	
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