

ENVIRONMENTAL AFFAIRS

January 31, 2001

Mr. Mark Roberts
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

VIACOM

Re: Report Revisions
Final Radiological Status Survey Report Building 7 and Sewer System
License No. SMB-1527, Viacom Inc.
Bloomfield Township, New Jersey

Dear Mr. Roberts:

Based upon the comments in the New Jersey Department of Environmental Protection (NJDEP) letter dated January 2, 2001, Viacom has revised the above-referenced report. The following new or revised tables and figures are enclosed:

1. Revised Cover Page with revision date;
2. Table of Contents pages iv and v (revised);
3. Revised Pages 21, 27, and 32;
4. Table L-2 – Comparison of Alpha and Gamma Spectroscopy (new);
5. Figure A-1 – Final Survey Soil Sample Locations Survey Unit A (revised);
6. Figure B-1 – Final Survey Soil Sample Locations Survey Unit B (revised);
7. Figure C-1 – Final Survey Soil Sample Locations Survey Unit C (revised);
8. Figure D-1 – Final Survey Soil Sample Locations Survey Unit D (revised);
9. Figure E-1 – Final Survey Soil Sample Locations Survey Unit E (revised);
10. Figure F-1 – Final Survey Soil Sample Locations Survey Unit F (revised);
11. Figure G-2 – Former Building 7, 1st Excavation Soil Sample Locations, Survey Unit G (revised);
12. Figure G-3 – Former Building 7, 2nd Excavation Soil Sample Locations Survey, Unit G (revised);
13. Figure G-4 – Former Building 7, Final Excavation Soil Sample Locations, Survey Unit G (revised);
14. Figure H-1 – Final Survey Soil Sample Locations Survey Unit H (revised);
15. Figure I-1 – Final Survey Soil Sample Locations Survey Unit I (revised);
16. Figure J-1 – Final Survey Soil Sample Locations Survey Unit J (revised);
17. Table A-4 – Final Soil Samples Survey Unit A (revised);
18. Table B-4 – Final Soil Samples Survey Unit B (revised);
19. Table G-5 – Final Soil Samples Survey Unit G (revised);
20. Table G-5a – Weighted Average Calculations Survey Unit G Grid 1 (revised);

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Mr. Mark Roberts
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21. Table K-1a – Lab Analysis of Backfill Material Survey Unit A (revised); and
22. Table P-1 – Final Soil Sample Locations and Laboratory Results, Pages 28 – 40 (revised).

The corresponding tables and figures in the August 2000 report should be replaced with these documents. If you have any questions regarding this letter, please contact me.

Respectfully submitted,



Kenneth J. Bird, CIH
Project Engineer/Consultant

Enclosures

pc: Mr. Steven Myers, NJDEP (2 copies)
Mr. Richard Proctor, Township of Bloomfield, Health & Human Services
Mr. James Moran, Viacom
Mr. Andrew Lombardo, Earth Science Consultants, Inc. (without enclosure)
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**Final Radiological Status Survey Report
Building 7 and Sewer System Remediation**

**Former Lamp Manufacturing Plant
Bloomfield, New Jersey**

**CBS Corporation
Pittsburgh, Pennsylvania**

**Project No. 5275
August 2000
Revised January 2001**



Earth Sciences Consultants, Inc.

Providing Environmental Consulting Services Since 1979

Final Radiological Status Survey Report Building 7 and Sewer System Remediation

**Former Lamp Manufacturing Plant
Bloomfield, New Jersey**

**CBS Corporation
Pittsburgh, Pennsylvania**

**Project No. 5275
August 2000
Revised January 2001**

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- Gross α and β removable contamination of accessible pipe surfaces.
- Excavated surface soil sample below the abandoned pipe centerline, obtained by trowel or auger inserted to a 15-cm (6-in.) depth.
- When the α combination survey results exceeded LCR P-1 (removable) or P-2 (fixed) levels, a sample of abandoned pipe material was obtained by hand scraping the interior pipe surface. The scrape sample was analyzed by α or γ spectroscopy and the results were used to calculate a sample-specific GLV in accordance with LCR P-2.

3.5.5 Backfill Material

Gross γ radioactivity scans were performed to segregate excavated soil as detailed in Section 3.4.4.1. In addition, representative soil samples from potentially radiologically impacted soil, acceptable backfill material, and off-site borrow fill (e.g., sand) were analyzed by α or γ spectroscopy. The analytical results are presented in Appendix K.

3.6 QA/QC

Final survey data obtained by laboratory analysis and field instrumentation were subject to QA/QC procedures. Standard radioactive sources of appropriate energies were used routinely to check instrument operability. Ten percent of the samples analyzed in the laboratory were processed as sample duplicates or method blanks, with twice as many sample duplicates prepared as method blanks. The method blank sample results were evaluated against background conditions; results and duplicates were compared to each other. Laboratory QA/QC data are included in Appendix L. A comparison of alpha and gamma spectroscopy results for samples analyzed by both is presented in Table L-2.

An approved health physics services organization (GTS Duratek or Applied Health Physics) calibrated portable instruments using appropriate NIST-traceable sources based upon the radiation energy range of the nuclides of concern. Field instruments were calibrated semiannually and following maintenance that could affect calibration. Before being used in the field, the instruments were checked against standard sources to confirm instrument operability. Results of routine QC checks of field instruments are included in Appendix M.

Final survey data were verified to assure that the measurements that produced the data were performed in accordance with the approach specified in the Final Status Survey Plan (Earth Sciences, 1999). The data were also verified by ensuring that the results supported the final survey objectives. Among the items selected for verification review were the following:

4.2.3 Laboratory Analysis of Final Soil Samples

Table B-4 shows that 28 soil samples were taken in Survey Unit B; 9 of these samples were analyzed by α spectroscopy and the remainder by γ spectroscopy. Seventeen of the 28 uranium nuclide identifications were at or below the MDA of the spectroscopy analysis used; the thorium nuclide searches returned above-MDA results. The calculated $unity_{soil}$ values for this data set ranged from about 0.2 to 1.8, with an average calculated $unity_{soil}$ value of 0.50. The corresponding μ_{α} value of 0.65 satisfies LCR S-1. The results for the samples taken in the Grid 2 segment of Survey Unit B prompted a hot spot analysis per LCR S-2 that is discussed separately below.

- **Weighted Average Calculations for Grid 2** – Table B-4a shows that 12 samples of soil were taken in Grid 2; half of these samples were analyzed by α spectroscopy, the other half by γ spectroscopy. With the exception of 4 samples (FS-21, FS-23, FS-24, and FS-25), none of the calculated $unity_{soil}$ values exceeded 1.0. The $unity_{soil}$ values calculated for samples FS-21 and FS-23 through FS-25 ranged from 1.02 to 1.78. However, the weighted average $unity_{soil}$ value for this data set was 0.87 that satisfies LCR S-2.

4.2.4 Exposure Rate Survey of Backfilled Trench

Table B-5 shows that 28 measurements of the γ exposure rate at 1-meter height were obtained. The gross exposure rate measurement results ranged between 5 and 10 $\mu\text{R/hr}$ (up to 4 $\mu\text{R/hr}$ net), with an average net exposure rate of 1.3 $\mu\text{R/hr}$. The calculated net μ_{α} value for this data set was 1.6 $\mu\text{R/hr}$ that satisfies LCR S-3.

4.3 Survey Unit C

A total of four field measurements and four laboratory soil analyses were completed in Survey Unit C (see Figure C-1 and Tables C-1 and C-2) to demonstrate conformance with the required LCR. The data obtained for this survey unit showed that all the required LCR were satisfied; therefore, Survey Unit C meets the criteria for free release.

4.3.1 Laboratory Analysis of Final Soil Samples

Table C-1 shows that four soil samples were taken in Survey Unit C; these samples were subsequently analyzed by γ spectroscopy. Uranium nuclide identifications were at or below the MDA of the spectroscopy analysis; the thorium nuclide searches returned above-MDA results. The calculated $unity_{soil}$ values for this data set ranged from about 0.2 to 0.5, with an average $unity_{soil}$ value of 0.32. The corresponding μ_{α} value for this data set was 0.51 that satisfies LCR S-1.

4.7.3 Removable Contamination Surveys of Former Building 7 Basement Concrete Floor

Fifty-five swipe samples of the former Building 7 concrete basement floor were obtained and surveyed for removable α radioactivity. As shown in Table G-3, the net removable α radioactivity results ranged from 0 to 11 dpm/100 cm². The average net removable α radioactivity result was 2 dpm/100 cm². The corresponding net removable α radioactivity μ_{α} value for this data set was 2 dpm/100 cm² that satisfies LCR P-1.

Although not required to demonstrate conformance with any LCR, Table G-3 also shows that another 55 swipe samples of the former Building 7 basement floor were obtained and surveyed for removable β contamination. The net removable β contamination results ranged from 0 to 65 dpm/100 cm².

4.7.4 Removable Contamination Surveys of Former Building 7 Sectioned Concrete Blocks

Forty-three swipe samples of the sides and bottom of concrete sectioned from the former Building 7 basement floor were obtained and surveyed for removable α contamination. As shown in Table G-4, all but one of the α radioactivity results were indistinguishable above the MDA of the survey instrument used (which ranged from 19 to 22 dpm/100 cm²). The α radioactivity result for swipe Sample B7-64 of Block No. 2 was 40.8 dpm/100 cm². Assuming the presence of α radioactivity at levels corresponding to the MDA for the survey instrumentation for all other measurements, the removable α contamination result was 21.4 dpm/100 cm². The corresponding gross α removable radioactivity μ_{α} value for this data set was 22.4 dpm/100 cm² that satisfies LCR P-1.

4.7.5 Laboratory Analysis of Final Soil Samples

Table G-5 shows that 50 final soil samples were taken in Survey Unit G; 7 of these samples were analyzed by α spectroscopy and the remainder by γ spectroscopy. Thirty-one of the 50 uranium nuclide identifications were at or below the MDA of the spectroscopy analysis used; all except 1 of the thorium nuclide searches returned above-MDA results. The calculated unity_{soil} values for this data set ranged from about 0.2 to 1.5, with an average unity_{soil} value of 0.61. The corresponding μ_{α} value for this data set was 0.69 that satisfies LCR S-1.

The results for the soil samples taken in Survey Unit G prompted a hot spot analysis per LCR S-2. Table G-5a shows that the weighted average unity_{soil} value for this data set was 0.57 that also satisfies LCR S-2.

**Table L-2
Comparison of Alpha and Gamma Spectroscopy Results**

Gamma Spec Results:
Total U = 2 x Th-234 + U-235
Total Th = 2 x Ra-228

Alpha Spec Results:
Total U = U-234 + U-235 + U-238
Total Th = Th-228 + Th-232

Sample Number	Comments	Gamma Spec Results		Alpha Spec Results		Uranium Comparison % $1-U_{tot,\alpha}/U_{tot,\gamma}$	Thorium Comparison % $1-Th_{tot,\alpha}/Th_{tot,\gamma}$
		Total U (pCi/g)	Total Th (pCi/g)	Total U (pCi/g)	Total Th (pCi/g)		
1	Manhole 15" TC pipe	10.22	1.16	12.65	1.25	-24%	-8%
2	Manhole 12" TC pipe	8.16	1.51	2.07	1.49	75%	2%
3	Bldg 7 3.5m S	36.28	1.75	42.33	2.38	-17%	-36%
4	Bldg 7 6m S 3m E	89.33	2.00	80.54	2.00	10%	0%
5	Bldg 7 8m S	28.97	1.71	28.64	2.02	1%	-18%
6	Bldg 7 8m S .4m E	27.13	1.79	44.97	1.71	-66%	5%
7	Bldg 7 10m S	17.10	1.51	13.82	1.75	19%	-16%
8	Bldg 7 11.6m S 1m E	8.39	1.66	1.69	1.71	80%	-3%
9	Bldg 7 13m S 2.2m E	9.52	1.22	1.97	1.86	79%	-52%
10	Bldg 7 14m S 4.5m E	11.07	1.26	8.17	1.40	26%	-11%
11	Bldg 7 12.5m S	30.41	70.60	6.73	8.30	78%	88%
18	Average background soil	10.01	1.42	1.12	1.25	89%	12%
19	BKG-1	9.63	1.65	1.52	2.08	84%	-26%
20	BKG-2	10.53	1.58	1.88	1.79	82%	-13%
21	BKG-3	2.06	1.60	1.61	1.84	22%	-15%
22	BKG-4	9.56	0.93	1.62	1.68	83%	-80%
23	BKG-5	9.58	1.08	1.60	1.65	83%	-52%
24	BKG-6	10.67	1.09	1.29	1.58	88%	-45%

Notes:

MDA values are shaded.

**Table A-4
Final Soil Samples
Survey Unit A**

Sample Date	Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
2/3/00	ARL-FS-27	8.40E+00	1.80E+00	1.20E-01
2/15/00	Soil RR-7 (FS-30)	9.80E+00	1.83E+00	1.49E-01
2/15/00	Soil RR-8 (FS-31)	1.15E+01	2.36E+00	5.65E-01
2/15/00	Soil RR-9 (FS-32)	9.09E+00	2.30E+00	1.00E-01
2/16/00	Soil-RR-10 (FS-33)*	3.70E+00	1.72E+00	2.78E-01
2/16/00	Soil-RR-11 (FS-34)*	4.40E+00	1.60E+00	2.86E-01
2/16/00	Soil-RR-12 (FS-35)*	3.06E+01	1.82E+00	1.06E+00
2/16/00	Align-1-1 (FS-36)	8.97E+00	2.14E+00	1.70E-01
2/16/00	Align-1-2 (FS-37)	9.14E+00	2.24E+00	1.85E-01
2/17/00	Align-1-3 (FS-38)	9.21E+00	1.34E+00	8.97E-01
2/17/00	Align-1-4 (FS-39)	8.57E+00	1.98E+00	3.03E-01
2/17/00	Align-1-5 (FS-40)	1.08E+01	2.78E+00	5.87E-01
2/8/00	Rock Frag. RR-1 (FS-41)	5.86E+00	2.10E+00	3.77E-01
2/18/00	Align-1-6 (FS-42)*	5.66E+00	2.25E+00	3.87E-01
2/18/00	Align-1-7 (FS-43)	5.59E+00	1.41E+00	3.01E-01
2/9/00	Soil-RR-4 (FS-44)*	6.08E+00	2.27E+00	4.01E-01
2/9/00	Soil-RR-6 (FS-45)*	9.03E+00	2.92E+00	5.50E-01
2/21/00	Align-1-8 (FS-67)	1.25E+01	1.28E+00	4.84E-01
2/21/00	Align-1-9 (FS-68)	8.99E+00	1.03E+00	8.59E-01
2/21/00	Align-1-10 (FS-69)	9.44E+00	1.28E+00	3.98E-01
2/22/00	Align-1-11 (FS-70)	7.13E+00	7.48E-01	2.78E-01
2/22/00	Align-1-12 (FS-71)	9.42E+00	7.64E-01	8.75E-01
2/22/00	Align-1-13 (FS-72)	8.04E+00	8.22E-01	1.69E-01
2/22/00	Align-1-14 (FS-73)*	1.30E+00	1.44E+00	1.81E-01
2/22/00	Align-1-15 (FS-74)	8.97E+00	1.37E+00	8.93E-01
2/23/00	Align-1-16 (FS-75)*	1.82E+00	1.32E+00	1.84E-01
2/23/00	Align-1-17 (FS-76)*	1.12E+01	1.54E+00	4.74E-01
2/23/00	Align-1-18 (FS-77)*	2.38E+01	2.40E+00	9.19E-01

**Table A-4
Final Soil Samples
Survey Unit A**

Sample Date	Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
2/23/00	Align-1-19 (FS-78)	4.04E+00	2.02E+00	3.17E-01
2/24/00	Align-1-20 (FS-79)	9.79E+00	2.38E+00	5.18E-01
2/25/00	Align-1-21 (FS-80)	6.57E+00	2.10E+00	3.12E-01
2/25/00	Align-1-22 (FS-81)	6.33E+00	1.91E+00	1.29E-01
2/28/00	Align-1-23 (FS-82)*	1.72E+01	1.96E+00	6.86E-01
2/28/00	Align-1-24 (FS-83)	1.59E+01	1.52E+00	3.07E-01
2/28/00	Align-1-25 (FS-84)	5.35E+00	1.49E+00	3.16E-01
2/29/00	Align-1-26 (FS-85)*	4.83E+00	1.51E+00	2.89E-01
2/29/00	Align-1-27 (FS-86)*	1.66E+01	1.63E+00	6.36E-01
2/29/00	Align-1-28 (FS-87)*	5.89E+00	1.72E+00	3.40E-01
3/1/00	Align-1-29 (FS-88)*	2.11E+00	2.23E+00	2.83E-01
3/1/00	Align-1-30 (FS-89)*	3.15E+00	2.49E+00	3.39E-01
3/1/00	Align-1-31 (FS-90)*	4.62E+01	2.04E+00	1.52E+00
3/1/00	Align-1-32 (FS-91)*	3.57E+01	2.10E+00	1.23E+00
3/1/00	Align-1-33 (FS-92)*	1.88E+00	1.66E+00	2.05E-01
3/2/00	Drain-1 (FS-93)*	2.69E+00	1.52E+00	2.20E-01
3/2/00	Drain-2 (FS-94)*	1.23E+00	1.43E+00	1.78E-01
3/2/00	Drain-3 (FS-95)*	1.03E+00	1.39E+00	1.68E-01
	Railroad Spur Weighted Average:			5.23E-01
	Grid 4 Weighted Average:			5.48E-01
	Count			48
	Average			0.45
t	Standard Deviation			0.27
1.679	95% CL Test		$\mu_{\alpha} =$	0.52
2.014	97.5% CL Test		$\mu_{\alpha} =$	0.53

Notes:

1. MDA values are shaded.
2. **Bold results are > Acceptance Criteria.**
3. t values from NUREG/CR-5849, Table B-1.
4. * Denotes values from alpha spectroscopy.
5. Also included in the μ_{α} calculation is the weighted average from the grid 4 and railroad spur grid elevated area (hot spot) evaluation, per NUREG/CR-5849.

Table B-4
Final Soil Samples
Survey Unit B

Sample Date	Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
12/21/99	Arl. Ave. FS1	6.97E+00	1.14E+00	8.13E-01
12/21/99	Arl. Ave. FS2	1.32E+01	1.25E+00	5.02E-01
12/21/99	Arl. Ave. FS3	9.17E+00	1.15E+00	8.77E-01
12/21/99	Arl. Ave. FS4	2.32E+01	1.68E+00	8.31E-01
12/21/99	Arl. Ave. FS5	1.35E+01	1.49E+00	5.63E-01
1/11/00	Arling-FS-8	8.17E+00	1.16E+00	3.49E-01
1/11/00	Arling-FS-9	7.01E+00	9.36E-01	2.94E-01
1/11/00	Arling-FS-10	6.71E+00	9.46E-01	2.86E-01
1/17/00	ARL-FS-13*	1.67E+00	2.31E+00	2.79E-01
1/17/00	ARL-FS-14*	3.77E+00	9.60E-01	2.04E-01
1/19/00	ARL-FS-15	5.08E+00	3.90E-01	2.18E-01
1/21/00	ARL-FS-16	5.87E+00	5.74E-01	2.25E-01
1/21/00	ARL-FS-17	6.18E+00	9.08E-01	2.66E-01
1/24/00	ARL-FS-18	1.33E+01	6.44E-01	2.44E-01
1/24/00	ARL-FS-19	5.64E+00	6.74E-01	2.29E-01
1/27/00	ARL-FS-20A*	3.27E+01	8.30E-01	1.02E+00
1/27/00	ARL-FS-21	4.45E+01	8.48E-01	1.36E+00
1/28/00	ARL-FS-22	4.49E+00	1.47E+00	2.75E-01
1/29/00	ARL-FS-23*	5.52E+00	1.33E+00	2.91E-01
1/31/00	ARL-FS-24	3.44E+01	1.11E+00	1.09E+00
2/2/00	ARL-FS-25*	5.49E+01	2.11E+00	1.78E+00
2/2/00	ARL-FS-26*	1.82E+01	1.99E+00	7.18E-01
2/7/00	ARL-FS-28*	1.63E+00	1.05E+00	1.51E-01
2/7/00	ARL-FS-29*	1.10E+00	1.42E+00	1.73E-01
3/6/00	FS-100	8.64E+00	1.21E+00	3.68E-01
3/6/00	FS-101*	2.41E+00	1.28E+00	1.97E-01
3/6/00	FS-102	1.05E+01	1.29E+00	4.29E-01
3/8/00	FS-106	1.12E+01	1.40E+00	4.61E-01
	Grid 2 Weighted Average:			8.75E-01
	Count			29
	Average			0.50
<i>t</i>	Standard Deviation			0.39
1.701	95% CL Test		$\mu_\alpha =$	0.63
2.048	97.5% CL Test		$\mu_\alpha =$	0.65

Notes:

1. MDA values are shaded.
2. **Bold results are > Acceptance Criteria.**
3. *t* values from NUREG/CR-5849, Table B-1.
4. * Denotes values from alpha spectroscopy.
5. Also included in the μ_α calculation is the weighted average from the grid 2 elevated area (hot spot) evaluation, per NUREG/CR-5849.

**Table G-5
Final Soil Samples
Survey Unit G**

Sample Date	Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
1/12/00	D-13 (FS-11)*	3.72E+00	2.33E+00	3.39E-01
1/7/00	B7-E13 (FS-12)	9.70E+00	1.47E+00	4.24E-01
3/14/00	B-10 (FS-116)	8.68E+00	1.51E+00	3.99E-01
3/14/00	D-11 (FS-117)	2.21E+01	1.01E+00	7.34E-01
3/14/00	E-9 (FS-118)	1.57E+01	2.26E+00	6.76E-01
3/14/00	A-13 (FS-119)	9.68E+00	1.98E+00	4.72E-01
3/14/00	C-13 (FS-120)	3.45E+00	1.79E+00	2.77E-01
3/14/00	E-9 (FS-121)*	1.74E+01	3.43E+00	8.41E-01
3/14/00	D-5 (FS-123)	1.16E+01	2.72E+00	6.04E-01
3/14/00	E-7 (FS-124)	1.68E+01	1.97E+00	6.77E-01
3/14/00	F-6 (FS-126)*	6.70E+00	3.14E+00	5.05E-01
3/14/00	E-1 (FS-128)	3.18E+00	9.42E-01	1.85E-01
3/14/00	F-3 (FS-129)	1.79E+01	1.23E+00	6.35E-01
3/14/00	E-7 (FS-130)	1.57E+01	2.42E+00	5.90E-01
3/14/00	E-5 (FS-131)	1.45E+01	1.75E+00	5.89E-01
3/14/00	A-13 (FS-132)	3.00E+00	1.34E+00	3.62E-01
3/14/00	E-4 (FS-134)*	1.58E+01	2.40E+00	6.91E-01
3/14/00	E-10 (FS-135)	2.03E+01	1.23E+00	7.05E-01
3/14/00	D-8 (FS-136)	2.85E+01	1.80E+00	9.94E-01
3/14/00	D-3 (FS-137)	1.55E+01	1.92E+00	6.35E-01
3/14/00	C-6 (FS-138)	1.21E+01	2.72E+00	5.18E-01
3/15/00	F-2 (FS-139)	1.94E+01	1.71E+00	7.25E-01
3/15/00	E-11 (FS-140)	5.87E+00	6.35E-01	2.17E-01
3/15/00	F-2 (FS-141)	3.49E+00	1.37E+00	3.80E-01
3/15/00	D-6 (FS-142)	1.10E+01	2.10E+00	5.24E-01
3/15/00	D-4 (FS-144)	5.02E+00	2.10E+00	3.53E-01
3/15/00	E-6 (FS-145)*	1.43E+01	2.64E+00	6.73E-01
3/15/00	E-2 (FS-147)	1.51E+01	1.91E+00	6.22E-01
3/15/00	F-4 (FS-148)	2.71E+00	8.70E-01	1.63E-01
3/15/00	B-3 (FS-149)	3.29E+00	1.64E+00	4.01E-01
3/15/00	B-6 (FS-150)	1.08E+01	1.92E+00	5.01E-01
3/21/00	D-7 (FS-151)	1.11E+01	2.08E+00	5.26E-01
3/21/00	D-8 (FS-152)	1.34E+01	2.04E+00	5.87E-01
3/21/00	F-8 (FS-153)	1.39E+01	2.94E+00	6.90E-01
3/21/00	F-7 (FS-154)	1.07E+01	2.24E+00	5.29E-01
3/21/00	F-7 (FS-155)	1.46E+01	2.92E+00	7.08E-01
3/21/00	E-8 (FS-156)	1.99E+01	2.24E+00	7.93E-01
3/24/00	G-10 (FS-160)	7.14E+00	1.11E+00	3.15E-01
3/28/00	G-2 (FS-161)	4.16E+01	2.66E+00	1.45E+00
3/28/00	G-6 (FS-162)	2.34E+01	1.98E+00	8.67E-01
3/27/00	F-9 (FS-163)*	1.10E+01	1.53E+00	4.67E-01
3/28/00	F-2 (FS-164)	3.10E+01	1.86E+00	1.07E+00

**Table G-5
Final Soil Samples
Survey Unit G**

Sample Date	Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
3/27/00	G-6 (FS-165)*	2.73E+01	2.23E+00	1.00E+00
3/28/00	G-5 (FS-166)	2.32E+01	2.32E+00	8.94E-01
3/28/00	G-2 (FS-167)	3.95E+01	2.14E+00	1.34E+00
3/28/00	E-6 (FS-168)	1.12E+01	1.75E+00	4.96E-01
3/28/00	G-7 (FS-169)	1.21E+01	2.24E+00	5.70E-01
3/28/00	G-7 (FS-170)	1.77E+01	1.53E+00	6.59E-01
3/28/00	G-8 (FS-171)	1.04E+01	2.26E+00	5.22E-01
3/28/00	G-8 (FS-172)	1.11E+01	3.04E+00	6.21E-01
	weighted mean			5.72E-01
	Count			51
	Average			0.61
t	Standard Deviation			0.26
1.678	95% CL Test		$\mu_\alpha =$	0.67
2.011	97.5% CL Test		$\mu_\alpha =$	0.69

Notes:

- MDA values are shaded.
- Bold results are > Acceptance Criteria.**
- t values from NUREG/CR-5849, Table B-1.
- * Denotes values from alpha spectroscopy.
- μ_α values were calculated including the as left FS samples.
- Also included in the μ_α calculation is the weighted average from the grid 1 elevated area (hot spot) evaluation, per NUREG/CR-5849.

Table G-5a
Weighted Average Calculations
Survey Unit G
Grid 1

Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
E-1 (FS-128)	3.8E+00	9.42E-01	3.85E-01
F-3 (FS-129)	1.79E+01	1.23E+00	6.35E-01
E-4 (FS-134)*	1.58E+01	2.40E+00	6.91E-01
D-3 (FS-137)	1.55E+01	1.92E+00	6.35E-01
F-2 (FS-139)	1.94E+01	1.71E+00	7.25E-01
F-2 (FS-141)	3.9E+00	1.37E+00	3.8E-01
D-4 (FS-144)	5.02E+00	2.10E+00	3.53E-01
E-2 (FS-147)	5.1E+01	1.91E+00	6.22E-01
E-2 (FS-148)	2.7E+00	8.70E-01	3.4E-01
B-3 (FS-149)	3.29E+00	1.64E+00	1.01E-01
Average:	1.11E+01	1.61E+00	4.79E-01

Elevated Area Samples

G-2 (FS-161)	4.16E+01	2.66E+00	1.45E+00
F-2 (FS-164)	3.10E+01	1.86E+00	1.07E+00
G-6 (FS-165)*	2.73E+01	2.23E+00	1.00E+00
G-2 (FS-167)	3.95E+01	2.14E+00	1.34E+00
Average:	3.49E+01	2.22E+00	1.22E+00

$$\bar{x}_w = (1/n_s) \sum_{i=1}^{n_s} x_i \left[1 - \sum_{k=1}^{n_k} A_k \right] + \sum_{k=1}^{n_k} y_k A_k$$

Area test: $A_1 = (80/10)^{0.5} = 2.83$

Average in elevated area must be < 2.83 x guideline value of unity:
 $1.22 < 2.83$

$X_{\text{weighted average}} = (0.479 \times (1 - (10/80))) + (1.22 \times (10/80)) = 0.572$

where $A_{\text{hs}1} = 10 \text{ m}^2$

$A_{\text{tot}} = 80 \text{ m}^2$

y_k = elevated area activity in area k

n_s = number of systematic and random measurements

n_k = number of measurements in area k

x_i = systematic and random measurements at point

$A_k = A_{\text{hs}}/A_{\text{tot}}$ = ratio of hotspot area to total averaged area

Notes:

MDA values are shaded.

* Denotes results from alpha spectroscopy.

**Table K-1a
Lab Analysis of Backfill Material
Survey Unit A**

Sample Date	Survey Point	Total U (pCi/g)	Total Th (pCi/g)	Sum (Unity)
2/3/00	SP-6A	1.24E+01	1.32E+00	4.85E-01
2/3/00	SP-6B	1.23E+01	1.23E+00	4.76E-01
2/3/00	SP-6C	1.27E+01	1.22E+00	4.85E-01
2/3/00	SP-7	2.00E+00	2.02E+00	3.32E-01
2/15/00	Stockpile-SP-9-1	1.21E+00	1.48E+00	3.1E-01
2/15/00	Stockpile-SP-9-2	1.39E+00	2.06E+00	3.01E-01
2/16/00	Stockpile-SP-9-3	1.61E+00	1.64E+00	3.10E-01
2/16/00	Stockpile-SP-9-4	1.96E+00	1.27E+00	2.8E-01
2/18/00	Stockpile-SP-9-7	1.68E+00	1.01E+00	2.92E-01
2/18/00	Stockpile-SP-9-8	1.90E+00	1.61E+00	3.1E-01
2/17/00	Stockpile-SP-9-5	1.02E+01	2.00E+00	1.91E-01
2/17/00	Stockpile-SP-9-6	1.07E+01	2.04E+00	1.609E-01
2/21/00	Stockpile-SP-9-9	1.74E+00	1.46E+00	3.39E-01
2/15/00	Stockpile-SP-10-1	1.05E+01	1.49E+00	1.52E-01
2/15/00	Stockpile-SP-10-2	1.03E+01	1.85E+00	1.80E-01
2/21/00	Stockpile-SP-11-1	1.1E+00	2.04E+00	1.1E-01
2/22/00	Stockpile-SP-12-1	1.57E+00	1.31E+00	2.3E-01
2/23/00	Stockpile SP-13-1	1.73E+00	1.98E+00	1.76E-01
2/23/00	Stockpile SP-14-1	1.1E+00	2.20E+00	1.89E-01
2/24/00	Stockpile-SP-15-1	1.76E+01	1.32E+00	1.62E-01
2/25/00	Stockpile-SP-15-2	1.03E+01	1.72E+00	4.66E-01
2/28/00	Stockpile-Sp-16-1	1.50E+01	1.25E+00	1.53E-01
2/28/00	Stockpile-Sp-16-2	1.05E+00	1.74E+00	1.1E-01
3/1/00	Stockpile-SP-17-1*	1.59E+01	1.64E+00	6.19E-01
3/1/00	Stockpile-SP-18-1*	1.79E+01	1.90E+00	7.00E-01
2/17/00	Quarry Sand 1	1.16E+01	1.19E+01	1.51E-01
2/8/00	Backfill-1	1.07E+01	1.40E+01	1.07E-01
2/21/00	Backfill-2	1.10E+01	1.15E+01	1.15E-01
2/21/00	Backfill-3	1.80E+00	8.48E-01	1.08E-01
2/28/00	Backfill-4*	7.98E-01	9.20E-01	1.15E-01
	Count	30	30	30
	Average	10.67	2.67	0.57
	Standard Deviation	4.57	3.36	0.42
1.699	95% CL Test $\mu_\alpha =$	12.09	3.71	0.70
2.045	97.5% CL Test $\mu_\alpha =$	12.38	3.92	0.73

Notes:

- * Denotes results from alpha spectroscopy.
- MDA values are shaded.
- t values from NUREG/CR-5849, Table B-1.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
B-10 (FS-116)	G	Grid B-10, bottom @ 2' depth	709742.0722	576606.7474	148.4300	Gamma	U-238	NR	NR	1.04E+01
							U-235	NR	NR	5.52E-01
							Th-234	NR	NR	4.06E+00
							Th-228	7.93E-01	1.83E-01	NR
							Ra-228	7.54E-01	1.39E-01	NR
							Ra-226	5.38E-01	7.02E-02	NR
D-11 (FS-117)	G	Grid D-11, bottom @ 2' depth	709730.7322	576610.3014	148.9900	Gamma	U-238	1.43E+01	5.78E+00	NR
							U-235	5.38E-01	1.83E-01	NR
							Th-234	1.08E+01	1.32E+00	NR
							Th-228	5.67E-01	1.37E-01	NR
							Ra-228	5.05E-01	1.06E-01	NR
							Ra-226	4.05E-01	6.21E-02	NR
E-9 (FS-118)	G	Grid E-9, bottom @ 4' depth	709730.4002	576593.2444	146.9300	Gamma	U-238	1.69E+01	6.78E+00	NR
U-235							5.89E-01	4.80E-01	NR	
Th-234							7.58E+00	4.71E+00	NR	
Th-228							1.12E+00	2.49E-01	NR	
Ra-228							1.13E+00	1.48E-01	NR	
Ra-226							6.77E-01	8.18E-02	NR	
A-13 (FS-119)	G	Grid A-13, bottom @ 4' depth	709749.2832	576624.8814	150.7300	Gamma	U-238	NR	NR	1.01E+01
							U-235	NR	NR	5.60E-01
							Th-234	NR	NR	4.51E+00
							Th-228	1.26E+00	2.62E-01	NR
							Ra-228	9.92E-01	1.72E-01	NR
							Ra-226	7.19E-01	8.80E-02	NR
C-13 (FS-120)	G	Grid C-13, wall @ 2' depth	709728.8112	576621.5614	150.1200	Gamma	U-238	NR	NR	1.14E+01
							U-235	NR	NR	3.58E-01
							Th-234	NR	NR	1.54E+00
							Th-228	9.77E-01	2.03E-01	NR
							Ra-228	8.93E-01	1.43E-01	NR
							Ra-226	5.80E-01	7.38E-02	NR

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
E-9 (FS-121)	G	Grid E-9, wall @ 3' depth	709728.9172	576589.2284	147.9000	Alpha	U-234	7.80E+00	1.60E+00	1.80E-01
U-235							6.20E-01	2.90E-01	1.60E-01	
U-238							9.00E+00	1.80E+00	1.60E-01	
Th-228							1.75E+00	3.30E-01	1.00E-01	
Th-230							1.09E+00	2.30E-01	3.50E-02	
Th-232							1.68E+00	3.20E-01	1.60E-02	
F-7 (FS-122)	G	Grid F-7, bottom @ 4' depth	709731.2442	576580.6884	150.1700	Alpha	U-234	2.63E+01	4.70E+00	2.20E-01
U-235							1.68E+00	5.40E-01	1.50E-01	
U-238							2.59E+01	4.70E+00	2.40E-01	
Th-228							1.44E+00	2.80E-01	5.40E-02	
Th-230							1.04E+00	2.10E-01	3.20E-02	
Th-232							1.33E+00	2.60E-01	2.50E-02	
F-7 (FS-122) Lab Dup	G	Grid F-7, bottom @ 4' depth	709731.2442	576580.6884	150.1700	Alpha	U-234	2.52E+01	4.50E+00	NR
U-235							1.58E+00	5.20E-01	NR	
U-238							2.56E+01	4.60E+00	NR	
Th-228							1.48E+00	2.90E-01	NR	
Th-230							1.14E+00	2.30E-01	NR	
Th-232							1.41E+00	2.70E-01	NR	
D-5 (FS-123)	G	Grid D-5, bottom @ 4' depth	709749.8712	576575.8334	147.0400	Gamma	U-238	1.33E+01	NR	1.33E+01
U-235							7.00E-01	NR	7.00E-01	
Th-234							5.45E+00	NR	5.45E+00	
Th-228							1.44E+00	2.94E-01	NR	
Ra-228							1.36E+00	2.05E-01	NR	
Ra-226							9.08E-01	9.86E-02	NR	
E-7 (FS-124)	G	Grid E-7, bottom @ 4' depth	709738.6292	576587.5354	146.5300	Gamma	U-238	1.49E+01	NR	1.49E+01
U-235							6.17E-01	NR	6.17E-01	
Th-234							8.08E+00	1.75E+00	NR	
Th-228							1.07E+00	2.26E-01	NR	
Ra-228							9.86E-01	2.01E-01	NR	
Ra-226							6.07E-01	8.86E-02	NR	

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
E-7 (FS-124) Field Dup	G	Grid E-7, bottom @ 4' depth	709738.6292	576587.5354	146.5300	Gamma	U-238	1.20E+01	7.10E+00	NR
							U-235	8.78E-01	2.76E-01	NR
							Th-234	1.10E+01	1.92E+00	NR
							Th-228	1.04E+00	2.39E-01	NR
							Ra-228	9.86E-01	1.44E-01	NR
							Ra-226	6.00E-01	7.96E-02	NR
F-8 (FS-125)	G	Grid F-8, bottom @ 4' depth	709728.4372	576585.5564	149.2600	Gamma	U-238	3.14E+01	9.59E+00	NR
AFTER ADDITIONAL REMEDICATION - REPLACE F-8(FS-125) WITH F-8(FS-152)							U-235	5.41E-01	4.26E-01	NR
Th-234							2.20E+01	8.25E+00	NR	
Th-228							9.23E-01	2.28E-01	NR	
Ra-228							8.38E-01	1.67E-01	NR	
Ra-226							5.79E-01	9.18E-02	NR	
F-6 (FS-126)	G	Grid F-6, bottom @ 4' depth	709732.1552	576572.2744	148.9100	Alpha	U-234	2.88E+00	7.70E-01	2.20E-01
							U-235	2.10E-01	1.70E-01	2.00E-01
							U-238	3.61E+00	9.00E-01	1.80E-01
							Th-228	1.65E+00	3.20E-01	8.60E-02
							Th-230	1.17E+00	2.40E-01	3.80E-02
							Th-232	1.49E+00	2.90E-01	3.80E-02
F-6 (FS-126) Field Dup	G	Grid F-6, bottom @ 4' depth	709732.1552	576572.2744	148.9100	Alpha	U-234	3.52E+00	8.80E-01	2.40E-01
							U-235	2.90E-01	2.10E-01	2.30E-01
							U-238	3.62E+00	9.00E-01	2.40E-01
							Th-228	1.21E+00	2.40E-01	9.00E-02
							Th-230	1.09E+00	2.20E-01	3.40E-02
							Th-232	1.27E+00	2.50E-01	3.10E-02
D-9 (FS-127)	G	Grid D-9, bottom @ 4' depth	709739.3122	576600.2624	147.5000	Gamma	U-238	4.06E+01	1.25E+01	NR
AFTER ADDITIONAL REMEDICATION - REMOVE FROM CALCULATION							U-235	8.97E-01	3.64E-01	NR
Th-234							1.73E+01	7.77E+00	NR	
Th-228							1.12E+00	2.46E-01	NR	
Ra-228							1.11E+00	1.72E-01	NR	
Ra-226							8.50E-01	8.65E-02	NR	

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
E-1 (FS-128)	G	Grid E-1, under concrete @ 3' depth (wall)	709755.8322	576553.7464	145.7500	Gamma	U-238	NR	NR	8.24E+00
							U-235	NR	NR	3.12E-01
							Th-234	NR	NR	1.44E+00
							Th-228	6.92E-01	1.62E-01	NR
							Ra-228	4.71E-01	1.01E-01	NR
							Ra-226	4.31E-01	5.59E-02	NR
F-3 (FS-129)	G	Grid F-3, bottom @ 3' depth	709744.1352	576563.9044	147.1300	Gamma	U-238	9.58E+00	5.72E+00	NR
							U-235	4.56E-01	3.44E-01	NR
							Th-234	8.73E+00	4.77E+00	NR
							Th-228	6.38E-01	1.68E-01	NR
							Ra-228	6.17E-01	1.37E-01	NR
							Ra-226	4.99E-01	7.84E-02	NR
E-7 (FS-130)	G	Grid E-7, side @ 4' depth	709736.2792	576584.6744	146.6200	Gamma	U-238	1.58E+01	8.34E+00	NR
							U-235	6.54E-01	NR	6.54E-01
							Th-234	7.51E+00	2.44E+00	NR
							Th-228	1.24E+00	2.57E-01	NR
							Ra-228	1.21E+00	1.63E-01	NR
							Ra-226	7.30E-01	8.62E-02	NR
E-5 (FS-131)	G	Grid E-5, wall @ 3' depth	709739.5532	576570.4504	148.0700	Gamma	U-238	6.94E+00	6.71E+00	NR
							U-235	6.60E-01	NR	6.60E-01
							Th-234	6.92E+00	1.26E+00	NR
							Th-228	9.64E-01	2.20E-01	NR
							Ra-228	8.73E-01	1.70E-01	NR
							Ra-226	5.96E-01	7.98E-02	NR
A-13 (FS-132)	G	Grid A-13, wall @ 2' depth	709744.7622	576628.7884	151.2400	Gamma	U-238	9.55E+00	NR	9.55E+00
							U-235	4.57E-01	NR	4.57E-01
							Th-234	3.77E+00	NR	3.77E+00
							Th-228	7.34E-01	1.86E-01	NR
							Ra-228	6.68E-01	1.29E-01	NR
							Ra-226	3.88E-01	7.28E-02	NR

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
F-9 (FS-133)	G	Grid F-9, wall @ 4' depth	709722.8322	576589.1504	148.0500	Gamma	U-238	2.86E+01	8.43E+00	NR
AFTER ADDITIONAL REMEDIATION - REMOVE FROM CALCULATION							U-235	1.30E+00	5.91E-01	NR
							Th-234	2.48E+01	8.46E+00	NR
							Th-228	1.03E+00	2.20E-01	NR
							Ra-228	9.16E-01	1.43E-01	NR
							Ra-226	5.88E-01	7.49E-02	NR
E-4 (FS-134)	G	Grid E-7, bottom @ 2' depth	709744.0012	576564.6624	147.2700	Alpha	U-234	7.70E+00	1.60E+00	1.90E-01
							U-235	3.70E-01	2.20E-01	1.40E-01
							U-238	7.70E+00	1.60E+00	1.60E-01
							Th-228	1.27E+00	2.60E-01	1.10E-01
							Th-230	8.70E-01	1.90E-01	3.80E-02
							Th-232	1.13E+00	2.30E-01	3.50E-02
							E-4 (FS-134) Lab Dup	G	Grid E-7, bottom @ 2' depth	709744.0012
U-235	2.30E-01	1.70E-01	NR							
U-238	6.90E+00	1.40E+00	NR							
Th-228	1.13E+00	2.30E-01	NR							
Th-230	7.50E-01	1.70E-01	NR							
Th-232	1.10E+00	2.30E-01	NR							
E-10 (FS-135)	G	Grid E-10, bottom @ 2.5' depth	709732.8752	576602.2134	148.2100	Gamma	U-238	1.35E+01	6.92E+00	NR
AFTER ADDITIONAL REMEDIATION - ADD INTO CALCULATION							U-235	5.21E-01	3.62E-01	NR
							Th-234	9.91E+00	1.22E+00	NR
							Th-228	5.56E-01	1.59E-01	NR
							Ra-228	6.17E-01	1.61E-01	NR
							Ra-226	3.42E-01	6.15E-02	NR
D-8 (FS-136)	G	Grid D-8, bottom @ 4' depth	709739.1032	576593.2034	146.9900	Gamma	U-238	2.35E+01	9.28E+00	NR
							U-235	8.88E-01	8.29E-01	NR
							Th-234	1.38E+01	6.38E+00	NR
							Th-228	1.10E+00	2.40E-01	NR
							Ra-228	9.01E-01	2.07E-01	NR
							Ra-226	4.46E-01	7.49E-02	NR

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

Table P-1
Final Soil Sample Locations and Laboratory Results

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
D-3 (FS-137)	G	Grid D-3, bottom @ 4' depth	709756.7572	576564.7294	147.2400	Gamma	U-238	1.55E+01	8.77E+00	NR
							U-235	1.03E+00	4.62E-01	NR
							Th-234	7.23E+00	5.65E+00	NR
							Th-228	1.08E+00	2.43E-01	NR
							Ra-228	9.62E-01	1.57E-01	NR
							Ra-226	6.99E-01	8.30E-02	NR
C-6 (FS-138)	G	Grid C-6, bottom @ 4' depth	709753.0942	576583.6744	147.0900	Gamma	U-238	1.46E+00	NR	1.44E+01
							U-235	7.52E-01	NR	7.62E-01
							Th-234	5.67E+00	NR	5.67E+00
							Th-228	1.46E+00	3.54E-01	NR
							Ra-228	1.36E+00	2.05E-01	NR
							Ra-226	9.00E-01	1.09E-01	NR
F-2 (FS-139)	G	Grid F-2, east wall @ 4' depth	709748.7072	576551.4974	146.4800	Gamma	U-238	8.20E+00	5.40E+00	NR
							U-235	4.70E-01	4.68E-01	NR
							Th-234	9.46E+00	5.38E+00	NR
							Th-228	7.90E-01	2.04E-01	NR
							Ra-228	8.54E-01	1.58E-01	NR
							Ra-226	5.74E-01	8.20E-02	NR
E-11 (FS-140)	G	Grid E-11, center bottom @ 2' depth	709731.8912	576601.7774	148.5300	Gamma	U-238	1.06E+01	NR	1.06E+01
							U-235	2.94E-01	NR	2.94E-01
							Th-234	2.54E+00	4.92E-01	NR
							Th-228	4.36E-01	1.27E-01	NR
							Ra-228	3.17E-01	NR	3.17E-01
							Ra-226	2.47E-01	5.30E-02	NR
F-2 (FS-141)	G	Grid F-2, wall under concrete @ 2' depth	709749.3522	576552.1504	145.9600	Gamma	U-238	8.01E+00	NR	8.01E+00
							U-235	5.23E-01	NR	5.23E-01
							Th-234	3.98E+00	NR	3.98E+00
							Th-228	5.89E-01	1.44E-01	NR
							Ra-228	6.86E-01	1.21E-01	NR
							Ra-226	4.88E-01	6.87E-02	NR

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Table P-1
Final Soil Sample Locations and Laboratory Results

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
D-6 (FS-142)	G	Grid D-6, bottom center of grid @ 4.5' depth	709746.3092	576581.7244	146.8200	Gamma	U-238	NR	NR	1.17E+01
							U-235	NR	NR	5.88E-01
							Th-234	NR	NR	5.19E+00
							Th-228	1.12E+00	2.53E-01	NR
							Ra-228	1.05E+00	2.00E-01	NR
							Ra-226	7.73E-01	9.96E-02	NR
D-7 (FS-143)	G	Grid D-7, bottom center of grid @ 5' depth	709743.4122	576589.5644	147.1700	Gamma	U-238	3.54E+01	9.18E+00	NR
AFTER ADDITIONAL REMEDIATION - REPLACE WITH D-7(FS-151)							U-235	1.42E+00	6.25E-01	NR
Th-234							2.98E+01	9.93E+00	NR	
Th-228							1.07E+00	2.39E-01	NR	
Ra-228							9.81E-01	1.89E-01	NR	
Ra-226							6.02E-01	8.22E-02	NR	
D-4 (FS-144)	G	Grid D-4, bottom, east side of grid @ 4' depth	709752.0562	576568.5574	146.9700	Gamma	U-238	NR	NR	1.30E+01
							U-235	NR	NR	3.98E-01
							Th-234	2.31E+00	5.10E-01	NR
							Th-228	1.19E+00	2.47E-01	NR
							Ra-228	1.05E+00	1.57E-01	NR
							Ra-226	7.12E-01	7.82E-02	NR
E-6 (FS-145)	G	Grid E-6, bottom, east side of grid @ 4' depth	709737.2572	576576.2944	147.2300	Alpha	U-234	6.90E+00	1.30E+00	2.20E-01
							U-235	4.20E-01	2.10E-01	1.20E-01
							U-238	7.00E+00	1.40E+00	1.40E-01
							Th-228	1.53E+00	3.10E-01	7.70E-02
							Th-230	8.60E-01	2.00E-01	3.00E-02
							Th-232	1.11E+00	2.40E-01	1.70E-02
E-9 (FS-146)	G	Grid E-9, north wall @ 3' depth	709726.6972	576595.5504	147.1000	Gamma	U-238	2.64E+01	8.43E+00	NR
AFTER ADDITIONAL REMEDIATION - REMOVE FROM CALCULATION							U-235	8.96E-01	3.59E-01	NR
Th-234							1.89E+01	7.06E+00	NR	
Th-228							7.68E-01	1.95E-01	NR	
Ra-228							7.82E-01	1.32E-01	NR	
Ra-226							5.43E-01	7.83E-02	NR	

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
E-2 (FS-147)	G	Grid E-2, bottom center of grid @ 5' depth	709754.5792	576556.6074	145.6000	Gamma	U-238	1.03E+01	6.54E+00	NR
							U-235	6.92E-01	NR	6.92E-01
							Th-234	7.20E+00	1.30E+00	NR
							Th-228	1.13E+00	2.47E-01	NR
							Ra-228	9.56E-01	1.61E-01	NR
							Ra-226	6.63E-01	8.73E-02	NR
Align-5-2 (FS-148)	F	outside of bld 7 basement @ F-4 grid, next to iron pipe penetrating	709733.8592	576558.7574	150.1000	Gamma	U-238	7.78E+00	NR	7.78E+00
							U-235	2.61E-01	NR	2.61E-01
							Th-234	1.22E+00	NR	1.22E+00
							Th-228	4.15E-01	1.24E-01	NR
							Ra-228	4.35E-01	1.08E-01	NR
							Ra-226	4.18E-01	6.07E-02	NR
B-3 (FS-149)	G	Grid B-3, bottom @ 3' depth	709770.7032	576574.8874	148.1800	Gamma	U-238	9.13E+00	NR	9.13E+00
							U-235	4.58E-01	NR	4.58E-01
							Th-234	3.92E+00	NR	3.92E+00
							Th-228	7.69E-01	1.77E-01	NR
							Ra-228	8.19E-01	1.54E-01	NR
							Ra-226	6.03E-01	7.39E-02	NR
B-6 (FS-150)	G	Grid B-6, bottom, east side of grid @ 2' depth	709756.0302	576594.9334	148.6700	Gamma	U-238	1.29E+01	NR	1.29E+01
							U-235	6.81E-01	NR	6.81E-01
							Th-234	5.05E+00	NR	5.05E+00
							Th-228	1.04E+00	2.52E-01	NR
							Ra-228	9.62E-01	1.89E-01	NR
							Ra-226	7.66E-01	1.04E-01	NR
D-7 (FS-151)	G	Grid D-7, bottom @ 6' depth	N/A	N/A	N/A	Gamma	U-238	1.24E+01	NR	1.24E+01
							U-235	5.72E-01	NR	5.72E-01
							Th-234	5.27E+00	NR	5.27E+00
							Th-228	1.03E+00	2.37E-01	NR
							Ra-228	1.04E+00	1.93E-01	NR
							Ra-226	6.40E-01	9.31E-02	NR

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
D-8 (FS-152)	G	Grid F-8, bottom @ 5' depth	N/A	N/A	N/A	Gamma	U-238	9.98E+00	8.59E+00	NR
							U-235	7.22E-01	NR	7.22E-01
							Th-234	6.35E+00	NR	6.35E+00
							Th-228	1.10E+00	2.43E-01	NR
							Ra-228	1.02E+00	1.89E-01	NR
							Ra-226	5.59E-01	8.37E-02	NR
F-8 (FS-153)	G	Grid F-8, east wall @ 4' depth	N/A	N/A	N/A	Gamma	U-238	5.7E+00	NR	1.57E+01
							U-235	5.03E-01	NR	5.03E-01
							Th-234	6.68E+00	9.72E-01	NR
							Th-228	1.48E+00	2.91E-01	NR
							Ra-228	1.47E+00	1.79E-01	NR
							Ra-226	8.75E-01	9.79E-02	NR
F-7 (FS-154)	G	Grid F-7, east wall @ 4' depth	N/A	N/A	N/A	Gamma	U-238	1.9E+00	NR	1.19E+01
							U-235	5.78E-01	NR	5.78E-01
							Th-234	5.05E+00	NR	5.05E+00
							Th-228	1.29E+00	2.59E-01	NR
							Ra-228	1.12E+00	1.96E-01	NR
							Ra-226	7.26E-01	8.26E-02	NR
F-7 (FS-155)	G	Grid F-7, bottom @ 6' depth	N/A	N/A	N/A	Gamma	U-238	1.65E+00	NR	1.65E+01
U-235							8.03E-01	NR	8.03E-01	
Th-234							6.88E+00	NR	6.88E+00	
Th-228							1.47E+00	3.36E-01	NR	
Ra-228							1.15E+01	1.99E-01	NR	
Ra-226							8.57E-01	1.08E-01	NR	
E-8 (FS-156)	G	Grid C-8, bottom @ 6' depth	N/A	N/A	N/A	Gamma	U-238	1.96E+01	8.94E+00	NR
U-235							5.07E-01	NR	5.07E-01	
Th-234							9.71E+00	1.45E+00	NR	
Th-228							1.34E+00	2.50E-01	NR	
Ra-228							1.12E+00	1.67E-01	NR	
Ra-226							6.07E-01	7.83E-02	NR	

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**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
F-2 (FS-157)	G	Grid F-2, south wall @ 2' depth	N/A	N/A	N/A	Gamma	U-238	1.10E+01	NR	1.10E+01
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - REMOVE FROM CALCULATION							U-235	3.74E-01	NR	3.74E-01
							Th-234	4.53E+00	8.80E-01	NR
							Th-228	9.03E-01	1.91E-01	NR
							Ra-228	6.78E-01	1.17E-01	NR
							Ra-226	6.25E-01	7.03E-02	NR
F-2 (FS-157) Field Dup	G	Grid F-2, south wall @ 2' depth	N/A	N/A	N/A	Gamma	U-238	NRC	NRC	NRC
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - REMOVE FROM CALCULATION							U-235			
							Th-234			
							Th-228			
							Ra-228			
							Ra-226			
F-7 (FS-158)	G	Grid F-7, east wall @ 3' depth	N/A	N/A	N/A	Gamma	U-238	1.50E+01	NR	1.50E+01
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - REMOVE FROM CALCULATION							U-235	6.80E-01	NR	6.80E-01
							Th-234	6.80E-01	NR	6.80E-01
							Th-228	1.38E+00	3.02E-01	NR
							Ra-228	1.25E+00	1.91E-01	NR
							Ra-226	7.50E-01	9.53E-02	NR
F-7 (FS-158) Field Dup	G	Grid F-7, east wall @ 3' depth	N/A	N/A	N/A	Gamma	U-238	NRC	NRC	NRC
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - REMOVE FROM CALCULATION							U-235			
							Th-234			
							Th-228			
							Ra-228			
							Ra-226			
F-8 (FS-159)	G	Grid F-8, east wall @ 3' depth	N/A	N/A	N/A	Gamma	U-238	1.09E+01	9.11E+00	NR
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - REMOVE FROM CALCULATION							U-235	4.25E-01	3.45E-01	NR
							Th-234	9.71E+00	1.27E+00	NR
							Th-228	1.43E+00	3.14E-01	NR
							Ra-228	1.36E+00	1.88E-01	NR
							Ra-226	1.22E+00	1.09E-01	NR

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**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
F-8 (FS-159) Field Dup AFTER ADDITIONAL REMEDIAION BEHIND EAST WALL - REMOVE FROM CALCULATION	G	Grid F-8, east wall @ 3' depth	N/A	N/A	N/A	Gamma	U-238	NRC	NRC	NRC
U-235										
Th-234										
Th-228										
Ra-228										
Ra-226										
G-10 (FS-160) AFTER ADDITIONAL REMEDIAION BEHIND EAST WALL - ADD TO CALCULATION	G	Grid G-10 outside bld. 7, east wall, bottom	N/A	N/A	N/A	Gamma	U-238	9.58E+00	NR	9.58E+00
U-235							5.00E-01	NR	5.00E-01	
Th-234							3.32E+00	7.88E-01	NR	
Th-228							6.87E-01	1.61E-01	NR	
Ra-228							5.56E-01	1.20E-01	NR	
Ra-226							4.78E-01	7.48E-02	NR	
G-2 (FS-161) AFTER ADDITIONAL REMEDIAION BEHIND EAST WALL - ADD TO CALCULATION	G	Grid G-10 outside bld. 7, east wall, bottom	N/A	N/A	N/A	Gamma	U-238	2.73E+01	1.06E+01	NR
U-235							1.37E+00	6.64E-01	NR	
Th-234							2.01E+01	8.50E+00	NR	
Th-228							1.38E+00	3.15E-01	NR	
Ra-228							1.33E+00	2.24E-01	NR	
Ra-226							6.25E-01	9.36E-02	NR	
G-6 (FS-162) AFTER ADDITIONAL REMEDIAION BEHIND EAST WALL - ADD TO CALCULATION	G	Grid G-6 outside bld. 7, east wall, bottom	N/A	N/A	N/A	Gamma	U-238	1.45E+01	NR	1.45E+01
U-235							1.59E+00	1.14E+00	NR	
Th-234							1.09E+01	5.96E+00	NR	
Th-228							1.17E+00	2.83E-01	NR	
Ra-228							9.92E-01	1.86E-01	NR	
Ra-226							7.13E-01	9.87E-02	NR	
F-9 (FS-163) AFTER ADDITIONAL REMEDIAION BEHIND EAST WALL - ADD TO CALCULATION	G	Grid F-9, north wall @ 3' depth	N/A	N/A	N/A	Alpha	U-234	5.20E+00	1.10E+00	1.20E-01
U-235							3.90E-01	1.70E-01	8.00E-02	
U-238							5.40E+00	1.10E+00	4.60E-01	
Th-228							7.90E-01	1.70E-01	4.20E-02	
Th-230							7.00E-01	1.60E-01	1.40E-02	
Th-232							7.40E-01	1.70E-01	2.90E-02	

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**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
F-2 (FS-164)	G	Grid F-2, south wall @ 2.5' depth	N/A	N/A	N/A	Gamma	U-238	1.71E+01	8.31E+00	NR
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	3.81E-01	4.19E-01	NR
							Th-234	1.53E+01	6.59E+00	NR
							Th-228	6.97E-01	1.95E-01	NR
							Ra-228	9.32E-01	1.66E-01	NR
							Ra-226	5.78E-01	7.77E-02	NR
G-4 (FS-165)	G	Grid G-4, bottom @ 7.5' depth	N/A	N/A	N/A	Alpha	U-234	1.32E+01	2.50E+00	1.30E-01
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	6.40E-01	2.40E-01	8.70E-02
							U-238	1.35E+01	2.50E+00	8.70E-02
							Th-228	1.23E+00	2.50E-01	7.50E-02
							Th-230	8.00E-01	1.80E-01	4.40E-02
							Th-232	1.00E+00	2.10E-01	4.80E-02
G-5 (FS-166)	G	Grid G-5, east wallm @ 6' depth	N/A	N/A	N/A	Gamma	U-238	1.58E+01	7.30E+00	NR
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	7.78E-01	3.52E-01	NR
							Th-234	1.12E+01	6.54E+00	NR
							Th-228	1.20E+00	2.59E-01	NR
							Ra-228	1.16E+00	1.62E-01	NR
							Ra-226	7.77E-01	9.26E-02	NR
G-2 (FS-167)	G	Grid G-2, east wallm @ 6' depth	N/A	N/A	N/A	Gamma	U-238	2.54E+01	8.89E+00	NR
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	1.14E+00	5.82E-01	NR
							Th-234	1.92E+01	7.89E+00	NR
							Th-228	8.91E-01	2.43E-01	NR
							Ra-228	1.07E+00	1.93E-01	NR
							Ra-226	7.77E-01	9.50E-02	NR
G-6 (FS-168)	G	Grid G-6, bottom @ 7' depth	N/A	N/A	N/A	Gamma	U-238	1.24E+01	NR	1.24E+01
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	6.50E-01	NR	6.50E-01
							Th-234	5.29E+00	NR	5.29E+00
							Th-228	1.16E+00	2.51E-01	NR
							Ra-228	8.76E-01	1.58E-01	NR
							Ra-226	5.93E-01	8.06E-02	NR

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.

**Table P-1
Final Soil Sample Locations and Laboratory Results**

Sample ID	Survey Unit	Location	GPS Coordinates ⁽¹⁾			Spectroscopy	Radionuclide	Radionuclide Concentration (pCi/g)		
			Northing	Easting	Elevation			Activity	Uncertainty (2σ)	MDC
G-7 (FS-169)	G	Grid G-7, east wall @ 7' depth	N/A	N/A	N/A	Gamma	U-238	1.59E+01	8.07E+00	NR
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	6.23E-01	NR	6.23E-01
							Th-234	5.74E+00	NR	5.74E+00
							Th-228	1.27E+00	2.70E-01	NR
							Ra-228	1.12E+00	1.91E-01	NR
							Ra-226	7.84E-01	9.05E-02	NR
G-7 (FS-170)	G	Grid G-7, east wall @ 5' depth	N/A	N/A	N/A	Gamma	U-238	1.12E+01	6.33E+00	NR
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	6.86E-01	NR	6.86E-01
							Th-234	8.52E+00	1.91E+00	NR
							Th-228	8.02E-01	1.90E-01	NR
							Ra-228	7.65E-01	1.57E-01	NR
							Ra-226	6.49E-01	8.17E-02	NR
G-8 (FS-171)	G	Grid G-7, bottom @ 7' depth	N/A	N/A	N/A	Gamma	U-238	1.19E+01	NR	1.19E+01
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	5.83E-01	NR	5.83E-01
							Th-234	4.89E+00	NR	4.89E+00
							Th-228	1.15E+00	2.47E-01	NR
							Ra-228	1.13E+00	1.61E-01	NR
							Ra-226	5.91E-01	7.83E-02	NR
G-8 (FS-172)	G	Grid G-7, east wall @ 6' depth	N/A	N/A	N/A	Gamma	U-238	1.21E+01	NR	1.21E+01
AFTER ADDITIONAL REMEDIATION BEHIND EAST WALL - ADD TO CALCULATION							U-235	6.64E-01	NR	6.64E-01
							Th-234	5.22E+00	NR	5.22E+00
							Th-228	1.20E+00	2.83E-01	NR
							Ra-228	1.52E+00	2.32E-01	NR
							Ra-226	7.02E-01	8.61E-02	NR

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Notes:

MDA values are shaded.

"NR" denotes values not reported by the laboratory.

"NRC" denotes duplicate samples taken by NRC.

"N/A" denotes GPS readings not available.

* denotes result is less than the sample specific minimum detectable activity.

(1) New Jersey State Plane, 1983, Coordinate System used. Elevation in feet above mean sea level.