Attachment N

Final Status Survey Report #14 Documentation

(UNDER SEPARATE COVER)

FINAL

COLUMBUS CLOSURE PROJECT CHARACTERIZATION AND FINAL STATUS SURVEY REPORT FOR GRIDS 33, 42, 50, 51, 52, and 61 OF THE ABANDONED NORTH FILTER BED

Revision 1
June 16, 2006

Prepared by

ECC & E2 Closure Services
1425 State Route 142 East
West Jefferson, OH 43162

Contract Number: DE-AC24-04OH20171

Final Characterization and Final Status Report for Grids 33, 42, 50, 51, 52, and 61 of the Abandoned North Filter Bed

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1.0 Introduction

This report contains the final status surveys (FSS) of Grids 33, 42, 50, 51, 52, and 61 of the Abandoned North Filter Bed (AbNFB) located at the Columbus Closure Project (CCP), 1425 State Route 142 East, West Jefferson, OH 43162. Final status surveys were conducted according to the guidance presented in the *Manual for Conducting Surveys in Support of License Termination*, NUREG/CR-5849 (NUREG/CR-5849) (ORAU, 1992) and the *Radiological Characterization and Final Status Plan for Battelle Columbus Laboratories Decommissioning Project, West Jefferson Site*, DD-97-02 (Final Status Plan) (Battelle, 2000). The final status surveys were conducted in October and November of 2004 and performed under Work Instruction 2806 (Closure Services, 2004).

The intent of this final status survey report is to provide a complete and unambiguous record of the radiological status of the excavation. Sufficient information and data is provided to enable an independent re-creation and evaluation at some future date of both the survey activities and the reported results for the excavation. Information in this report is also available in referenced technical basis documents, final status survey plans and procedures, and the *Battelle Memorial Institute Columbus Operations, Decommissioning Plan*, DD-93-19 (BMI Decommissioning Plan), and reporting and quality assurance procedures.

To the extent practicable, this final status survey report is presented with minimal information incorporated by reference. This final status survey report has been generated following the comprehensive, annotated outline presented in Chapter 9 of NUREG-5849 (ORAU, 1992).

1.1 Background

On April 16, 1943, BMI, acting through what is now its Battelle Columbus Operations (BCO), entered into Contract No. W-7405-ENG-92 with the Manhattan Engineering District to perform atomic energy research and development (R&D) activities. BCO performed nuclear materials research and development at privately-owned facilities for the Manhattan Engineering District and its successor agencies – the Atomic Energy Commission (AEC), the Energy Research and Development Agency (ERDA), and the Department of Energy (DOE). Research and development continued until 1988 (Battelle, 2003a).

The BCO facilities at the King Avenue Site, Columbus, Ohio, and the West Jefferson North (WJN) and South (WJS) Sites, West Jefferson, Ohio, became partially radiologically contaminated as a result of the R&D activities. Decontamination of the King Avenue and WJS sites has been completed and activities continue at the WJN site. The DOE, as the successor to the AEC and the Government's earlier work, is the agreed party with predominant liability and responsibility for decontamination and decommissioning (D&D) of the BCO facilities (Battelle, 2003a). The Assistant Secretary for Nuclear Energy of the DOE accepted the decontamination and decommissioning

(D&D) of the WJN into the DOE's Surplus Facilities Management Program as a major project (DOE, 1986). The DOE is the agency funding and managing the cleanup of the WJN (Battelle, 2003a). However, the site is not a DOE-owned facility.

BMI holds U.S. Nuclear Regulatory Commission (NRC) license number SNM-7. BMI has continually operated and conducted D&D activities in full compliance with this NRC license. The BMI Decommissioning Plan for the WJN site does not serve as a declaration to terminate SNM-7, but establish the criteria for performing D&D activities. The end goal of the BMI Decommissioning Plan is to reach unrestricted use conditions for the site (Battelle, 2003a).

The DOE has contracted ECC&E2 Closure Services, LLC (Closure Services) to safely remove DOE radioactive materials and contamination from the WJN site. Removal of radioactive material will be to levels allowing future use of the site without radiological restrictions as described in the BMI Decommissioning Plan. Closure Services has conducted characterization and final status surveys of grids 33, 42, 50, 51, 52, and 61 of the AbNFB excavation to demonstrate that the area is available for unrestricted release.

2.0 Site Description

Created in 1984, the Battelle Columbus Decommissioning Project (BCLDP) is a remediation project that includes nine buildings at the King Avenue site and five at the WJN site. The CCP is the successor of the BCLDP. The WJN site has two permanent structures, being Building JN-4 and the WJN Well House. Three former research facilities, JN-1, JN-2, and JN-3, have been demolished. Building JN-6 was also demolished. Several outfalls, filter beds, and wells are also located at the site. The AbNFB is one of the filter beds located at the WJN site. **Figure 1** presents a site map for the CCP.

2.1 Area Description

The AbNFB is a sanitary sand filter bed which served the WJN site. A site map display of the filter beds layout relative to the site as a whole is presented as Figure 1. The AbNFB was known to be contaminated above the volumetric release limits presented in DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993). For this reason, the soils were removed and disposed of as low level waste. The location of the AbNFB and grids covered under this FSS are presented as Figure 2. This report also includes data concerning the excavation of "the old dosing chamber" (grids 52 and 61) as well as a portion of a former sanitary sewer line that diagonally bisects grid 33. The depths of the remediation varied with each grid: however, the maximum depth of excavation did not exceed 6 feet below surface grade and was closely associated with the remediation of the utility line that bisected grid 33.

Two classifications of areas are used in NUREG-5849 and are termed **affected** or **unaffected.** These classifications are defined as (NRC, 1992):

> **Affected Areas:** Areas that have potential radioactive contamination (based on plant operating history) or known radioactive contamination (based on past or preliminary radiological surveillance). This would normally include areas where radioactive materials were used and stored, where records indicate spills or other unusual occurrences that could have resulted in spread of contamination, and where radioactive materials were buried. Areas immediately surrounding or adjacent to locations where radioactive materials were used, stored, or buried are included in this classification because of the potential for inadvertent spread of contamination.
>
> **Unaffected Areas:** All areas not classified as affected. These areas are not expected to contain residual radioactivity, based on knowledge of site history and previous information.

The AbNFB excavation was considered affected.

3.0 Decommissioning Activities

3.1 Decommissioning Objective

The objective of the final status survey performed on Grids 33, 42, 50, 51, 52, and 61of the AbNFB was to statistically demonstrate that the remediation of the area was successful and that the excavation is free from residual radioactive contamination that would not make it suitable for unrestricted release. The excavation is determined to be free of residual radioactive contamination when remaining soil contamination levels are below those presented DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993). **Table 1** presents the volumetric release criteria as presented in DD-93-03, Rev. 0.

4.0 Final Status Survey Procedures

Planning and implementation of the final status survey of the excavation adhered to the requirements of the Final Status Plan (Battelle, 2000) and Work Instruction 2806 (CS, 2004).

4.1 Sampling Parameters

Final status samples of grids 33. 42. 50, 51, 52, and 61 of the AbNFB were taken by dividing ten by ten meter grids in four quadrants and taking samples from each quadrant. Analyses of samples by gamma spectroscopy were performed by the Onsite Radioanalytical Laboratory (RAL).

4.2 Major Contaminants Identified

The characterization of the grids 33. 42. 50, 51. 52. and 61 of the AbNFB identified Cesium-137 (Cs-137) as the primary radiological contaminant of concern (RCOC). Other RCOCs included Cobalt-60 (Co-60), Europium-152 (Eu-152) and Eu-154, Americium-241 (Am-241). Strontium-90 (Sr-90), Plutonium-238 (Pu), and Pu-239. Cs-137 is used as a surrogate for the other RCOCs present in the soils as it typically accounts for 64 percent of the total isotopic activity. Further. the release criteria set for Cs-137 is considered conservative for the decommissioning activities. The surrogate relationship of Cs-137 to other RCOCs was calculated using data presented in **Table 2**. **Table 2** presents the isotopic quantity and activity concentrations of samples collected from the filter bed area by BMI from March through September 2000. These data are not associated with the excavation of the AbNFB. Average activities for the multiple samples were calculated for each RCOC prior to setting the ratios against Cs-137.[1] For each RCOC, the average activity concentration was set as a ratio against the average Cs-137 activity concentration as obtained from previous actions at the filter beds. The Plutonium-241 ratio to Cs-137 was not calculated using the sample. Instead, Pu-241 is calculated by applying a ratio to sum of Pu-238 and Pu-239 as obtained from the ORIGEN 2.1 derived values. (Battelle, 2003b). The resulting Cs-137 to Pu-241 ratio is 2.8. Cs-137 activity ratios for each RCOC utilized to calculate the RCOCs for grids 33. 42. 50. 51. 52. and 61 of the AbNFB are presented at the lower portion of **Table 2**.

4.2.1 Guidelines Established

Table 1 presents the guidelines for residual radioactivity concentrations for soil and solid volumes as applied to the Abandoned North Filter Bed (AbNFB) excavation. Criteria for residual radioactivity concentrations in soil are defined in "Volumetric Release Criteria

[1] Battelle, *Radiological Status of Abandoned Filter Bed Presentation*, http://www.ohio.doe.gov/ccp_seb/, Posted 7/15/2003. (Battelle, 2003b) Presentation provided by DOE to the CCP website. Page titled "Radioactive Inventory of the Abandoned North Filter Beds & Limit Fractions" contains sampling data obtained from March through September 2000 from the filter beds. Average Cs-137 ratios were utilized to calculate the activity concentrations of the isotopes of concern.

Technical Basis Document for Battelle Columbus Laboratories Decommissioning Project," DD-93-03. (Battelle, 1993). **Table 1** values have been generated primarily from various regulatory requirements, technical documents, and from soil guidelines generated by computer pathway analyses. Requirements such as those found in DOE Order 5400.5 have been incorporated into the volumetric release criteria. DOE Order 5400.5, Section IV.a.2. provides generic guidelines for residual concentrations of Radium-226 (Ra-226), Ra-228, Thorium-230 (Th-230), and Th-232 that have been incorporated into the volumetric release criteria. Additionally, NRC Guidance has been received by the CCP establishing the soil radioactivity concentration guidelines for Co-60, Sr-90, Cs-137, Ra-226, and Ra-228, and for natural, enriched and depleted uranium.

Compliance to the cleanup criteria presented in **Table 1** is demonstrated through a "fraction of limit." The total quantity and activity concentration of each RCOC is calculated using the average isotopic ratio listed in **Table 2**, with the exception of the Cs-137 to Pu-241 ratio of 2.8 (Battelle, 2003c). Calculated results for Co-60, Cs-137, Sr-90, Eu-152 and 154, Pu-239, 240 and 241, and Am-241 are then compared to the respective release criteria and a "fraction of the limit" is calculated. The "fraction of the limit" is determined by summing the ratios of each isotopic concentration to the respective release limit. Summed ratios must be less than one to meet sample release criteria. A modified screening criteria of 11 pCi/g for Cs-137 has been calculated using the "fraction of the limit" obtained from the filter bed surrogate ratio.

Exposure rates were compared to the 5 microRoentgen per hour (μR/hr) above mean background limit listed in DD-97-02, Rev. 0 (Battelle, 2000). Survey measurements are those 1-meter above the ground surface. The calculated mean background exposure rate and the 95 percent confidence intervals used for the CCP open area grounds is 8 ± 2 μR/hr. Compliance to the limit is met when the exposure rate survey is less then or equal to the limits as stated in DD-97-02. Initial compliance screening is met if individual exposure rates are less than or equal to 13 μR/hr. Further assessment of compliance allows for exposure rates to be averaged of a 100 m^2 grid area to meet the limit of less than or equal to 5 μR/hr above background at 1-meter above the ground surface. Additionally, exposure rates over any discreet area may not exceed 5 μR/hr above background.

Data collected from trench-like culverts located on Battelle property unassociated with site operations indicate a geometry effect, increasing the background exposure rates inside the trenches by 3 to 5 μR/hr. Trench exposure rate measurements must be less than or equal to 18 μR/hr. The same compliance assessment is applied to these measurements as stated above.

5.0 Equipment and Procedures

5.1 Equipment

Survey instruments sensitive to gamma radiation are used to monitor excavation surfaces for residual radioactive materials. Ludlum Model 44-10 two-inch by two-inch sodium iodide detectors with Eberline ESP-2 meters were used to scan the excavation. Ludlum Model 19 exposure rate meters were used to obtain μR/hr measurements.

Other instrumentation used in the Onsite Radioanalytical Laboratory (RAL) to support of the final status survey includes:

- A VMS based Canberra Procount data acquisition system in conjunction with high purity germanium detectors for gamma spectroscopy of soil samples.
- A Tennelec Model LB5100 Simultaneous Alpha and Beta Gas Proportional Counter to count smear samples

5.2 Scanning Minimum Detectable Activities

Scanning minimum detectable concentrations (MDC_{scan}) is determined to demonstrate that the MDC_{scan} is less than the modified Cs-137 cleanup criteria. The MDC_{scan} is calculated utilizing the methodology described in NUREG-1507 and the background count rate and a default detector response to Cs-137 (NRC, 1998). The equation used for the walkover surveys at the CCP incorporates a d' of 1.38 and a surveyor efficiency of 0.5. The ambient background in the area for scanning surveys on contact with the surface was 14,600 counts per minute (cpm). The following is the calculation of the MDC_{scan}:

b_i = (14,600 cpm) x (1 sec) x (1 min/60 sec) = 243 counts

MDCR = (1.38) x ($\sqrt{243}\,counts$) x (60 sec/1 min) = 1290 cpm

$MDCR_{surveyor}$ = 1290 cpm/$\sqrt{0.5}$ = 1820 cpm

MDER = 1820 cpm/(900 cpm/μR/hr) = 2.02 μR/hr

$$MDC_{scan} = (5\,pCi/g) * \frac{2.02\,\mu R/hr}{1.307\,\mu R/hr} = 7.73\,pCi/g$$

5.3 Procedures

The Characterization Team was formally trained and qualified to applicable procedures prior to the initiation of the characterization and final status surveys. Documentation of training is maintained by CCP Project Records.

The following plans and procedures were utilized for the surveys:

DD-93-19, Rev. 5	Decommissioning Plan, Battelle Memorial Institute Columbus Operations
DD-97-02, Rev. 0	Radiological Characterization and Final Status Plan for BCLDP West Jefferson Site
SC-OP-004, Rev. 0	Radioactive Contamination Monitoring Requirements For Facility Surface Characterization
SC-SP-004.2, Rev. 3	Manual and Mechanical Collection of Surface and Subsurface Soil Samples in Support of Site Characterization
WI-2806	Excavation and Trench Sampling and Surveys

6.0 Survey Findings

6.1 Exposure Rate Surveys

The calculated mean background exposure rate and the 95 percent confidence intervals used for the CCP grounds are 8 ± 2 μR/hr. The exposure rate readings for the excavation are presented in **Table 3**. The exposure rate readings were individually compared to the mean background value of 8 ± 2 μR/hr in order to show compliance with the 5 μR /hr above background release criterion (grounds exposure rate surveys must be less than or equal to 13 μR/hr to be compliant. trenches must be less than or equal to 18 μR/hr). The average one meter measurement was 12.5 μR/hr, the minimum measurement was 11 μR/hr and the maximum measurement was 20 μR/hr in grid 33.

The initial measurements were attributed to remaining radioactive wastes and source staged in the backyard of Building JN-1. Post-restoration exposure rate surveys performed in Grid 33 and 42. indicated final conditions to be less than or equal to the limit of 13 μR/hr. **Table 8** presents a summary of the post-restoration survey results. including exposure rates.

6.2 Excavation Sampling

Samples of the excavation were taken at a rate of four per ten by ten meter grid in accordance with Section 6.3.3 of DD-97-02, Rev. 0. Summary tables of the Cs-137 results for the excavation, in relation to the sample locations. are presented as **Table 5**. **Table 6** presents all radionuclides activities and minimum detectable activities of the analyses. (**Table 8** presents a summary of the post-restoration survey results. including additional soil samples.)

Table 7 presents the analytical results. evaluated against the release criterion presented in **Table 1,** of the excavation base. Compliance to the cleanup criteria presented in **Table 1** is demonstrated through a "fraction of limit" as discussed in Section 4.2.1. Guidelines Established. The following is a summary Table of the Cs-137 results.

Location	Number of Samples	Average (pCi/g)	Standard Deviation (pCi/g)	Range (pCi/g)	Modified Screening Criteria (pCi/g)
Excavation Base	27	1.30	2.27	0.02 – 9.24	11

6.3 Scanning Measurements

Scanning measurements were performed with a two inch by two inch sodium iodide detector in accordance with section 6.3.1 of DD-97-02 (Battelle, 2000). Measurements were performed for the entire excavation of the AbNFB.

The decision level value (DLV) for the scanning of open grounds and trenches is set at 18,374 cpm for final status surveys at the CCP. The DLV is the mean background plus the MDA of the scanning instruments. Scanning surveys of an area that exceed the DLV require additional radiological measurements. DD-97-02 requires that soil samples be collected at each location where the DLV is exceeded (Battelle, 2000). Sample results are presented in **Table 5**.

The bulk of the scanning measurements of the AbNFB were less than the DLV of 18,374 cpm for open ground surfaces. The exception to this being those measurements initially collected in grid 33, and grid 42. These results are presented in **Table 4**.

Data presented in **Table 4** that exceeded the DLV in grid 33 and grid 42, were attributed to influences from radiation sources in areas adjacent to the grids. Removal actions of radiation sources were performed as a separate action. The results of the separate action are further detailed in the report *Columbus Closure Project Characterization and Final Status Survey Report for the Remaining Affected Areas Within the Filter Beds Including the Well Injection Deep Extraction (Wide) System.* The relevant sections from the aforementioned report specifically, those data concerning grids 33 and 42 are summarized in **Table 8**.

7.0 Conclusions

The characterization and final status survey results demonstrate that the radiological endpoint criteria objectives of the NRC-approved Decommissioning Plan have been met for the excavation addressed by this effort (Battelle, 2003). Reported analytical results for media samples obtained from the excavation are below the residual radioactivity concentrations for soil and solid volumes as presented in **Table 1**.

Remaining soil contamination levels are below those presented in DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993). The decommissioning objective has been satisfied. The final status survey, performed on grids 33, 42, 50, 51, 52, and 61 of the Abandoned North Filter Bed, statistically demonstrates that the remediation of the area was successful and that the excavation is free from residual radioactive contamination making it suitable for unrestricted release.

8.0 References

American National Standards Institute (ANSI). 1997. ANSI-N323a. "Radiation Protection Instrumentation Test and Calibration."

Battelle. 2003a. "Decommissioning Plan for the Battelle Memorial Institute Columbus Operations," DD-93-19.

Battelle. 2003b. Radiological Status of Abandoned Filter Bed Presentation, http://www.ohio.doe.gov/ccp_seb/. Posted 7/15/2003. Presentation provided by DOE to the CCP website. Page titled "Radioactive Inventory of the Abandoned North Filter Beds & Limit Fractions" contains sampling data obtained from March through September 2000 from the filter beds. Average Cs-137 ratios were utilized to calculate the activity concentrations of the isotopes of concern.

Battelle, 2003c. Waste Characterization, Classification. and Shipping Support Technical Basis Document. Rev. 5 for BCLDP West Jefferson Facility. November 2003. Isotopic mixture for Pu-241 is calculated using the values obtained form the ORIGEN2.1-derived data values presented in the technical basis document.

Battelle .2000. "Radiological Characterization and Final Status Survey Plan for Battelle Columbus Laboratory Decommissioning Project West Jefferson Site." DD-97-02.

Battelle, 1993. "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratories Decommissioning Project." DD-93-03.

ECC&E2 Closure Services. LLC (Closure Services. 2004). Work Instruction 2806. Rev. 2. Excavation and Trench Sampling and Survey.

U.S. Department of Energy (DOE), 1990. Finding of No Significant Impact. Decontamination and Decommissioning of the Battelle Columbus Laboratories in Columbus and West Jefferson, Ohio.

U.S. Department of Energy (DOE), 1986. May 29, 1986 memorandum, Voight to Vaughan. approved by Vaughan, June 10, 1986.

U.S. Nuclear Regulatory Commission (NRC), 1998. "Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions" NUREG-1507.

Oak Ridge Associated Universities (ORAU), 1992. "Manual for Conducting Radiological Surveys in Support of License Termination. Draft Report for Comment" NUREG/CR-5849. ORAU-92/C57, prepared for the Nuclear Regulatory Commission by the Environmental Survey and Assessment Program, Energy/Environmental Systems Division. ORAU. 1992.

FIGURES

FIGURE 1
SITE MAP

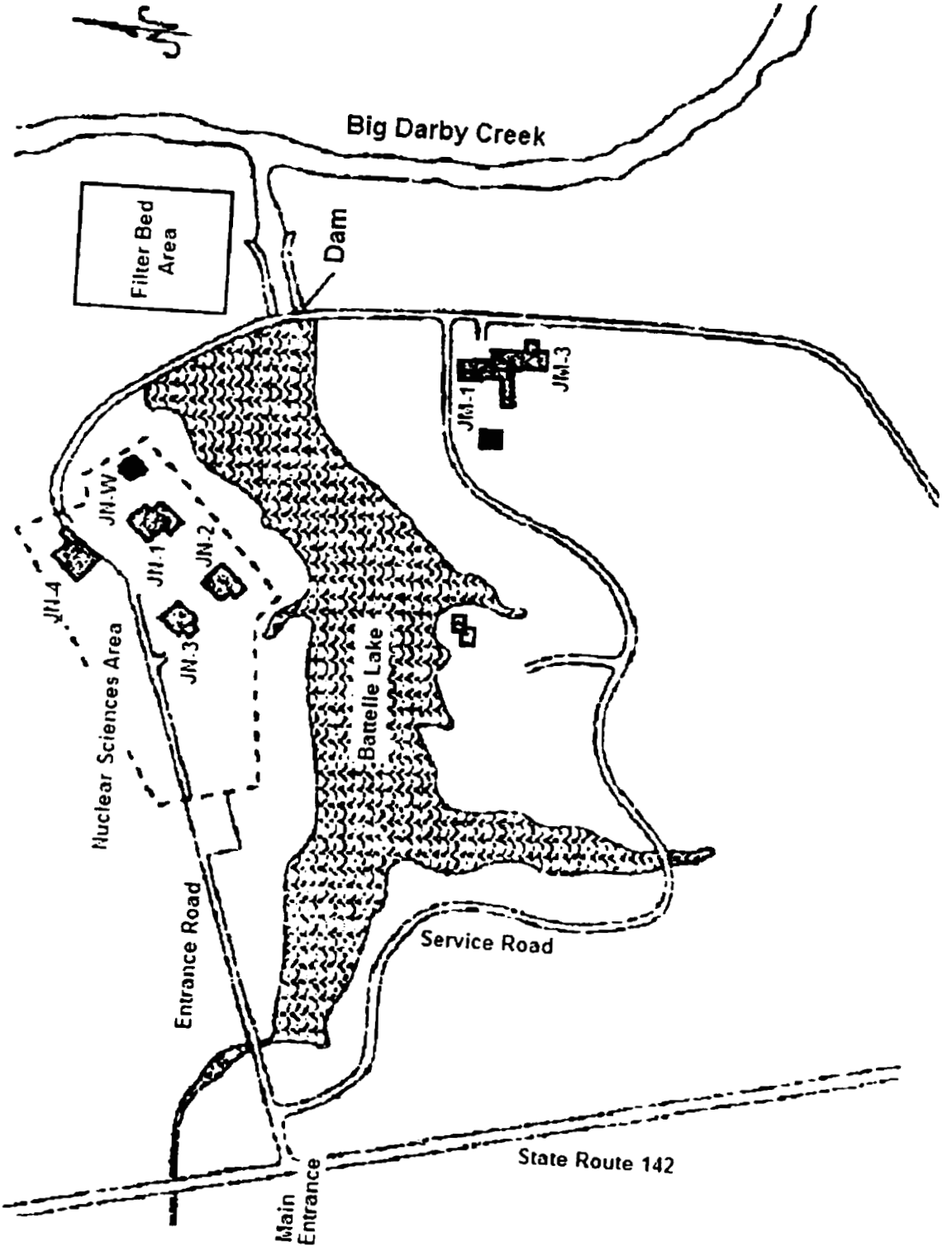
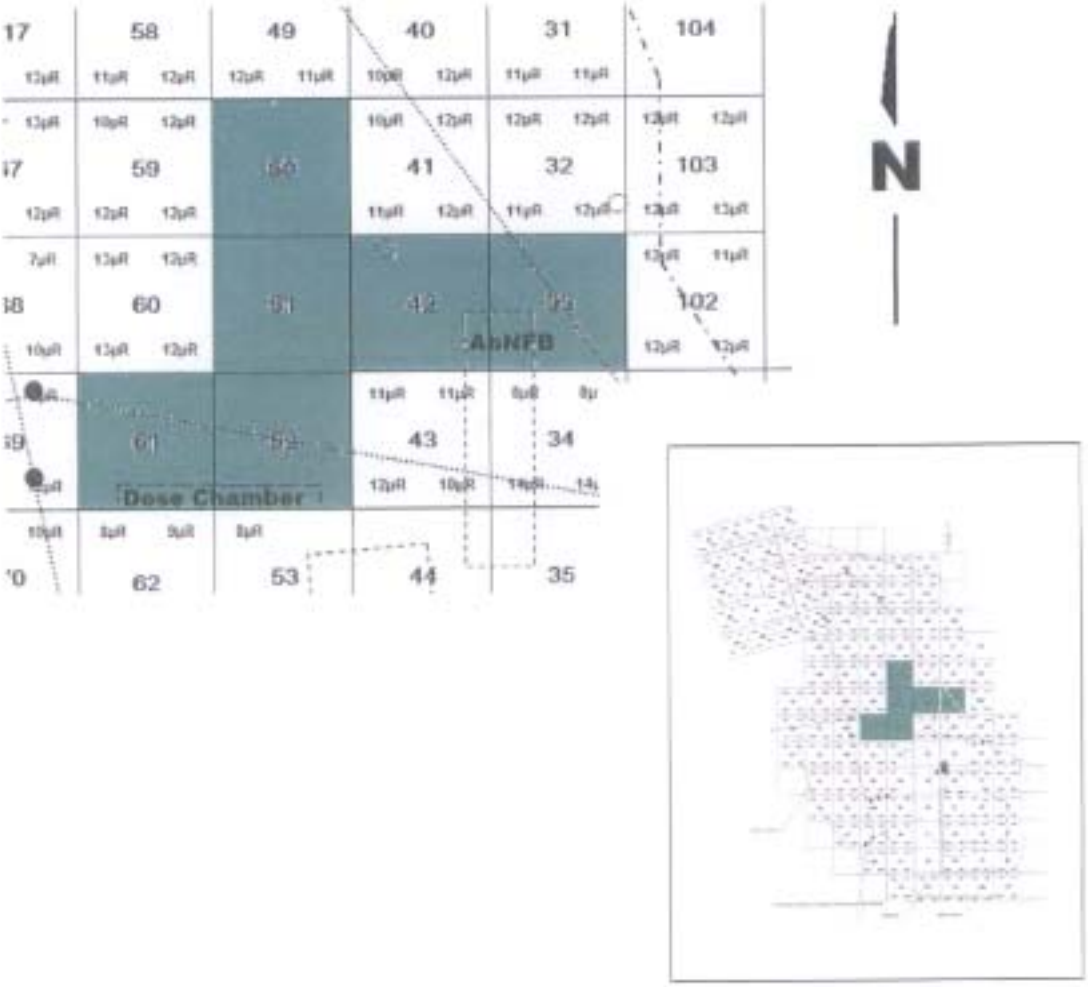


Figure 2

AbNFB Grids 33, 42, 50, 51, 52, and 61 Map



TABLES

TABLE 1

BCLDP GUIDELINES FOR RESIDUAL
RADIOACTIVITY CONCENTRATIONS FOR SOIL AND SOLID VOLUMES

Radionuclide[a]	King Avenue Concentration (pCi/g)[b]	West Jefferson Concentration (pCi/g)[b]
Natural Uranium	10[1]	na[c]
Enriched Uranium	30[1]	30[1]
Depleted Uranium	35[1]	35[1]
Ac-227	19	19
Am-241	na[c]	30
Am-243	na	30
Ce-144	na	2.100
Cm-243	na	0.79
Cm-244	na	1.0
Co-60	8[2]	8[2]
Cs-134	na	33
Cs-137	15[2]	15[2]
C-14	940	940
Eu-152	na	36
Eu-154	na	32
Eu-155	na	1,800
Fe-55	na	2.7E+07
H-3[d]	41,000	38,000
I-129	na	13
Mn-54	na	61
Ni-59	na	1.3E+07
Ni-63	na	4.9E+06
Np-237	na	0.58
Pa-231	18	18
Pb-210	140	na
Pu-238	na	25[4]
Pu-239	na	25[4]
Pu-240	na	25[4]
Pu-241	na	25[4]
Pu-242	na	25[4]

Radionuclide[a]	King Avenue Concentration (pCi/g)[b]	West Jefferson Concentration (pCi/g)[b]
Ra-226 (0-15 cm of soil)	5[2,3]	na
Ra-226 (>15 cm of soil)	15[2,3]	na
Ra-228	5[2,3]	na
Ru-106	na	180
Sb-125	na	118
Sm-151	na	6.700
Sr-90	5[2]	5[2]
Th-228	29	na
Th-230	5[3]	na
Th-232	5[3]	na

Table 1 Notes and References

Notes:

a. Activity concentrations above natural background concentrations. Where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed 1.

b. Concentrations for which no specific reference is cited have been derived from RESRAD calculations and are the more restrictive values calculated for soil deposition at a depth of 5 meters.

c. Indicates that this radionuclide is not expected to be found at the indicated site.

d. Difference in tritium activity concentrations are due to the difference in depths of the water tables at two sites. The water table depth at King Avenue is deeper than that at West Jefferson.

References:

1. Options 1 and 2 of the Branch Technical Position, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (46 FR 52061, October 23, 1981).

2. NRC Memorandum, "Acceptable Cleanup Criteria and Practices for Decontamination and Decommissioning (License No. SNM-7)" dated April 17, 1992, to Harley L. Toy, License Coordinator and Manager, Nuclear Sciences, Battelle Memorial Institute from J.W.N. Hickey, Chief, Fuel Cycle Safety Branch, Division of Industrial and Medical Nuclear Safety, Office of Nuclear Material Safety and Safeguards.

3. DOE Order 5400.5, "Radiation Protection of the Public and the Environment".

4. NRC Policy and Guidance Directive FC83-23, "Termination of Byproduct, Source, and Special Nuclear Material Licenses".

Table 2
Cesium-137 Surrogate Analysis Data & Modified Cs-137 Screening Criteria

Sample ID (a,b)	Cs-137 Activity (pCi/g)	Co-60 Activity (pCi/g)	Eu-152 Activity (pCi/g)	Eu-154 Activity (pCi/g)	Am-241 Activity (b) (pCi/g)	Sr-90 Activity (pCi/g)	Pu-238 Activity (pCi/g)	Pu-239 Activity (pCi/g)
16741	40.1	0.05	<0.096	<0.053	1.36 g	<0.172	<0.009	0.053
16746	21.6	0.04	<0.079	<0.051	1.29 a	<0.184	0.026	0.9
16747	28.1	0.06	<0.077	<0.046	0.89 g	<0.175	<0.011	0.116
16751	8	<0.024	<0.068	<0.047	0.93g	<0.151	0.021	0.496
16752	39.1	0.06	<0.086	<0.046	10.74 a	<0.167	0.131	5.822
16607	74.2	0.28	7.26	0.65	1.18 a	0.59	0.0213	0.629
16608	18.7	0.07	4.03	0.26	0.47 a	<0.180	0.016	0.287
16668	41.6	0.08	<0.098	<0.061	2.59 a	NA	0.036	1.846
16686	38.1	0.07	<0.050	<0.031	4.71 a	NA	0.135	3.84
19079	11.7	0.17	8.02	0.84	0.018	4.39	<0.016	0.034
19080	32.4	<0.016	0.562	<0.053	<0.016	0.21	<0.019	<0.017
Average	*31.99*	*0.084*	*1.857*	*0.176*	*2.2*	*0.691*	*0.04*	*1.276*

Calculated Cs-137 Surrogate Ratio (c)	
Cs-137/Co-60	381
Cs-137/Eu-152	17
Cs-137/Eu-154	182
Cs-137Am-241	15
Cs-137/Sr-90	46
Cs-137/Pu-238	800
Cs-137/Pu-239	25
Cs-137/Pu-241 (d)	2.8

Modified Cs-137 Screening Criteria			
Cleanup Criteria (pCi/g)		*Surrogate Activity (pCi/g)*	*Summed Ratio*
Cs-137	15	11	0.73
Co-60	8	0.028884026	0.00
Eu-152	36	0.638543295	0.02
Eu-154	32	0.060518912	0.00
Am-241	30	0.756486402	0.03
Sr-90	5	0.237605502	0.05
Pu-238	25	0.013754298	0.00
Pu-239	25	0.438782113	0.02
Pu-241	25	3.928571429	0.16
		Unity Rule (e)	*1.00*

Notes
(a) Battelle reported analytical results of samples obtained from the filter bed area between March and September 2000.
(b) Reported data obtained from gamma spectroscopy analysis
(c) Surrogate ratio calculated by dividing average Cs-137 activity by average activity of isotope of concern
(d) Pu-241 is calculated by applying a ratio to sum of Pu-238 and Pu-239 (obtained from ORIGEN 2.1 derived values, Battelle, 2003c), resulting in a Cs-137 to Pu-241 ratio of 2.8.
(e) Unity Rule applied to surrogate calculated activity resulting in modified Cs-137 screening level of 11 pCi/g

Table 3

AbNFB

Grids 33, 42, 50, 51, 52, and 61

Excavation Exposure Rate Survey

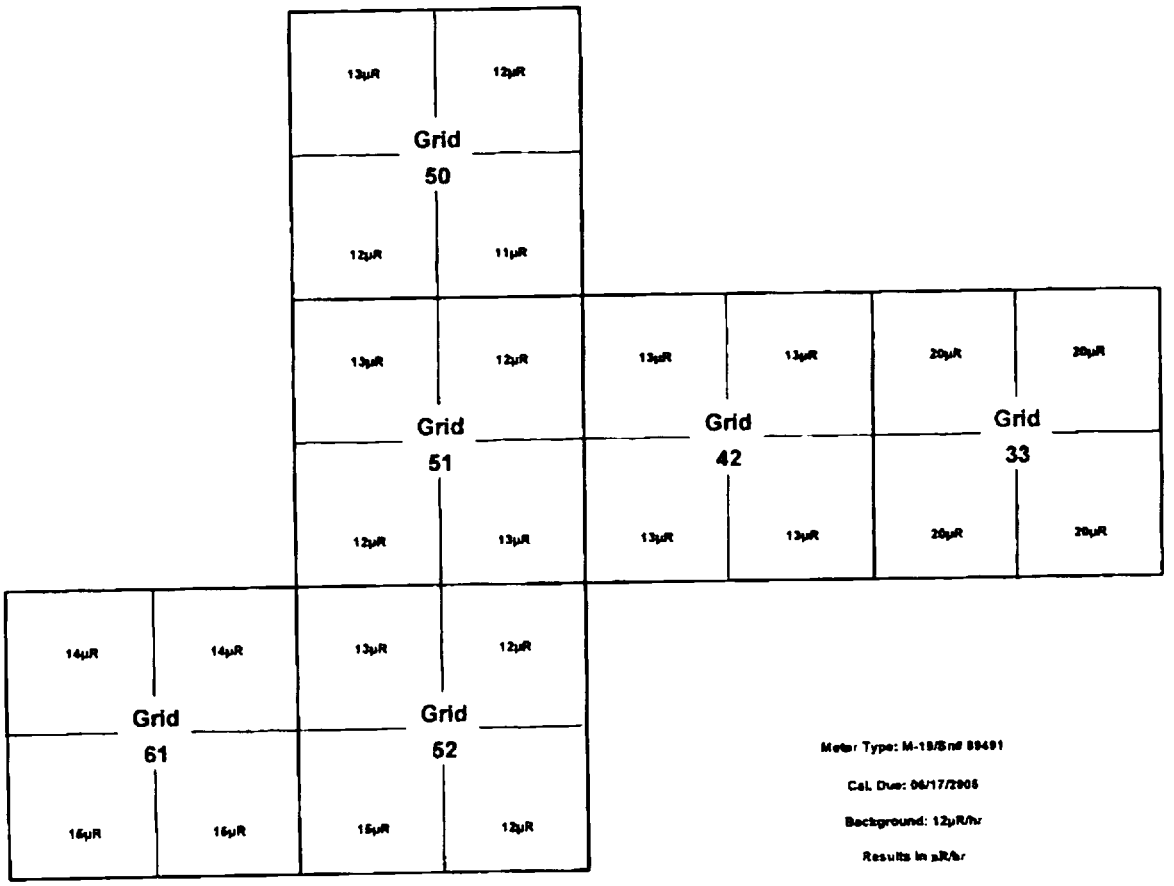
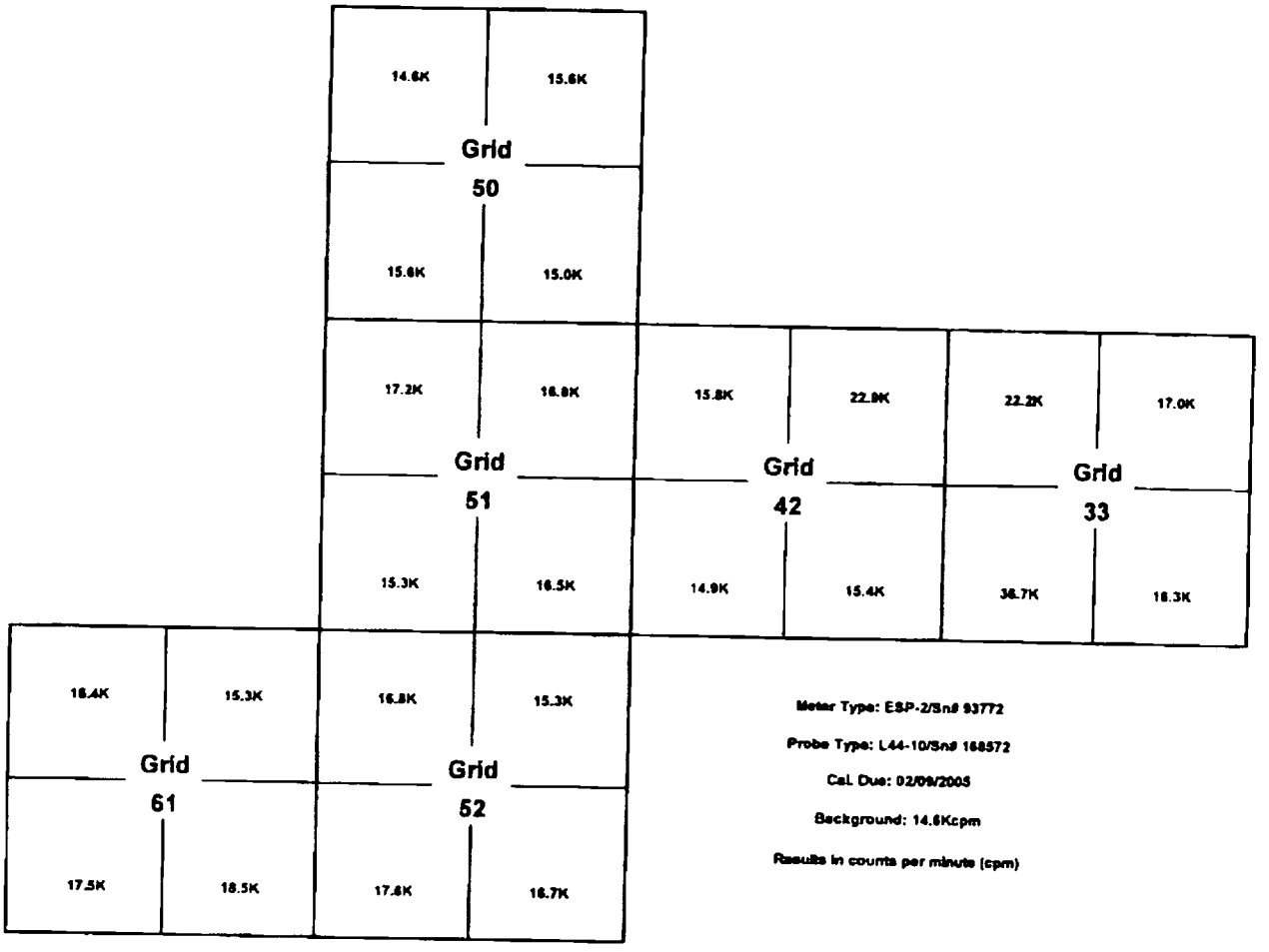


Table 4
AbNFB
Grids 33, 42, 50, 51, 52, and 61
Walkover Scan Survey Results



Meter Type: ESP-2/Sn# 93772

Probe Type: L44-10/Sn# 168572

Cal. Due: 02/09/2005

Background: 14.6Kcpm

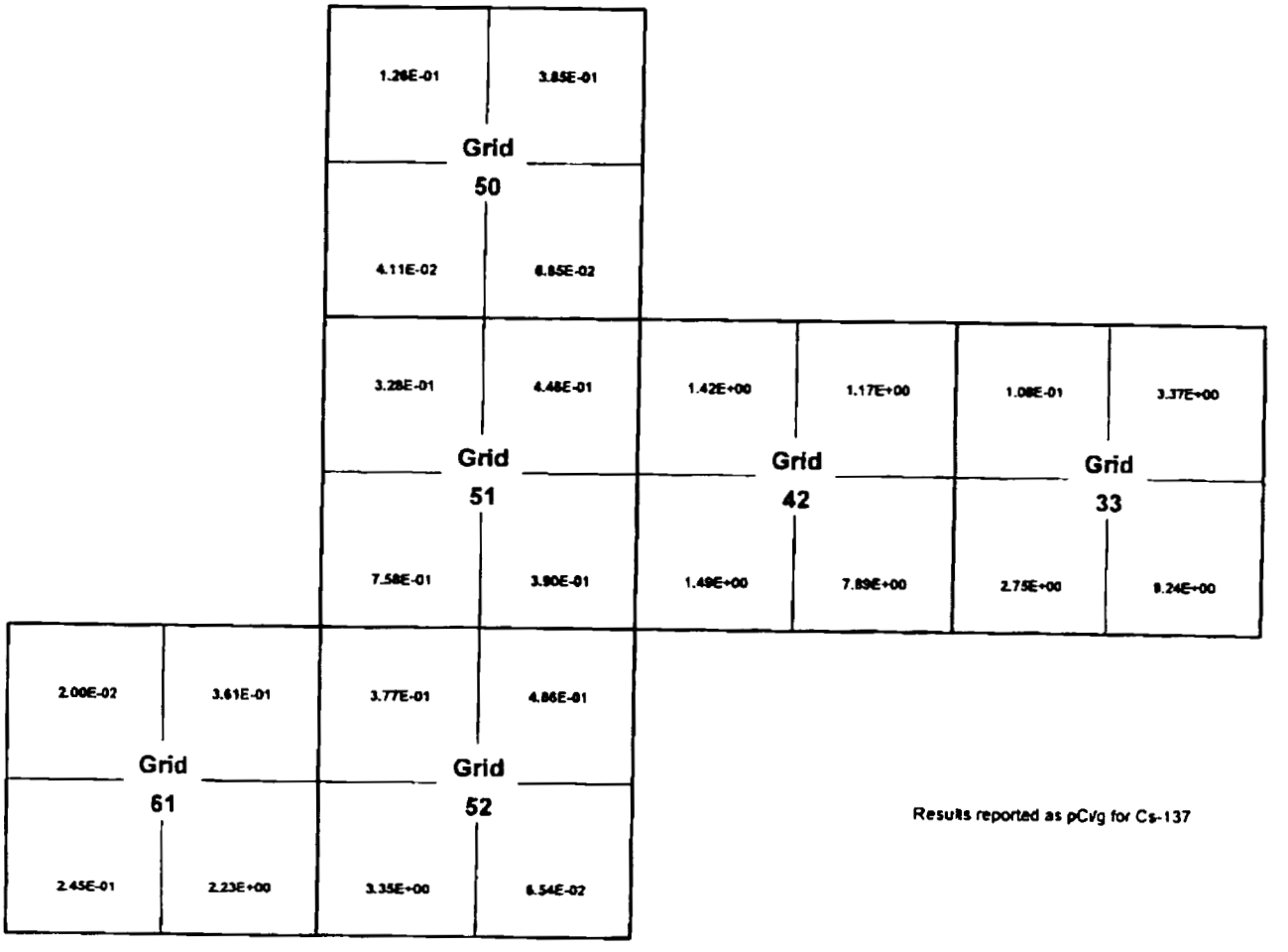
Results in counts per minute (cpm)

Table 6

AbNFB

Grids 33, 42, 50, 51, 52, and 61

Excavation Soil Sample Result Sumary



Results reported as pCi/g for Cs-137

Table 6

AbNFB Grids 33, 42, 50,51, 52, and 61 Soil Sample Analytical Results

Analytical Parameter	RL04-1666-641 GRID 33			RL04-1667-642 GRID 33			RL04-1668-643 GRID 33		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	2.88E-01	2.12E-01	2.40E-01	1.48E-01	1.80E-01	3.12E-01	-5.99E-02	2.44E-01	4.07E-01
K-40	1.12E+01	1.22E+00	1.62E-01	1.19E+01	1.33E+00	2.00E-01	1.19E+01	1.33E+00	2.15E-01
Co-58	-1.74E-02	1.10E-02	1.70E-02	-1.64E-02	1.28E-02	2.02E-02	-9.56E-03	1.43E-02	2.41E-02
Co-60	1.81E-02	1.17E-02	2.24E-02	-2.69E-03	1.35E-02	2.33E-02	2.08E-02	2.11E-02	2.77E-02
Zn-65	3.44E-02	4.46E-02	4.69E-02	2.60E-02	6.20E-02	8.22E-02	9.95E-02	6.67E-02	7.45E-02
Sb-125	3.29E-02	4.52E-02	7.81E-02	-3.38E-02	5.56E-02	9.26E-02	-9.59E-02	7.72E-02	1.26E-01
I-131	2.30E-03	2.27E-02	3.90E-02	-7.52E-03	2.74E-02	4.67E-02	2.15E-02	3.84E-02	6.61E-02
Cs-134	5.22E-03	1.31E-02	1.96E-02	7.16E-03	1.63E-02	2.47E-02	-2.78E-03	2.16E-02	3.11E-02
Cs-137	2.75E+00	2.94E-01	2.23E-02	3.37E+00	3.61E-01	3.00E-02	9.24E+00	9.72E-01	3.43E-02
Eu-152	3.11E-01	4.35E-02	8.03E-02	4.00E-01	4.95E-02	9.80E-02	9.47E-01	7.37E-02	1.04E-01
Eu-154	2.12E-01	6.91E-02	6.48E-02	2.60E-01	6.11E-02	7.76E-02	1.03E-01	4.25E-02	8.68E-02
Tl-208	1.72E-01	3.38E-02	2.31E-02	2.27E-01	4.07E-02	2.70E-02	2.07E-01	4.00E-02	3.49E-02
Bi-212	6.38E-01	2.67E-01	2.56E-01	6.91E-01	2.52E-01	3.34E-01	4.16E-01	3.45E-01	4.13E-01
Pb-212	5.88E-01	6.19E-02	5.22E-02	6.32E-01	7.08E-02	6.51E-02	6.31E-01	8.95E-02	1.12E-01
Bi-214	1.11E+00	8.28E-02	4.07E-02	1.06E+00	8.76E-02	5.38E-02	1.14E+00	9.49E-02	6.63E-02
Pb-214	1.08E+00	9.14E-02	5.55E-02	1.18E+00	1.01E-01	7.11E-02	1.21E+00	1.16E-01	9.56E-02
Ac-228	6.31E-01	7.64E-02	6.91E-02	6.84E-01	8.63E-02	8.48E-02	7.19E-01	9.35E-02	9.48E-02
Th-234	-5.37E-01	2.13E+00	8.10E-01	-3.91E-01	2.54E+00	9.68E-01	2.20E+00	3.16E+00	1.14E+00
U-235	7.12E-02	1.32E-01	4.69E-02	6.22E-02	1.52E-01	5.69E-02	1.01E-01	1.84E-01	6.87E-02
Am-241	-2.22E-02	3.83E-01	6.53E-01	8.41E-02	4.60E-01	7.93E-01	-5.57E-01	5.58E-01	9.26E-01

Table 6

AbNFB Grids 33, 42, 50,51, 52, and 61 Soil Sample Analytical Results

Analytical Parameter	RL04-1647-0625 GRID 42			RL04-1648-0626 GRID 42			RL04-1649-0627 GRID 42		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	-3.43E-02	1.24E-01	2.10E-01	8.73E-02	1.23E-01	2.14E-01	-8.63E-02	9.69E-02	1.58E-01
K-40	1.27E+01	1.41E+00	1.75E-01	1.09E+01	1.21E+00	1.69E-01	7.15E+00	8.20E-01	1.32E-01
Co-58	-7.41E-03	1.16E-02	1.97E-02	-1.35E-02	1.14E-02	1.82E-02	-8.49E-03	8.26E-03	1.34E-02
Co-60	1.48E-03	1.32E-02	2.32E-02	4.37E-03	1.02E-02	1.88E-02	2.17E-02	1.96E-02	2.16E-02
Zn-65	4.29E-02	4.25E-02	4.89E-02	-2.50E-02	3.53E-02	4.82E-02	4.40E-02	3.80E-02	4.35E-02
Sb-125	4.41E-03	4.27E-02	7.33E-02	1.12E-02	4.05E-02	7.00E-02	1.96E-03	3.41E-02	5.85E-02
I-131	-4.26E-03	1.45E-02	2.47E-02	-3.85E-03	1.40E-02	2.39E-02	4.87E-03	1.19E-02	2.07E-02
Cs-134	2.16E-03	1.43E-02	2.11E-02	4.57E-03	1.27E-02	1.91E-02	-4.59E-03	1.07E-02	1.51E-02
Cs-137	1.42E+00	1.58E-01	2.32E-02	1.49E+00	1.64E-01	2.25E-02	1.17E+00	1.30E-01	1.88E-02
Eu-152	1.48E-01	4.03E-02	7.25E-02	9.30E-02	7.07E-02	8.23E-02	2.99E-01	3.73E-02	6.07E-02
Eu-154	8.45E-02	5.13E-02	6.67E-02	6.48E-02	4.90E-02	6.37E-02	1.87E-01	5.33E-02	5.97E-02
Tl-208	1.94E-01	3.65E-02	2.34E-02	2.16E-01	3.43E-02	2.14E-02	7.40E-02	2.04E-02	2.92E-02
Bi-212	7.81E-01	2.50E-01	2.91E-01	8.02E-01	2.66E-01	2.83E-01	2.54E-01	1.53E-01	2.18E-01
Pb-212	7.38E-01	7.65E-02	5.08E-02	5.94E-01	6.10E-02	4.95E-02	2.74E-01	4.38E-02	3.69E-02
Bi-214	8.81E-01	7.84E-02	4.70E-02	8.98E-01	7.51E-02	3.91E-02	7.78E-01	6.35E-02	3.41E-02
Pb-214	9.00E-01	8.16E-02	5.47E-02	8.64E-01	8.43E-02	5.34E-02	8.36E-01	6.91E-02	4.56E-02
Ac-228	7.22E-01	7.64E-02	7.10E-02	6.30E-01	7.61E-02	6.49E-02	2.61E-01	7.32E-02	1.04E-01
Th-234	-2.15E-01	2.14E+00	8.59E-01	-4.21E-01	2.04E+00	7.94E-01	-2.18E-01	1.65E+00	6.48E-01
U-235	8.45E-02	1.31E-01	5.10E-02	1.07E-01	1.22E-01	4.78E-02	1.16E-01	1.04E-01	3.91E-02
Am-241	-2.30E-01	3.84E-01	6.48E-01	1.05E-01	3.76E-01	6.51E-01	-3.76E-02	3.02E-01	5.18E-01

Analytical Parameter	RL04-1650-0628 GRID 42			RL04-1613-0599 GRID 50			RL04-1614-0600 GRID 50		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	-8.06E-02	1.85E-01	3.08E-01	1.00E-01	1.02E-01	1.81E-01	-7.94E-02	9.61E-02	1.58E-01
K-40	1.12E+01	1.22E+00	1.42E-01	1.34E+01	1.48E+00	1.79E-01	1.39E+01	1.51E+00	1.79E-01
Co-58	-8.34E-03	1.05E-02	1.75E-02	-1.03E-02	1.09E-02	1.79E-02	-1.89E-02	1.13E-02	1.73E-02
Co-60	2.49E-02	1.27E-02	1.78E-02	-1.22E-02	1.16E-02	1.82E-02	-6.89E-03	1.11E-02	1.83E-02
Zn-65	8.45E-02	4.99E-02	5.58E-02	-6.37E-03	2.92E-02	4.26E-02	-1.52E-02	2.91E-02	4.08E-02
Sb-125	7.67E-02	6.07E-02	1.04E-01	1.92E-02	3.47E-02	6.08E-02	6.06E-03	3.18E-02	5.51E-02
I-131	-1.78E-02	2.08E-02	3.46E-02	1.10E-02	1.66E-02	2.92E-02	-1.12E-02	1.57E-02	2.63E-02
Cs-134	-4.50E-03	1.69E-02	2.31E-02	-2.71E-03	1.25E-02	1.80E-02	7.45E-03	1.20E-02	1.84E-02
Cs-137	7.89E+00	8.30E-01	2.69E-02	1.26E-01	2.65E-02	1.99E-02	4.11E-02	2.36E-02	2.02E-02
Eu-152	7.63E-01	5.91E-02	8.77E-02	4.99E-02	4.96E-02	6.59E-02	-7.05E-02	4.82E-02	6.57E-02
Eu-154	5.32E-01	1.04E-01	7.22E-02	2.06E-02	3.49E-02	5.92E-02	-2.28E-02	3.31E-02	5.44E-02
Tl-208	1.46E-01	2.98E-02	2.87E-02	2.45E-01	3.51E-02	2.05E-02	2.52E-01	3.61E-02	2.07E-02
Bi-212	4.92E-01	1.93E-01	2.72E-01	9.11E-01	3.29E-01	2.78E-01	8.30E-01	2.73E-01	2.48E-01
Pb-212	5.11E-01	6.92E-02	6.15E-02	7.96E-01	7.30E-02	4.44E-02	8.12E-01	7.25E-02	4.37E-02
Bi-214	8.15E-01	6.66E-02	5.34E-02	1.20E+00	8.86E-02	3.94E-02	1.15E+00	8.44E-02	3.91E-02
Pb-214	8.35E-01	8.87E-02	7.36E-02	1.27E+00	9.70E-02	4.98E-02	1.15E+00	9.44E-02	4.91E-02
Ac-228	5.14E-01	7.61E-02	6.73E-02	8.12E-01	8.11E-02	7.75E-02	8.63E-01	8.09E-02	7.22E-02
Th-234	2.03E+00	2.65E+00	9.10E-01	3.03E-01	2.08E+00	8.12E-01	1.34E+00	2.02E+00	7.79E-01
U-235	2.04E-01	1.53E-01	5.53E-02	1.01E-01	1.22E-01	4.78E-02	-6.36E-02	1.20E-01	4.69E-02
Am-241	-2.76E-01	4.57E-01	7.68E-01	-1.67E-01	3.81E-01	6.45E-01	-2.63E-01	3.58E-01	6.00E-01

Table 6

AbNFB Grids 33, 42, 50,51, 52, and 61 Soil Sample Analytical Results

Analytical Parameter	RL04-1615-0601 GRID 50			RL04-1616-0602 GRID 50			RL04-1609-0595 GRID 51		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	-6.47E-02	1.16E-01	1.94E-01	-3.10E-02	8.02E-02	1.35E-01	-2.09E-02	9.07E-02	1.53E-01
K-40	1.36E+01	1.49E+00	1.85E-01	9.33E+00	1.04E+00	1.20E-01	1.15E+01	1.26E+00	1.42E-01
Co-58	-7.43E-03	1.25E-02	2.11E-02	-2.35E-03	9.18E-03	1.60E-02	-1.15E-02	9.07E-03	1.46E-02
Co-60	-9.26E-03	1.29E-02	2.09E-02	5.21E-03	8.89E-03	1.65E-02	1.02E-02	9.69E-03	1.83E-02
Zn-65	-1.43E-03	3.38E-02	5.00E-02	-8.64E-03	2.53E-02	3.63E-02	-9.01E-03	2.62E-02	3.76E-02
Sb-125	3.72E-02	3.71E-02	6.60E-02	-1.54E-02	2.71E-02	4.54E-02	-2.16E-02	3.05E-02	5.05E-02
I-131	-1.67E-03	1.81E-02	3.11E-02	1.46E-02	1.36E-02	2.45E-02	-5.30E-03	1.37E-02	2.36E-02
Cs-134	-9.12E-03	1.33E-02	1.84E-02	1.11E-02	1.01E-02	1.61E-02	-2.60E-03	1.08E-02	1.55E-02
Cs-137	3.85E-01	5.45E-02	2.39E-02	6.85E-02	1.54E-02	1.75E-02	3.28E-01	4.41E-02	1.85E-02
Eu-152	3.20E-02	5.19E-02	7.70E-02	-1.82E-03	3.90E-02	5.21E-02	4.23E-02	4.23E-02	6.06E-02
Eu-154	4.72E-03	3.59E-02	6.05E-02	-1.71E-02	2.73E-02	4.49E-02	4.48E-02	2.95E-02	5.05E-02
Tl-208	2.36E-01	3.40E-02	2.14E-02	1.37E-01	2.44E-02	1.75E-02	1.73E-01	2.74E-02	1.78E-02
Bi-212	9.70E-01	2.75E-01	2.87E-01	3.91E-01	2.22E-01	2.16E-01	3.40E-01	2.54E-01	2.30E-01
Pb-212	8.67E-01	7.84E-02	4.57E-02	4.75E-01	4.80E-02	3.49E-02	5.98E-01	5.79E-02	3.78E-02
Bi-214	1.31E+00	9.28E-02	4.11E-02	9.24E-01	6.85E-02	3.21E-02	9.08E-01	6.82E-02	3.32E-02
Pb-214	1.31E+00	1.01E-01	5.20E-02	1.00E+00	7.89E-02	3.90E-02	9.69E-01	7.75E-02	4.04E-02
Ac-228	8.21E-01	8.28E-02	7.41E-02	4.51E-01	6.21E-02	6.12E-02	5.94E-01	6.42E-02	6.11E-02
Th-234	8.78E-01	2.21E+00	8.45E-01	8.63E-02	1.66E+00	6.50E-01	1.12E+00	6.51E-01	5.61E-01
U-235	3.51E-02	1.26E-01	5.05E-02	5.76E-02	9.86E-01	3.98E-02	1.25E-01	3.00E-02	3.07E-02
Am-241	-1.06E-01	3.93E-01	6.68E-01	1.79E-02	2.91E-01	5.01E-01	8.29E-02	3.31E-01	5.06E-01

Analytical Parameter	RL04-1610-0596 GRID 51			RL04-1611-0597 GRID 51			RL04-1612-0598 GRID 51		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	-4.27E-02	9.40E-02	1.57E-01	-1.30E-01	1.07E-01	1.72E-01	4.14E-02	9.40E-02	1.63E-01
K-40	1.29E+01	1.38E+00	1.29E-01	1.22E+01	1.33E+00	1.72E-01	1.38E+01	1.48E+00	1.53E-01
Co-58	-1.08E-02	9.56E-03	1.55E-02	-1.57E-03	1.03E-03	1.81E-02	-1.14E-02	9.52E-03	1.53E-02
Co-60	-1.58E-03	9.81E-03	1.68E-02	2.86E-03	1.15E-02	2.04E-02	-7.56E-03	1.03E-02	1.68E-02
Zn-65	4.07E-03	2.63E-02	3.94E-02	-3.76E-02	3.33E-02	4.25E-02	-1.64E-03	2.79E-02	4.10E-02
Sb-125	1.14E-02	3.10E-02	5.36E-02	2.06E-03	3.52E-02	6.04E-02	1.74E-02	2.92E-02	5.10E-02
I-131	-2.53E-03	1.45E-02	2.48E-02	4.42E-03	1.64E-02	2.85E-02	8.35E-03	1.46E-02	2.56E-02
Cs-134	2.83E-03	1.10E-02	1.63E-02	3.46E-03	1.22E-02	1.83E-02	-3.98E-03	1.11E-02	1.57E-02
Cs-137	7.58E-01	8.58E-02	1.82E-02	4.46E-01	5.56E-02	2.35E-02	3.90E-01	4.70E-02	1.79E-02
Eu-152	7.33E-02	4.40E-02	6.13E-02	1.57E-02	4.77E-02	6.99E-02	3.49E-02	4.38E-02	6.05E-02
Eu-154	3.05E-02	3.07E-02	5.22E-02	3.00E-03	3.32E-02	5.58E-02	4.14E-02	3.07E-02	5.24E-02
Tl-208	1.96E-01	3.07E-02	1.75E-02	2.24E-01	3.23E-02	2.00E-02	1.98E-01	2.86E-02	1.79E-02
Bi-212	8.40E-01	2.46E-01	2.26E-01	7.71E-01	2.67E-01	2.74E-01	7.00E-01	2.32E-01	2.43E-01
Pb-212	5.88E-01	6.74E-02	4.04E-02	7.17E-01	6.65E-02	4.47E-02	6.58E-01	6.00E-02	3.98E-02
Bi-214	9.84E-01	7.15E-02	3.51E-02	1.13E+00	8.36E-02	3.94E-02	1.09E+00	7.81E-02	3.33E-02
Pb-214	1.02E+00	8.26E-02	4.29E-02	1.09E+00	8.34E-02	4.88E-02	1.11E+00	8.43E-02	4.28E-02
Ac-228	6.66E-01	6.70E-02	6.43E-02	7.43E-01	7.84E-02	6.78E-02	6.86E-01	6.76E-02	6.29E-02
Th-234	1.50E-01	1.71E+00	6.83E-01	-2.04E+00	2.18E+00	7.87E-01	3.98E-02	1.76E+00	7.07E-01
U-235	-7.42E-03	1.05E-01	3.86E-02	3.61E-02	1.19E-01	4.55E-02	1.00E-02	1.07E-01	4.03E-02
Am-241	-3.63E-03	3.15E-01	5.40E-01	-1.37E-01	3.60E-01	6.10E-01	-6.46E-02	3.14E-01	5.35E-01

Table 6

AbNFB Grids 33, 42, 50,51, 52, and 61 Soil Sample Analytical Results

Analytical Parameter	RL04-1601-587 GRID 61			RL04-1602-588 GRID 61			RL04-1603-589 GRID 61		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	-6.00E-02	8.84E-02	1.46E-01	-8.35E-02	9.95E-02	1.63E-01	-1.08E-02	9.18E-02	1.56E-01
K-40	1.42E+01	1.53E+00	1.53E-01	1.45E+01	1.57E+00	1.72E-01	1.26E+01	1.37E+00	1.44E-01
Co-58	-1.30E-02	1.01E-02	1.62E-02	-8.31E-03	1.03E-02	1.72E-02	-1.24E-02	9.61E-03	1.53E-02
Co-60	5.03E-04	1.15E-02	2.00E-02	-3.84E-03	1.05E-02	1.78E-02	3.72E-02	1.46E-02	2.33E-02
Zn-65	-5.78E-03	2.82E-02	4.10E-02	-1.36E-02	3.25E-02	4.61E-02	-5.61E-03	2.89E-02	4.21E-02
Sb-125	1.43E-02	3.04E-02	5.31E-02	3.65E-02	3.43E-02	6.07E-02	3.85E-03	3.17E-02	5.47E-02
I-131	-3.54E-03	1.38E-02	2.36E-02	-9.50E-03	1.51E-02	2.53E-02	-1.15E-03	1.45E-02	2.49E-02
Cs-134	1.10E-03	1.03E-02	1.53E-02	1.26E-02	1.17E-02	1.84E-02	1.50E-03	1.12E-02	1.66E-02
Cs-137	-4.32E-03	1.21E-02	2.00E-02	2.46E-01	3.34E-02	1.96E-02	3.61E-01	4.51E-02	1.95E-02
Eu-152	-1.82E-02	4.22E-02	5.59E-02	2.34E-02	4.74E-02	6.19E-02	8.66E-02	5.47E-02	6.89E-02
Eu-154	-1.55E-03	3.03E-02	4.90E-02	8.48E-03	3.29E-02	5.55E-02	6.04E-02	3.79E-02	5.43E-02
Tl-208	1.99E-01	2.84E-02	1.89E-02	2.25E-01	3.33E-02	1.86E-02	2.13E-01	3.07E-02	1.72E-02
Bi-212	7.10E-01	3.06E-01	2.28E-01	9.97E-01	2.66E-01	2.46E-01	6.13E-01	2.28E-01	2.44E-01
Pb-212	6.71E-01	6.22E-02	3.80E-02	7.52E-01	5.98E-02	4.33E-02	6.12E-01	5.96E-02	4.23E-02
Bi-214	9.56E-01	7.43E-02	3.13E-02	1.15E+00	8.18E-02	3.57E-02	9.67E-01	7.35E-02	3.64E-02
Pb-214	1.00E+00	7.98E-02	4.29E-02	1.15E+00	8.88E-02	4.48E-02	9.73E-01	7.87E-02	4.44E-02
Ac-228	6.57E-01	6.85E-02	6.40E-02	7.88E-01	7.75E-02	6.68E-02	6.48E-01	7.39E-02	6.82E-02
Th-234	9.19E-01	1.81E+00	7.07E-01	2.16E+00	2.12E+00	7.48E-01	-8.23E-02	1.80E+00	7.11E-01
U-235	6.76E-02	1.05E-01	3.98E-02	1.40E-01	1.18E-01	4.59E-02	4.11E-02	1.09E-01	4.20E-02
Am-241	-1.57E-01	3.20E-01	5.42E-01	-1.71E-01	3.49E-01	5.91E-01	-1.47E-01	3.28E-01	5.55E-01

Analytical Parameter	RL04-1604-590 GRID 61			RL04-1605-591 GRID 52			RL04-1606-592 GRID 52		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	-3.36E-02	1.27E-01	2.13E-01	4.61E-03	9.13E-02	1.57E-01	-7.91E-02	1.35E-01	2.24E-01
K-40	1.20E+01	1.31E+00	1.37E-01	1.31E+01	1.42E+00	1.52E-01	1.11E+01	1.22E+00	1.58E-01
Co-58	-1.27E-02	9.91E-03	1.58E-02	-7.41E-03	9.62E-03	1.61E-02	-1.12E-03	1.08E-02	1.63E-02
Co-60	-3.35E-03	1.08E-02	1.83E-02	6.95E-03	1.11E-02	2.02E-02	4.68E-03	1.07E-02	1.92E-02
Zn-65	3.22E-04	2.89E-02	4.30E-02	-2.02E-02	2.67E-02	3.82E-02	8.78E-03	4.90E-02	4.66E-02
Sb-125	-6.37E-03	3.93E-02	6.66E-02	-4.23E-03	3.19E-02	5.44E-02	1.44E-02	4.52E-02	7.73E-02
I-131	1.36E-02	1.77E-02	3.10E-02	1.08E-02	1.44E-02	2.54E-02	-2.72E-03	1.90E-02	3.24E-02
Cs-134	1.64E-03	1.27E-02	1.87E-02	7.87E-03	1.08E-02	1.67E-02	5.72E-04	1.30E-02	1.90E-02
Cs-137	2.23E+00	2.40E-01	2.24E-02	3.77E-01	5.07E-02	1.88E-02	3.35E+00	3.56E-01	2.17E-02
Eu-152	9.22E-02	5.15E-02	7.95E-02	4.40E-02	4.42E-02	6.50E-02	1.07E-01	3.12E-02	7.66E-02
Eu-154	2.79E-02	3.52E-02	5.99E-02	1.63E-02	3.08E-02	5.22E-02	3.99E-02	4.88E-02	6.22E-02
Tl-208	2.24E-01	3.44E-02	1.94E-02	2.11E-01	3.03E-02	1.84E-02	1.76E-01	3.03E-02	2.21E-02
Bi-212	5.77E-01	3.64E-01	2.36E-01	8.12E-01	2.72E-01	2.42E-01	6.25E-01	2.15E-01	2.63E-01
Pb-212	6.59E-01	6.43E-02	4.79E-02	6.41E-01	6.13E-02	4.25E-02	5.43E-01	6.70E-02	5.15E-02
Bi-214	9.19E-01	6.95E-02	4.12E-02	9.01E-01	7.13E-02	3.58E-02	9.58E-01	7.16E-02	4.05E-02
Pb-214	8.97E-01	7.91E-02	5.02E-02	9.56E-01	8.00E-02	4.41E-02	9.00E-01	8.03E-02	5.62E-02
Ac-228	7.01E-01	7.19E-02	6.37E-02	6.45E-01	6.89E-02	7.60E-02	6.32E-01	7.02E-02	5.92E-02
Th-234	-8.53E-01	2.02E+00	7.57E-01	5.31E-02	1.77E+00	7.03E-01	3.06E-01	2.04E+00	7.48E-01
U-235	1.26E-01	1.21E-01	4.57E-02	1.65E-02	1.12E-01	4.27E-02	1.22E-01	1.23E-01	4.62E-02
Am-241	3.73E-01	3.64E-01	6.34E-01	1.28E-02	3.29E-01	5.65E-01	-2.88E-01	3.75E-01	6.27E-01

Table 6

AbNFB Grids 33, 42, 50,51, 52, and 61 Soil Sample Analytical Results

Analytical Parameter	RL04-1607-593 GRID 52			RL04-1608-594 GRID 52			RL05-0908-1370 Dose Chamber - SW		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	3.48E-02	9.62E-02	1.66E-01	-3.50E-02	8.81E-02	1.48E-01	-2.99E-02	1.28E-01	2.17E-01
K-40	1.25E+01	1.35E+00	1.57E-01	1.33E+01	1.43E+00	1.61E-01	1.40E+01	1.55E+00	1.87E-01
Co-58	-7.71E-03	9.69E-03	1.62E-02	-2.33E-04	9.86E-03	1.73E-02	-3.72E-03	1.38E-02	2.05E-02
Co-60	6.36E-03	1.15E-02	2.05E-02	4.65E-03	9.64E-03	1.75E-02	7.43E-03	1.30E-02	2.42E-02
Zn-65	-4.02E-03	2.57E-02	3.77E-02	2.01E-02	2.78E-02	4.32E-02	-1.27E-02	3.79E-02	5.44E-02
Sb-125	2.00E-04	3.06E-02	5.24E-02	3.20E-02	3.04E-02	5.39E-02	-7.04E-03	4.27E-02	7.27E-02
I-131	-1.93E-03	1.43E-02	2.46E-02	1.11E-02	1.41E-02	2.50E-02	9.55E-03	1.56E-02	2.77E-02
Cs-134	5.70E-03	1.04E-02	1.58E-02	-3.05E-03	1.10E-02	1.58E-02	-3.78E-03	1.51E-02	2.17E-02
Cs-137	4.86E-01	5.83E-02	1.95E-02	6.45E-02	2.48E-02	1.85E-02	9.03E-01	1.04E-01	2.77E-02
Eu-152	5.36E-03	3.30E-02	6.25E-02	1.82E-02	4.47E-02	5.90E-02	1.47E-01	9.27E-02	8.66E-02
Eu-154	-3.62E-03	3.09E-02	5.17E-02	1.38E-02	3.14E-02	5.31E-02	1.02E-01	6.42E-02	6.78E-02
Tl-208	1.87E-01	3.11E-02	1.86E-02	2.48E-01	3.33E-02	1.88E-02	2.54E-01	3.87E-02	2.37E-02
Bi-212	7.67E-01	2.46E-01	2.20E-01	8.44E-01	2.36E-01	2.52E-01	5.33E-01	3.21E-01	3.32E-01
Pb-212	7.00E-01	6.29E-02	4.03E-02	8.14E-01	7.13E-02	4.09E-02	7.71E-01	9.00E-02	5.06E-02
Bi-214	9.95E-01	7.68E-02	3.50E-02	1.16E+00	8.55E-02	3.44E-02	1.06E+00	8.60E-02	4.60E-02
Pb-214	1.03E+00	8.15E-02	4.16E-02	1.24E+00	9.27E-02	4.31E-02	1.16E+00	9.83E-02	5.84E-02
Ac-228	6.76E-01	6.86E-02	6.30E-02	8.14E-01	7.86E-02	6.63E-02	7.45E-01	8.17E-02	9.12E-02
Th-234	3.73E-01	1.80E+00	6.91E-01	8.24E-01	1.91E+00	7.51E-01	-1.18E+00	2.33E+00	9.19E-01
U-235	1.98E-02	1.08E-01	4.08E-02	1.36E-02	1.13E-01	4.34E-02	1.30E-01	1.34E-01	5.30E-02
Am-241	-4.11E-01	3.21E-01	5.25E-01	-2.47E-01	3.31E-01	5.54E-01	-2.93E-01	4.06E-01	6.82E-01

Analytical Parameter	RL05-0909-1371 Dose Chamber - Middle			RL05-0910-1372 Dose Chamber - SE		
	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)	Result (pCi/g)	2 σ (pCi/g)	MDA (pCi/g)
Be-7	8.89E-02	9.01E-02	1.61E-01	-3.41E-02	9.12E-02	1.54E-01
K-40	1.26E+01	1.37E+00	1.36E-01	1.09E+01	1.22E+00	1.62E-01
Co-58	-5.05E-03	1.01E-02	1.73E-02	-7.87E-03	1.03E-02	1.72E-02
Co-60	3.01E-03	1.18E-02	2.11E-02	-1.69E-03	1.20E-02	2.09E-02
Zn-65	-2.75E-02	3.01E-02	3.97E-02	-2.42E-03	2.89E-02	4.29E-02
Sb-125	8.70E-03	3.10E-02	5.39E-02	8.64E-03	3.19E-02	5.57E-02
I-131	-2.80E-03	1.22E-02	2.08E-02	-6.96E-03	1.31E-02	2.21E-02
Cs-134	-3.20E-03	1.13E-02	1.62E-02	6.00E-03	1.03E-02	1.61E-02
Cs-137	1.53E-01	2.50E-02	2.11E-02	1.97E-01	3.17E-02	1.97E-02
Eu-152	1.12E-02	4.28E-02	6.24E-02	2.71E-03	4.41E-02	6.06E-02
Eu-154	-9.64E-03	3.04E-02	5.06E-02	1.70E-02	3.03E-02	5.18E-02
Tl-208	1.95E-01	3.02E-02	1.79E-02	1.63E-01	2.74E-02	1.90E-02
Bi-212	8.50E-01	2.69E-01	2.34E-01	6.70E-01	2.30E-01	2.34E-01
Pb-212	5.78E-01	5.84E-02	3.89E-02	5.39E-01	6.36E-02	4.09E-02
Bi-214	8.40E-01	6.89E-02	3.47E-02	8.48E-01	7.20E-02	3.32E-02
Pb-214	9.00E-01	7.45E-02	4.28E-02	9.49E-01	7.85E-02	4.52E-02
Ac-228	5.85E-01	6.85E-02	7.20E-02	5.09E-01	6.60E-02	6.91E-02
Th-234	-5.17E-01	1.79E+00	7.04E-01	1.06E+00	1.90E+00	7.26E-01
U-235	1.33E-01	3.17E-02	3.16E-02	3.69E-02	1.08E-01	4.33E-02
Am-241	-1.48E-01	3.24E-01	5.50E-01	-3.09E-01	3.39E-01	5.64E-01

Table 7

AbNFB Grids 33, 42, 50, 51, 52, and 61 Excavation Fraction of Limit Calculation

Analytical Parameter	RL04-1647-626 Result[a] (pCi/g)	RL04-1648-626 Result[a] (pCi/g)	RL04-1649-627 Result[a] (pCi/g)	RL04-1650-628 Result[a] (pCi/g)	RL04-1613-599 Result[a] (pCi/g)	RL04-1614-600 Result[a] (pCi/g)	RL04-1615-601 Result[a] (pCi/g)	RL04-1616-602 Result[a] (pCi/g)	RL04-1609-595 Result[a] (pCi/g)	RL04-1610-596 Result[a] (pCi/g)	RL04-1611-597 Result[a] (pCi/g)	RL04-1612-598 Result[a] (pCi/g)
Co-60	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02
Sr-90[b]	3.09E-02	3.24E-02	2.54E-02	1.72E-01	2.83E-03	8.70E-04	8.48E-03	1.62E-03	7.17E-03	1.65E-02	9.76E-03	8.48E-03
Cs-137	1.42E+00	1.49E+00	1.17E+00	7.69E+00	1.30E-01	4.00E-02	3.90E-01	7.00E-02	3.30E-01	7.60E-01	4.50E-01	3.90E-01
Eu-152	1.50E-01	8.00E-02	3.00E-01	7.60E-01	7.00E-02	7.00E-02	8.00E-02	6.00E-02	6.00E-02	6.00E-02	7.00E-02	6.00E-02
Eu-154	7.00E-02	6.00E-02	6.00E-02	7.00E-02	6.00E-02	5.00E-02	6.00E-02	4.00E-02	5.00E-02	5.00E-02	6.00E-02	5.00E-02
Pu-238[b]	1.78E-03	1.86E-03	1.46E-03	9.86E-03	1.63E-04	5.00E-05	4.88E-04	8.76E-05	4.13E-04	9.50E-04	5.63E-04	4.88E-04
Pu-239[b]	5.68E-02	5.96E-02	4.68E-02	3.16E-01	5.20E-03	1.60E-03	1.56E-02	2.80E-03	1.32E-02	3.04E-02	1.80E-02	1.56E-02
Am-241[b]	9.47E-02	9.93E-02	7.80E-02	5.26E-01	8.67E-03	2.67E-03	2.60E-02	4.67E-03	2.20E-02	5.07E-02	3.00E-02	2.60E-02
Pu-241[c]	5.07E-01	5.32E-01	4.18E-01	2.82E+00	4.64E-02	1.43E-02	1.39E-01	2.50E-02	1.18E-01	2.71E-01	1.61E-01	1.39E-01
Fraction of Limit	1.30E-01	1.36E-01	1.06E-01	7.06E-01	1.45E-02	6.44E-03	3.77E-02	9.02E-03	3.23E-02	7.06E-02	4.30E-02	3.76E-02

Analytical Parameter	RL04-1601-587 GRID Result[a] (pCi/g)	RL04-1602-588 GRID Result[a] (pCi/g)	RL04-1603-589 GRID Result[a] (pCi/g)	RL04-1604-590 GRID Result[a] (pCi/g)	RL04-1605-591 GRID Result[a] (pCi/g)	RL04-1606-592 GRID Result[a] (pCi/g)	RL04-1607-593 GRID Result[a] (pCi/g)	RL04-1608-594 GRID Result[a] (pCi/g)	RL04-1666-641 GRID Result[a] (pCi/g)	RL04-1667-642 GRID Result[a] (pCi/g)	RL04-1668-643 GRID Result[a] (pCi/g)	RL04-1660-637 GRID Result[a] (pCi/g)
Co-60	5.03E-04	1.78E-02	3.72E-02	1.83E-02	6.96E-03	4.68E-03	6.36E-03	4.85E-03	1.81E-02	2.33E-02	2.08E-02	4.66E-03
Sr-90[b]	4.35E-04	5.33E-03	7.85E-03	4.85E-02	8.20E-03	4.72E-04	1.06E-02	1.40E-03	5.96E-02	7.33E-02	2.01E-01	5.61E-03
Cs-137	2.00E-02	2.45E-01	3.61E-01	2.23E+00	3.77E-01	2.17E-02	4.06E-01	6.46E-02	2.75E+00	3.37E+00	9.24E+00	2.56E-01
Eu-152	6.69E-02	2.34E-02	8.66E-02	9.22E-02	4.40E-02	7.66E-02	5.36E-03	1.82E-02	3.11E-01	4.00E-01	9.47E-01	1.65E-01
Eu-154	4.90E-02	8.48E-03	6.04E-02	2.79E-02	1.83E-02	6.22E-02	5.17E-02	1.38E-02	2.12E-01	2.60E-01	1.03E-01	9.68E-02
Pu-238[b]	2.50E-05	3.06E-04	4.51E-04	2.79E-03	4.71E-04	2.71E-05	6.08E-04	8.06E-05	3.44E-03	4.21E-03	1.16E-02	3.23E-04
Pu-239[b]	8.00E-04	9.80E-03	1.44E-02	8.92E-02	1.51E-02	8.68E-04	1.94E-02	2.58E-03	1.10E-01	1.35E-01	3.70E-01	1.03E-02
Am-241[b]	1.33E-03	1.63E-02	2.41E-02	1.49E-01	2.51E-02	1.45E-03	3.24E-02	4.30E-03	1.93E-01	2.25E-01	6.16E-01	1.72E-02
Pu-241[c]	7.14E-03	8.75E-02	1.29E-01	7.96E-01	1.36E-01	7.76E-03	1.74E-01	2.30E-02	9.82E-01	1.20E+00	3.30E+00	9.21E-02
Fraction of Limit	2.16E-03	2.42E-02	3.73E-02	2.01E-01	3.46E-02	2.95E-03	4.43E-02	6.43E-03	2.48E-01	3.06E-01	6.29E-01	2.44E-02

Analytical Parameter	RL05-0908-1370 Dose Result[a] (pCi/g)	RL05-0909-1371 Dose Result[a] (pCi/g)	RL05-0910-1372 Dose Result[a] (pCi/g)
Co-60	7.43E-03	3.01E-03	2.09E-02
Sr-90[b]	1.96E-02	3.33E-03	4.28E-03
Cs-137	9.03E-01	1.63E-01	1.97E-01
Eu-152	1.47E-01	1.12E-02	2.71E-03
Eu-154	1.02E-01	5.06E-02	1.70E-02
Pu-238[b]	1.13E-03	1.91E-04	2.48E-04
Pu-239[b]	3.61E-02	6.12E-03	7.88E-03
Am-241[b]	6.02E-02	1.02E-02	1.31E-02
Pu-241[c]	3.23E-01	5.46E-02	7.04E-02
Limit	6.22E-02	1.42E-02	2.02E-02

Table 8
AbNFB Grids 33, 42, 52, and 61
Summary of Post -Restoration Survey Results

Grid Location	Walkover Scan (cpm)	Exposure Rate (µR/hr)	Cs-137 Activity (pCi/g)
Grid 33 NE	14000	12	2.29E-01
Grid 33 NW	14000	12	5.53E-02
Grid 33 SE	14000	10	1.04E-01
Grid 33 SW	14000	12	4.61E-02
Grid 42 NE	15000	12	1.98E-01
Grid 42 NW	14000	12	2.64E-01
Grid 42 SE	14000	13	8.99E-02
Grid 42 SW	15000	10	4.72E-02
Grid 52 NE	14000	10	1.26E-01
Grid 52 NW	14000	12	5.16E-02
Grid 52 SE	15000	10	3.80E-02
Grid 52 SW	15000	12	2.33E-01
Grid 61 NE	15000	10	2.19E-01
Grid 61 NW	15000	10	8.57E-02
Grid 61 SE	15000	12	5.24E-02
Grid 61 SW	15000	12	5.37E-02