Attachment G

Final Status Survey Report #7 Documentation

(UNDER SEPARATE COVER)

FINAL

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

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

Characterization and Final Status Report for the Remaining Affected Areas Within the Filter Beds Including the WIDE System, Revision 0

Revision Data Compiled By:

Randy Parsons, Characterization Lead — Date: 6/16/06

Revised FSS Report Written By:

Keith Anderson, Site Radiation Safety Officer — Date: June 16, 2006

Approved By:

Glenn Henderson, Closure Manager — Date: June 16, 2006

Dave Garber, Quality Assurance Manager — Date: 6/16/06

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1.0 Introduction

This report contains the final status surveys (FSS) for the remaining areas of the Affected Filter Bed Area (AFBA) and the excavation of the Well Injection Deep Extraction (WIDE) System located at the Columbus Closure Project (CCP), 1425 Plain City/Georgesville Road 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, 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 May and June of 2005 and performed under Work Instruction 2806 (Closure Services, 2004).

The intent of this final status survey report is to provide a complete record of the radiological status of the WIDE System excavation prior to restoration, or the final condition of the site. The final status survey report also provides a complete record of the radiological status of the remaining areas within the AFBA. 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, technical procedures, the *Battelle Memorial Institute Columbus Operations, Decommissioning Plan*, DD-93-19 (BMI Decommissioning Plan), and other 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 guidance of Chapter 9 of NUREG-5849 (ORAU, 1992).

1.1 Background

On April 16, 1943, the Battelle Memorial Institute (BMI), acting through what is now its Battelle Columbus Operations (BCO), entered into Contract No. W-7405-ENG-92 with the Manhattan Engineering District (MED) to perform atomic energy research and development (R&D) activities. BCO performed nuclear materials research and development at privately-owned facilities for the MED 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 decommissioning 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 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 and according to the BMI Decommissioning Plan. 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 for the Affected Filter Bed Area and the WIDE System excavation. The results of the surveys demonstrate that these areas have been remediated to levels allowing future use without radiological restrictions.

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 one permanent structure (Well House). Three former research facilities, JN-1, JN-2, and JN-3 have been demolished as well as JN-6, the guard house. Several outfalls, filter beds, and wells are also located at the site.

The WJN Site is located west of Columbus, Ohio. The site is bounded by the Big Darby Creek, a national scenic and state protected river on the east, and farm lands to the west, south, and north. Immediately east of the Big Darby Creek are a Girl Scout camp and several residential neighborhoods, all within ½ mile of the site. The CCP consists of the decontamination and decommissioning of the 11.7 acre WJN site, a 2.6 acre filter bed area and connecting areas. Buildings JN-1, JN-2, and JN-3 were the three radiological contaminated buildings located within the 11.7 acre site. The buildings previously contained a reactor, a plutonium test facility and radioactive analysis laboratory, three large hot cells, and 50 foot deep fuel pool contaminated with fuel residuals. Each of these building and Building JN-6 have been demolished and removed from the site. Extensive excavation and removal have successfully remediated almost 4,000 linear feet of contaminated underground piping and filter beds. The filter beds are located in a designated wetland protection area and flood plain. **Figure 1** shows the location of the WJN site and details the AFBA and the WIDE System excavation.

2.1 Area Description

The former AFBA was atop a sloped field located to the east of the Lake Battelle Dam and to the west of the Big Darby Creek. The area included the:

- Abandoned North Filter Bed(s) (AbNFB),
- Active North Filter Bed (ANFB),
- Abandoned Middle Filter Bed (AbMFB), and
- Active Middle Treatment System (AMTS).

The AFBA covered close to 2.6 acres of land. The area had been divided into roughly 107, 10-meter by 10-meter grids, with a total surface area of 10,700 square meters (m^2). **Figure 2** details the AFBA. In **Figure 2,** a dotted line represents a chain linked fence that encloses the former AFBA. The portion within the fenced enclosure is considered the affected area. Closure Services extended the chain link fence to the north to accommodate remediation activities. Relocation of the fence did not alter the areas designated as affected in the BMI Decommissioning Plan. For the purposes of this report, the AFBA encompasses the entire fenced enclosure as shown in **Figure 2.**

In September 2004, Closure Services began surveying, characterizing, demolishing, and removing the contaminated structures, piping, and soils in and around the Affected Filter Bed Area. Characterization and final status surveys were performed on an iterative basis to support ongoing remediation and restoration activities. Final status surveys of remediated areas were performed and unrestricted release requirements have been met for all areas.

Final Status Surveys have been performed and documented for the following excavations:

- Abandoned Middle Filter Bed, including the Manhole B to E1 Sanitary Sewer Line
- Manhole 7 to A Sanitary Sewer Line
- Active North Filter Bed – North Subsurface Sand Filter
- Active North Filter Bed – South Subsurface Sand Filter
- Grids 42, 50, 51, 52, and 60.
- Manhole 7 to 8 Sanitary Sewer Line
- Active North Filter Bed Discharge Line

Surveys and samples of the excavations listed above have been documented in previously drafted FSS Reports. These excavations are not within the scope of this particular report.

Affected areas and excavations addressed in this report include:

- Excavation of a portion of the WIDE System.
- The portion of clay piping leading from survey grid 53 to survey grid 46, and
- Remaining affected areas within the fenced enclosure.

Remaining affected areas within the fenced enclosure include:

- Final status surveys and samples obtained from unexcavated grids within the fenced enclosure, and
- Areas previously excavated and restored.

Final status surveys of the remaining affected areas of post-restoration areas were performed to document the "as left" condition of the AFBA.

Figure 2 illustrates in blue, the location and perimeter of the excavated portion of the WIDE System. **Figure 3** provides greater detail of the location and perimeter of the WIDE System Excavation. **Figure 2** shows the location and perimeter of the area including and surrounding the Active Middle Filter Bed that is excluded from this report.

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.

Areas within the fenced enclosure of the filter bed area are considered to be affected.

2.2 Remediation and Characterization Surveys

2.2.1 Remediation and Characterization of the WIDE System Excavation

In 1980, portions of the Abandoned North Filter Beds were removed, packaged as low level radioactive waste, and disposed off-site. Analysis of samples taken from the remaining filter media were submitted to the NRC by BMI. BMI was then authorized by the NRC to backfill the beds with clean sand, blend the sand with the remaining filter bed media, and cover the blended material with three feet of soil. BMI completed this action in 1982. (DOE, 1990).

Starting in the early 2000's, BMI installed and partially tested the WIDE System with water. The WIDE System was an *in situ* soil decontamination process for washing subsurface soils with chemical solution injected through prefabricated vertical wells (PVW). The intent was to invect each PVW with chemical solution to loose the radionuclides from the soil. Specialize pumps would then extract the radionuclide solution from the ground through the PVW. The extracted solution was then to be filtered through ion specific filters and tested to remove the radionuclides. In early 2003, BMI preformed multiple test injections by pumping large amounts of chemical solution free water into the system. (DOE, 2003) In the first quarter of 2004, Closure Services abandoned the WIDE System and prepared to perform excavation and removal of contaminated soils.

In 2005, Closure Services began the demolition and removal of the Affected Filter Bed Area, including the Abandoned North Filter Beds and the WIDE System. It was anticipated by Closure Services that 39,000 cubic feet would require removal to affectively remediate the area. In completing the excavation, approximately 90,000 cubic feet of soil and debris were removed and packaged for off-site disposal from the Abandoned North Filter Beds and the WIDE System portion of the Filter Bed Area. Excavation and off-site disposal represented a total reduction of the source term by approximately 8.2 millicuries of radioactive material. **Figure 3** provides details of the location and perimeter of the WIDE System excavation.

2.2.2 Remediation and Characterization of Abandoned Clay Pipes

In April 2005, excavation activities exposed the north end of two (2) vitrified clay pipes following the removal of the dosing chamber and a splitter box from the Abandoned North Filter Bed area. The vitrified clay pipes originated as discharge lines from the south side of the splitter box. Original design drawings indicated that the lines ran to the south and then turned east, eventually discharging to the now Abandoned North Filter Beds.

Samples collected from the splitter box and soil outside of the pipes attached to the splitter box indicated contamination levels greater than the release criteria. Specifically, soil samples collected from around the exterior of the pipe ranged from 12.6 to 207 pCi/g

for Cesium-137 (Cs-137). **Figure 4** details the location of pipes leading from the splitter box, towards the south, and then east towards the Abandoned North Filter Bed.

Excavation then removed the splitter box and roughly four (4) feet of the line running towards the south. A test trench was excavated at a pipe bend within survey grid 55, as shown in **Figure 4**. Following the excavation, characterization samples were obtained from the exterior and the interior of the exposed inlet sections of each pipe. The inlet sections of piping were collapsed and filled with soil. Soils and piping were sampled and are presented as sample numbers R1.05-0923 through 0934 in **Table 1**. Radiation surveys of the interior of the pipes could not be performed as it had collapsed, although the areas surrounding were scanned with a two (2) inch by two (2) inch Sodium Iodide (NaI) detector. Areas exceeding the decision limit value (DLV) were sampled. Analytical results of the samples indicated that the remaining materials were less than the release criteria. **Table 1** presents the analytical results of all the pre-remediation and post remediation samples obtained from within and around the section of the two (2) vitrified clay pipes running from the south of the splitter box and east into Grid 46.

The *Characterization and Final Status Report for the Areas Surrounding and Including the Active Middle Filter Bed* details the excavation and removal of the portion of the two (2) vitrified clay pipes after running to the east into Grid 46. The report presents scanning surveys and analytical results of samples obtained from within and around the east section of the pipes within Grid 46.

Excavation Crews encountered two (2) vitrified clay pipes in Grid 46 during the excavation activities in the south end of the areas surrounding and including the Active Middle Filter Bed. . Samples collected of soil from the outside of the pipes indicated contamination levels greater than the release criteria. **Figure 4** details the location of pipes exposed during the excavation of the area surrounding and including the AMFB.

Excavation proceeded roughly 6 feet to the west along the run of the pipes. Characterization Technicians then obtained samples of material from the interior of and around the outside of the pipes. A scanning survey of the interior of the pipes was also performed using a two (2) inch by two (2) inch NaI detector connected by a 12-foot long cord to a scaler/ratemeter. The detector was gently pushed toward the west, along the interior run of the pipe to a distance 12 feet from the pipe outlet. Readings obtained from the survey were at background levels of less than 16,000 counts per minute. Sample results indicated soil activity concentrations well below the screening criteria for unrestricted release. **Table 1** presents the analytical results of characterization and post remediation samples obtained from the interior and exterior of the two (2) clay pipes.

Post-remediation results of representative bulk samples obtained of the two (2) clay pipes and the surrounding soils are below those presented in DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993).

3.0 Decommissioning Activities

3.1 Decommissioning Objective

The objective of the final status survey performed of the Affected Filter Bed Area and the WIDE System excavation is to demonstrate that the remediation of the area will allow for future use without radiological restriction. Remediated areas of the CCP may be 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". *hereinafter* referred to as DD-93-03, Rev. 0. (Battelle, 1993). **Table 2** 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 Affected Filter Bed Area and the WIDE System excavation adhered to the requirements of the Final Status Plan (Battelle, 2000) and Work Instruction 2806 (CS, 2004)

4.1 Sampling Parameters

Final status soil samples of the Affected Filter Bed Area and the WIDE System excavation were obtained from survey grids. Survey grids were each ten by ten meters, with each grid divided into equal sized quadrants of five by five meters. Final status soil samples were then obtained from each of the grid quadrants. Analyses of soils samples by gamma spectroscopy were performed by the On-Site Radioanalytical Laboratory (RAL).

4.2 Major Contaminants Identified

The characterization of the Affected Filter Bed Area excavation 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), Srontium-90 (Sr-90), Plutonium-238 (Pu-238), 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 3**. **Table 3** 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 Affected Filter Bed Area. 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. Cs-137 activity ratios for each RCOC utilized to calculate the RCOCs for the Affected Filter Bed Area are presented at the lower portion of **Table 3**.

4.2.1 Guidelines Established

Table 2 presents the guidelines for residual radioactivity concentrations for soil and solid volumes as applied to the excavation. Criteria for residual radioactivity concentrations in soil are defined in a number of references. DOE Order 5400.5, Section IV.a.2 provides

[1] Battelle, *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.

generic guidelines for residual concentrations of Radium-226 (Ra-226), Ra-228, Thorium-230 (Th-230), and Th-232. NRC Guidance has been received by the CCP which contains soil radioactivity concentration guidelines for Co-60, Sr-90, Cs-137, Ra-226, and Ra-228. NRC guidance for soil radioactivity concentration guidelines for natural, enriched and depleted uranium are also utilized. **Table 2** compiles soil residual radioactivity concentration guidelines to be utilized by the CCP. **Table 2** values have been generated primarily from the various reference technical documents and from soil guidelines generated from computer pathway analyses. 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. Using the ratios from **Table 3** and the Cs-137 to Pu-241 ratio of 2.8, the sum of ratios of radionuclides will meet unity at Cs-137 concentrations of 11 pCi/g. This provides a modified screening criterion of 11 pCi/g, for Cs-137.

Exposure rates were compared to the 5 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 are 8 ± 2 μR/hr. Compliance to the limit is met when the exposure rate survey is less then or equal to the limits of DD-97-02, Rev. 0 (Battelle, 2000). 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 over 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 grounds and 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 grounds and excavation. Ludlum Model 19 exposure rate meters were used to obtain microRoentgen per hour measurements.

Other instrumentation used in the RAL to support 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 screening 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 during the walkover surveys of the CCP incorporates a d' of 1.38 and a surveyor efficiency of 0.5. The ambient background at the time of the excavation of the WIDE System and the survey of the remaining areas was 15,500 counts per minute (cpm). The following is the calculation of the MDC_{scan}:

b_i = (15,500 cpm) x (1 sec) x (1 min/60 sec) = 258 counts

MDCR = (1.38) x ($\sqrt{258 counts}$) x (60 sec/1min) = 1330 cpm

$MDCR_{surveyor}$ = 1330 cpm/ $\sqrt{0.5}$ = 1881 cpm

MDER = 1881 cpm/(900 cpm/μR/hr) = 2.09 μR/hr

$$MDC_{scan} = (5 pCi/g) * \frac{2.09 \mu R/hr}{1.307 \mu R/hr} = 7.99 pCi/g$$

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-002, Rev. 0	Facility Post-Decontamination Final Status Survey for Baseline Areas
SC-SP-004.2, Rev. 3	Manual and Mechanical Collection of Surface and Subsurface Soil Samples in Support of Site Characterization
HP-OP-100, Rev. 4	Operation and Calibration of the Eberline Model ESP-2 Survey Meter
WI-2806	Excavation and Trench Sampling and Surveys

6.0 Survey Findings

6.1 Exposure Rate Surveys

Exposure rate surveys were performed in each quadrant of the grids for the remaining areas within the AFBA and the excavation of the WIDE System.

6.1.1 Exposure Rate Surveys of Remaining Areas within AFBA

The calculated mean background exposure rate and the 95 percent confidence intervals used for the CCP open grounds are 8 ± 2 μR/hr. The exposure rate readings for the remaining areas within the AFBA are presented in **Table 4. Table 10** presents the compiled final status surveys of the remaining areas within the AFBA.
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. Initial compliance is met if the individual open grounds exposure rate surveys are less than or equal to13 μR/hr. The average one meter measurement was 10.8 μR/hr, the minimum measurement was 6 μR/hr and the maximum measurement was 14 μR/hr. Under further assessment, the average of each 100 m^2 grid is less than or equal to 13 μR/hr.

6.1.2 Exposure Rate Surveys of WIDE System Excavation

The calculated mean background exposure rate and the 95 percent confidence intervals used for the CCP trench excavations is 3-5 μR/hr greater than that for open grounds of 8 ± 2 μR/hr. The exposure rate readings within the excavation of the WIDE System are presented in **Table 7. Table 11** presents the compiled with all final status surveys of the WIDE System excavation.

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. Initial compliance is met if the individual open grounds exposure rate surveys are less than or equal to13 μR/hr. The average one meter measurement was 10.8 μR/hr. the minimum measurement was 10 μR/hr and the maximum measurement was 14 μR/hr. Under further assessment. the average of each 100 m^2 grid is less than or equal to 13 μR/hr.

6.2 Open Grounds and Excavation Sampling

Final status soil samples were collected from the remaining areas of the AFBA and the excavation of the WIDE System.

6.2.1 Open Grounds Sampling

Final status soils samples were collected from the remaining areas of the AFBA from each of the survey grids. Samples were obtained from each grid quadrant as required by Section 6.3.3 of DD-97-02. Rev. 0 from a depth of surface to 15 centimeters. **Table 5** presents the reported Cs-137 result for each final status soil sample location. Analytical results for Cs-137 of each soil sample are also presented in **Table 10**.

6.2.2 Excavation Sampling

Final status soils samples were collected from the excavation of the WIDE System from each of the survey grids. Samples were obtained from each grid quadrant as required by Section 6.3.3 of DD-97-02. Rev. 0 from a depth of surface to 15 centimeters. **Table 8** presents the reported Cs-137 result for each final status soil sample location. Analytical results for Cs-137 of each soil sample are also presented in **Table 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. These measurements were performed for the remaining area of the AFBA and the WIDE System excavation.

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.

Scanning measurements of the remaining areas of the AFBA exceeded the DLV of 18,374 cpm in several locations. These locations were primarily towards the north and west of the filter bed area. Characterization Technicians collected soil samples within the grid quadrants as required by DD-97-02. **Tables 6** and **10** present the surface scanning results of the remaining areas of the AFBA. Additional walkover scans were performed following site restoration. All results were less than the DLV and were added to the tables.

Scanning measurement of the WIDE System excavation were less than the DLV, with the exception of the southwest quadrant in Grid 27 and the southeast quadrant in Grid 36. Characterization Technicians collected soil samples as required by DD-97-02. **Table 9** presents the surface scanning results for the WIDE System excavation. Walkover scanning surveys are also presented in **Table 11**.

6.4 Radioanalytical Reporting Requirements

Tables 10 and 11 present the reported analytical results for Cs-137 of each final status survey soil sample. In general, soils samples exhibited low concentrations Cs-137

activity. Utilizing the ratio of Cs-137 to other radionuclides. low concentrations of Cs-137 would indicate even lower concentrations of other gamma emitting radionuclides of concern. As such. gamma emitting radionuclides of concern other than Cs-137 would be less than the corresponding Minimum Detectable Activity (MDA). **Table 12** presents the typical MDAs for the gamma-emitting radionuclides of concern.

Cesium-137 has been established as the predominate radionuclide and has been historically used as a surrogate for other radionuclides of concern as discussed in section 4.2 and section 4.2.1.

Evaluation of the 401 total samples collected and analyzed indicates that; 222 samples were below 1% of the Cleanup Criteria. 168 were between 1 and 10% of the Cleanup Criteria. 4 were between 10 and 20% of the Cleanup Criteria, 6 were between 20 and 41% of the Cleanup Criteria. and a single sample was at 70.55% of the Cleanup Criteria. **Table 13** presents the results of the evaluation. **Table 14** details the "fraction of limit" calculation for the final status soil sample with the reported Cs-137 activity of 7.76 pCi/g.

6.5 Supplemental FSS Activities

On June 29. 2005, the Characterization Crew performed a final verification scan survey of the Affected Filter Bed Area and the WIDE System excavation. Two (2) small localized areas of elevated contamination that exceeded the DLV limit were detected within the WIDE System excavation. Characterization Crews identified the locations and relinquished the survey area to the IVC Team.

The IVC Team then began the verification surveys of the Affected Filter Bed Area and the WIDE System excavation. Verification surveys performed by the IVC Team confirmed the presence of elevated areas of contamination not previously identified by Closure Services. In response to the discrepancy. Closure Services performed additional remediation and sampling of the identified areas. Subsequent evaluation of the supplemental sampling activities showed the remediation to be successful in eliminating the areas of elevated contamination. **Attachment 1** contains a detailed discussion of this event and actions taken by Closure Services.

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 Filter Bed's Affected Areas within the fence line and the WIDE System 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 in the Filter Bed's Affected Areas within the fence line and the WIDE System excavation, statistically demonstrates that the remediation of the area was successful and that the excavations are free from residual radioactive contamination making them suitable for unrestricted release.

8.0 References

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 from 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.

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by the Environmental Survey and Assessment Program, Energy/Environmental Systems Division. ORAU, 1992.

Figures

Figure 1
Site Map

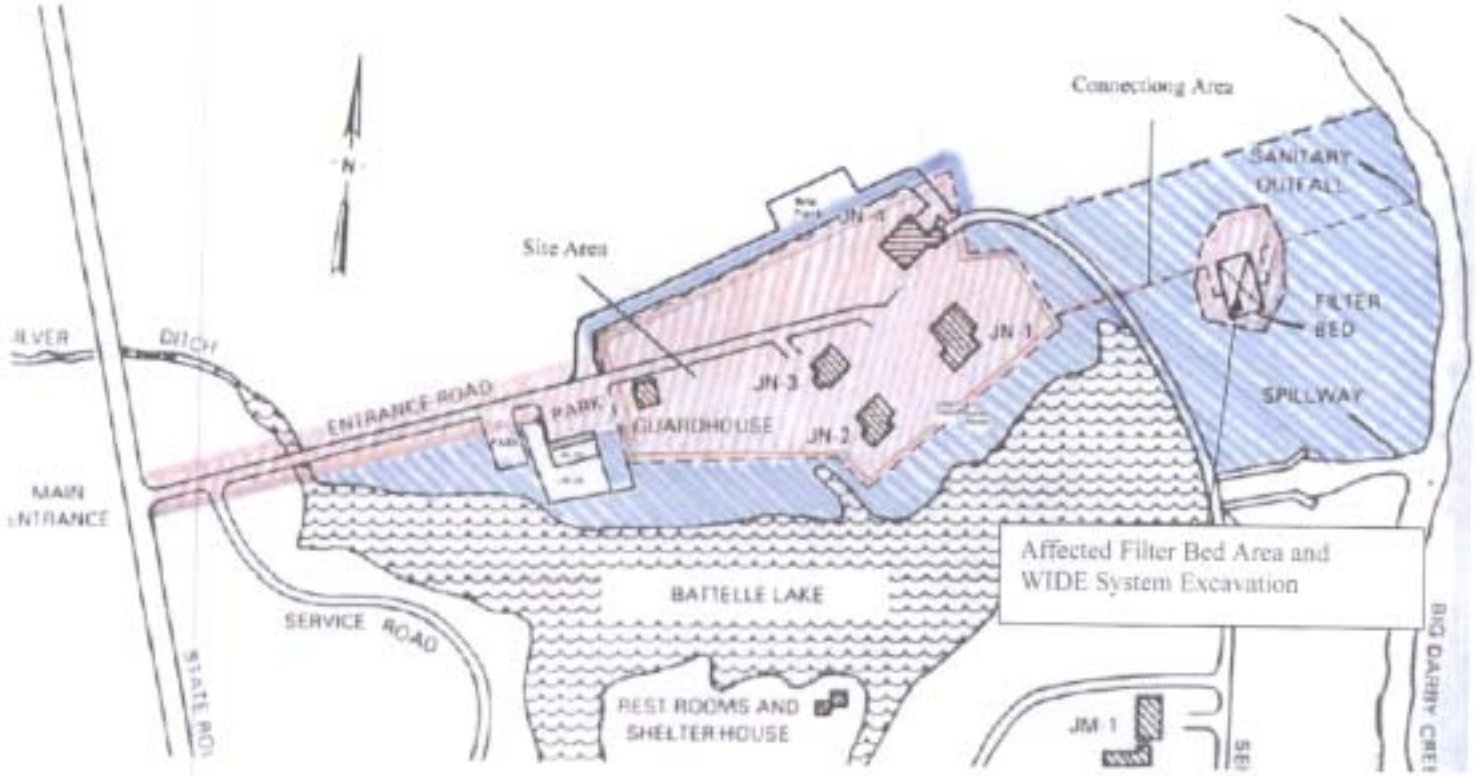


Figure 2
Affected Filter Bed Area Map

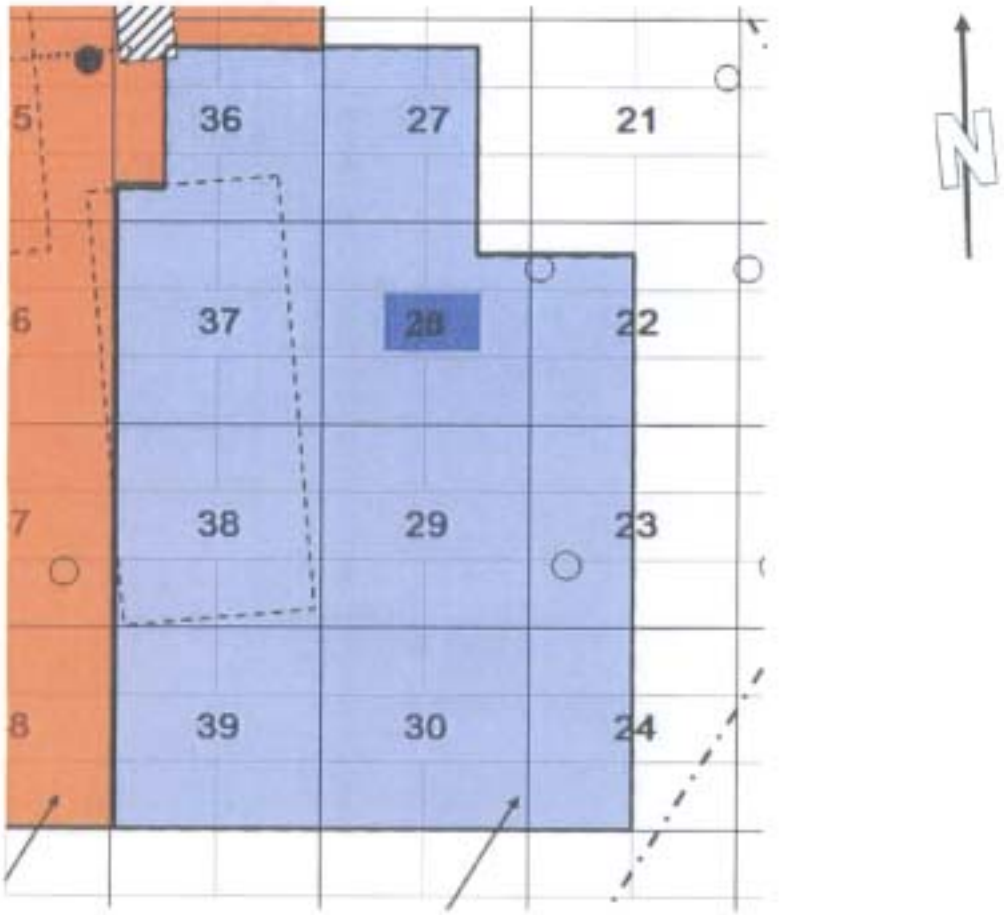
Fence Enclosing the Affected Filter Bed Area Fenceline.

Areas highlighted in Blue represent the WIDE System Area.

Area highlighted in Red represents the Active Middle Filter Bed Area and is outside the Scope of this FSS.

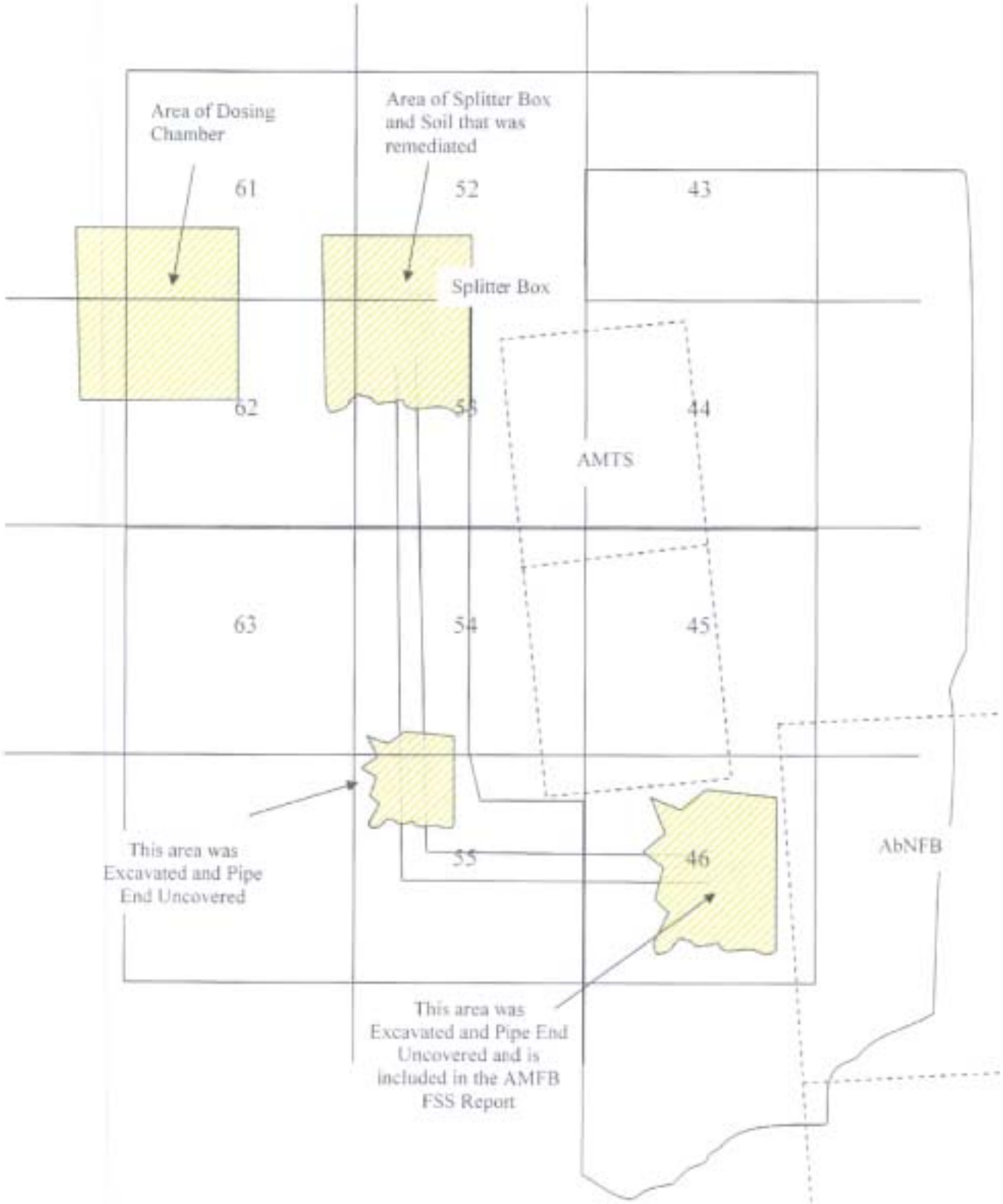
13MS

Figure 3
WIDE System Area Map



WIDE System Excavation is highlighted in Blue.

Figure 4
Area of 2 Remaining Clay Pipes



Tables

Table 1

AbNFB Clay Pipe Sampling Summary

Table 1-A Abandoned North Filter Bed - North Section Near Dosing Chamber Post-Remediation			
Sample ID	Grid ID	Cs-137 (pCi/g)	Comments/Notes
RL05-0908-1370	61/62	0.90	Under Dosing Chamber-SW End
RL05-0909-1371	61/62	0.15	Under Dosing Chamber- Middle
RL05-0910-1372	61/62	0.20	Under Dosing Chamber-SE End

Table 1-B Abandoned North Filter Bed - North Section Piping Samples Near Dosing Chamber Pre-Remediation			
Sample ID	Grid ID	Cs-137 (pCi/g)	Comments/Notes
RL05-0259-0919	52	0.17	Splitter Box - Grid 52 wall, I/S Splitter Box
RL05-0260-0920	52	24.10	Splitter Box - Grid 52 wall, I/S Splitter Box
RL05-0582-1127	WIDE	14.40	Splitter Box Wall, Pre-remediation
RL05-0583-1128	WIDE	12.60	Splitter Box Wall, Pre-remediation
RL05-0261-0921	52	207.00	Splitter Box - Grid 52 outflow to old "Y", O/S pipe, Soil Samples Pre-remediation
RL05-0262-0922	52	89.50	Splitter Box - Grid 52 outflow to old "Y", O/S pipe, Soil Samples, Pre-remediation

Table 1-C Abandoned North Filter Bed - North Section Near Dosing Chamber Removal of Material Around Clay Pipes Post-Remediation			
Sample ID	Grid ID	Cs-137 (pCi/g)	Comments/Notes
RL05-0282-0923	52	5.86	Splitter Box Vert. - Piping @ 4' After Remediation
RL05-0283-0924	52	2.67	Splitter Box Vert. - Piping @ 4' After Remediation
RL05-0284-0925	52	0.50	Splitter Box Vert. - Soil @ 4', I/S Piping
RL05-0285-0926	52	3.16	Splitter Box Vert. - Soil @ 4', I/S Piping
RL05-0286-0927	52	1.61	Splitter Box Vert. - Soil O/S Pipe North @ 4', Taken O/S pipes
RL05-0287-0928	52	6.18	Splitter Box Vert. - Soil O/S Pipe North @ 4', Taken O/S pipes
RL05-0288-0929	52	1.20	Splitter Box Vert. - Soil O/S Pipe North @ 4', Taken O/S pipes
RL05-0289-0930	52	0.59	Splitter Box Vert. - Soil O/S Pipe North @ 4', Taken O/S pipes
RL05-0290-0931	52	0.45	Splitter Box Vert. - Soil O/S Pipe South @ 4', Taken O/S pipes
RL05-0291-0932	52	0.79	Splitter Box Vert. - Soil O/S Pipe South @ 4', Taken O/S pipes
RL05-0292-0933	52	4.18	Splitter Box Vert. - Soil O/S Pipe South @ 4', Taken O/S pipes
RL05-0293-0934	52	0.51	Splitter Box Vert. - Soil O/S Pipe South @ 4', Taken O/S pipes

Table 1-D Abandoned North Filter Bed Middle Section in Grid 55 Characterization Samples			
Sample ID	Grid ID	Cs-137 (pCi/g)	Comments/Notes
RL05-0331-0952	54	0.02	AMTS @ 11' Soil from around Pipe
RL05-0332-0953	54	0.10	AMTS @ 8' Soil from around Pipe
RL05-0333-0954	54	0.02	AMTS @ 13' Soil from around Pipe
RL05-0365-0978	54	0.14	AMTS @ 7' Soil from around Pipe
RL05-0366-0979	54	0.08	AMTS @ 10' Soil from around Pipe
RL05-0367-0980	54	0.09	AMTS @ 10' Soil from around Pipe
RL05-0368-0981	54	0.21	AMTS @ 9' Above Tile Soil from around Pipe
RL05-0369-0982	54	0.04	AMTS @ 10' Soil from around Pipe
RL05-0330-0951	55	0.13	AMTS @ 6' Soil from around Pipe
RL05-0373-0983	55	0.07	AMTS @ Pipe Soil from around Pipe
RL05-0581-0984	55	0.03	AMTS @ Tile Soil from around Pipe
RL05-1147-1551	55	0.03	Sand from around pipe
RL05-0584-1129	WIDE	0.34	Piping
RL05-0585-1130	WIDE	0.92	Piping

Table 1-E Abandoned North Filter Bed - East Section in Grid 46 Samples of Clay Pipes and Soil Post-Remediation			
Sample ID	Grid ID	Cs-137 (pCi/g)	Comments/Notes
RL05-3652-3554	46	2.47	Soil from inside North Pipe
RL05-3653-3555	46	2.76	Soil from inside South Pipe
RL05-4232-3962	46	0.01	North Pipe - Pulverized
RL05-4233-3963	46	0.17	South Pipe - Pulverized
RL05-4234-3964	46	0.23	Soil from inside North Pipe
RL05-4235-3965	46	5.45	Soil from inside South Pipe

Table 1-F Removable Contamination Survey of Clay Pipe Material			
Smear Sample	Location	Alpha	Beta
ID		Result (dpm)	Result (dpm)
1	North Pipe Outside	-0.28	1.55
2	North Pipe Outside	-0.28	0.58
3	North Pipe Inside	4.38	6.40
4	North Pipe Inside	2.83	3.49
5	North Pipe Inside	32.06	59.80
6	North Pipe Inside	24.06	102.52
7	South Pipe Outside	2.83	6.40
8	South Pipe Outside	-0.28	4.46
9	South Pipe Inside	18.39	37.47
10	South Pipe Inside	2.83	4.46
11	South Pipe Inside	38.62	93.78
12	South Pipe Inside	52.62	140.38

Table 2
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[4]
Am-243	na	30[4]
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]
Ra-226 (0-15 cm of soil)	5[2,3]	na

Radionuclide[a]	King Avenue Concentration (pCi/g)[b]	West Jefferson Concentration (pCi/g)[b]
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 2 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 3
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	26 1	0 05	<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 05	<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	0 267
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 64	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 438762113	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

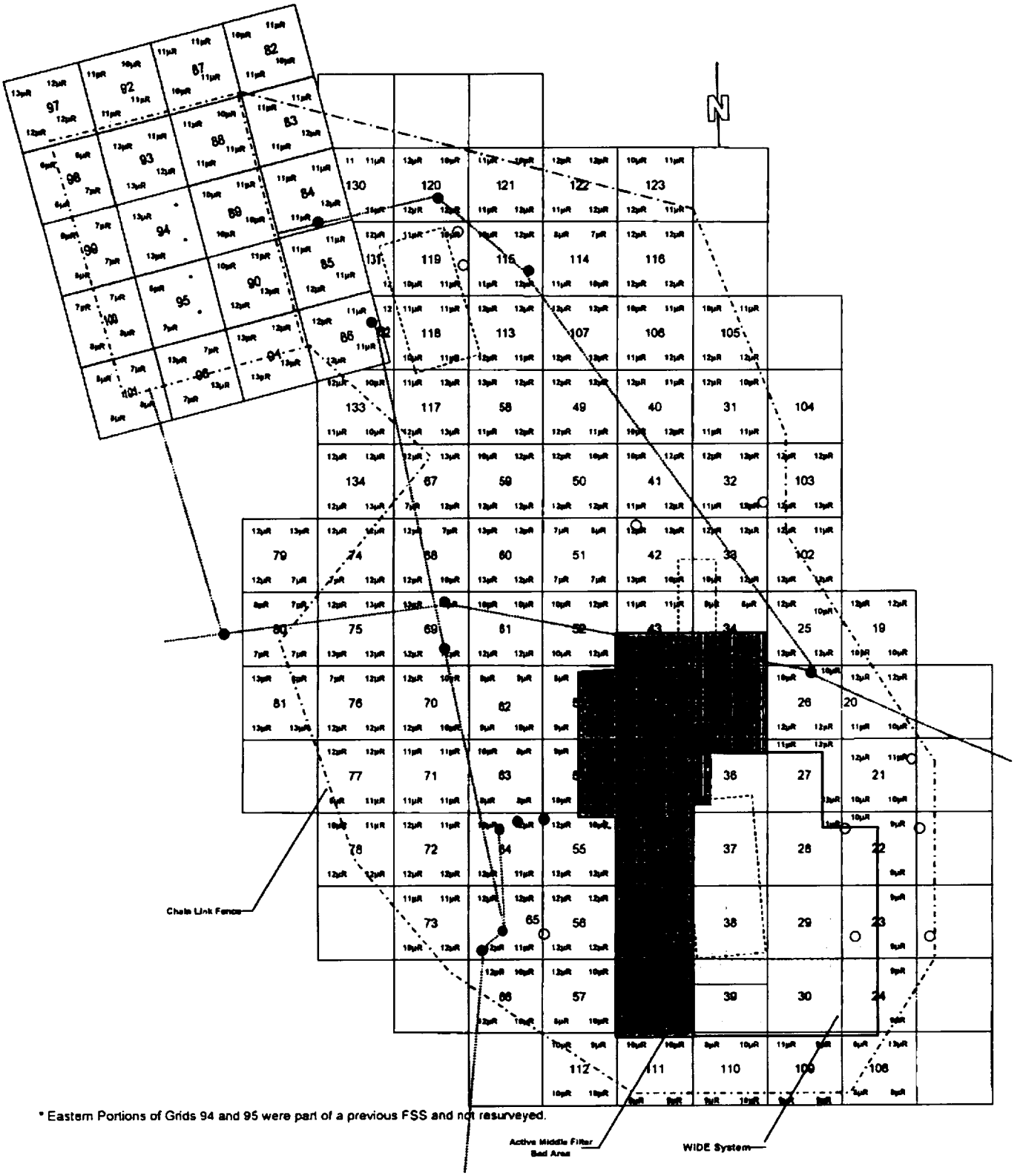
(b) Reported data obtained from gamma spectroscopy analysis

(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.

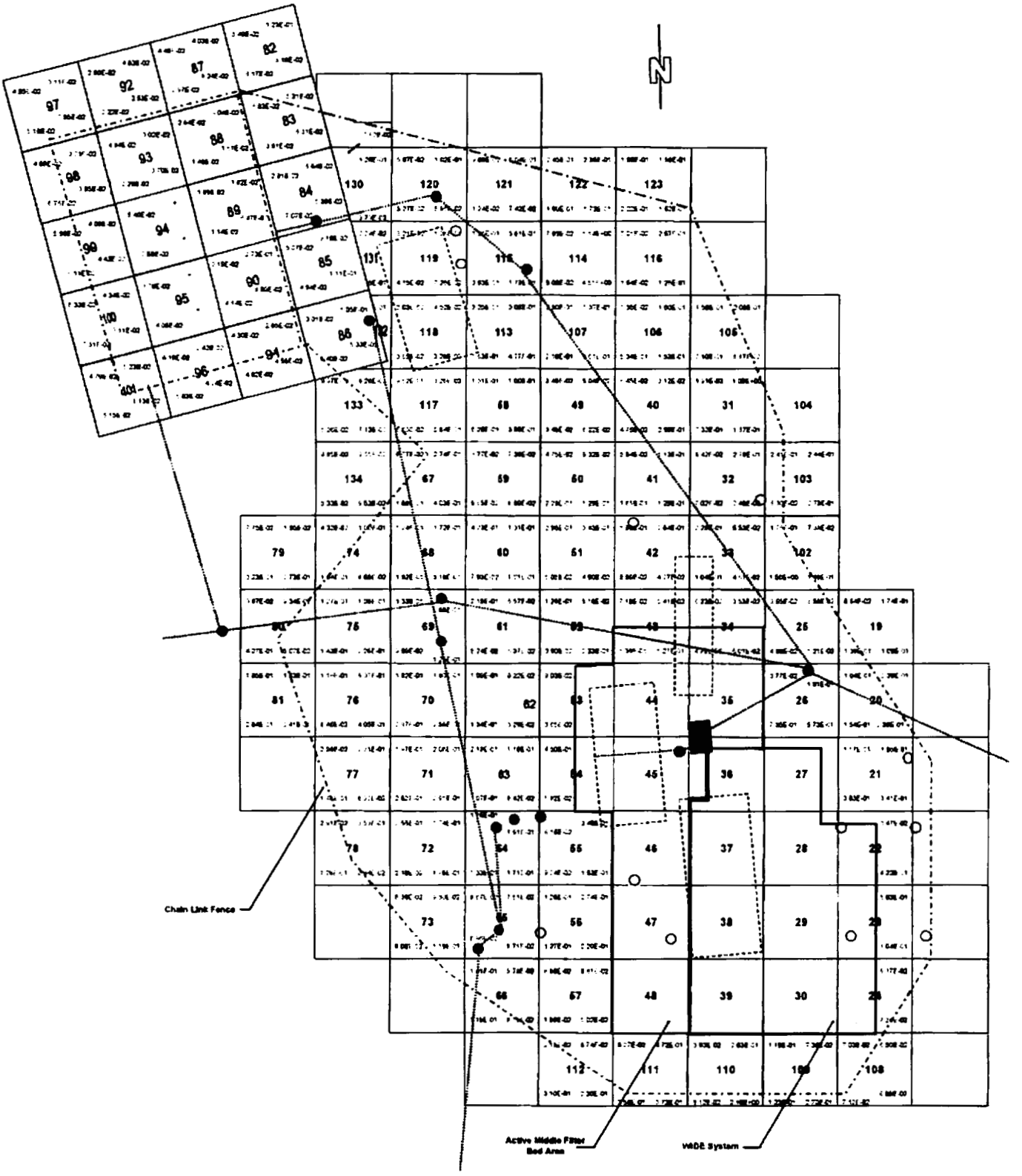
(e) Unity Rule applied to surrogate calculated activity resulting in modified Cs-137 screening level of 11 pCi/g

Table 4
Remaining Areas of Affected Filter Bed Area
Exposure Rate Surveys



* Eastern Portions of Grids 94 and 95 were part of a previous FSS and not resurveyed.

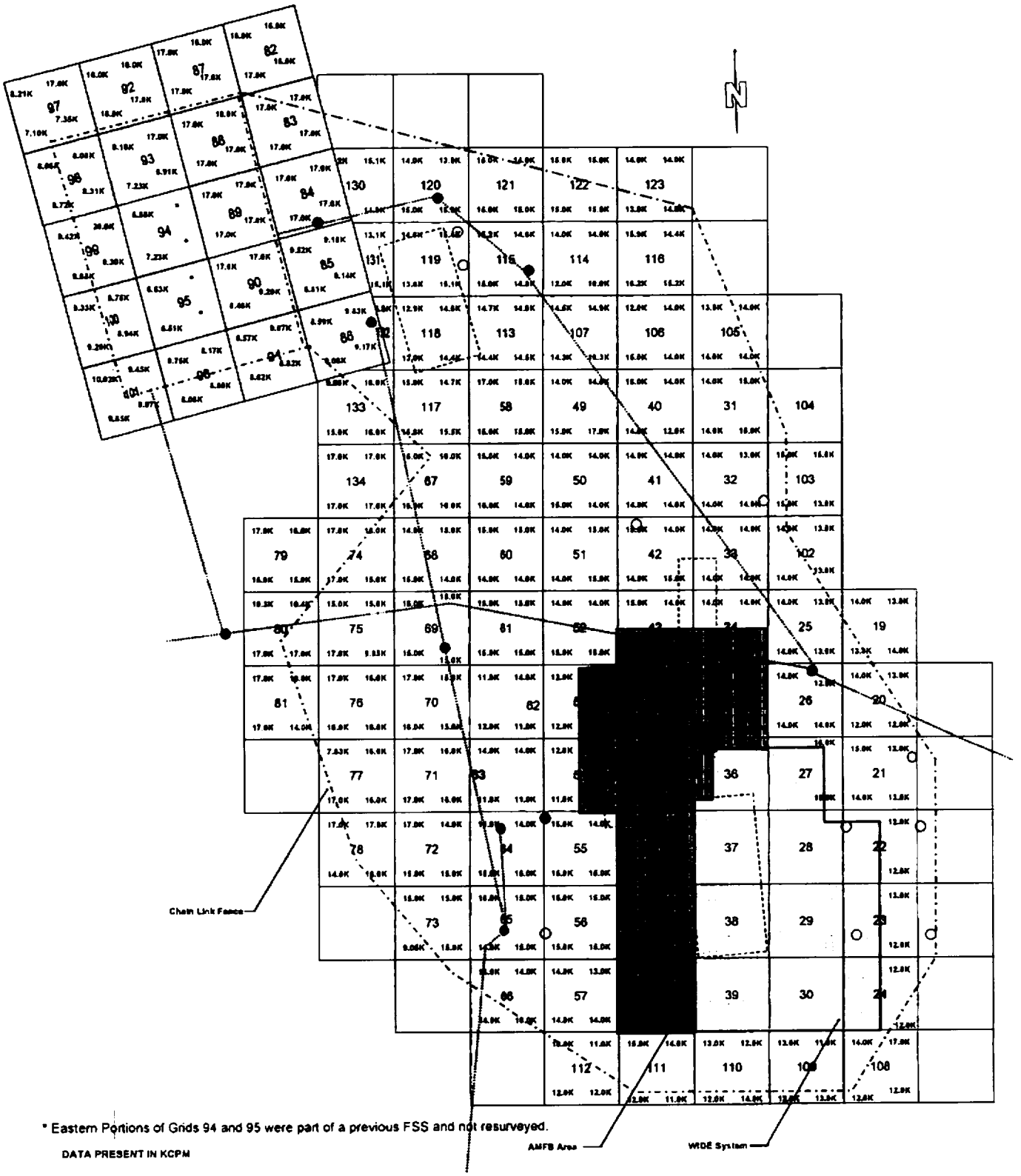
Table 5
Remaining Areas of Affected Filter Bed Area
Soil Sample Results



* Eastern Portions of Grids 94 and 95 were part of a previous FSS and not resurveyed.

Cs-137 Results in pCi/g

Table 6
Remaining Areas of Affected Filter Bed Area
Walkover Scan Surveys



* Eastern Portions of Grids 94 and 95 were part of a previous FSS and not resurveyed.

DATA PRESENT IN KCPM

Table 7
WIDE System Excavation
Exposure Rate Surveys

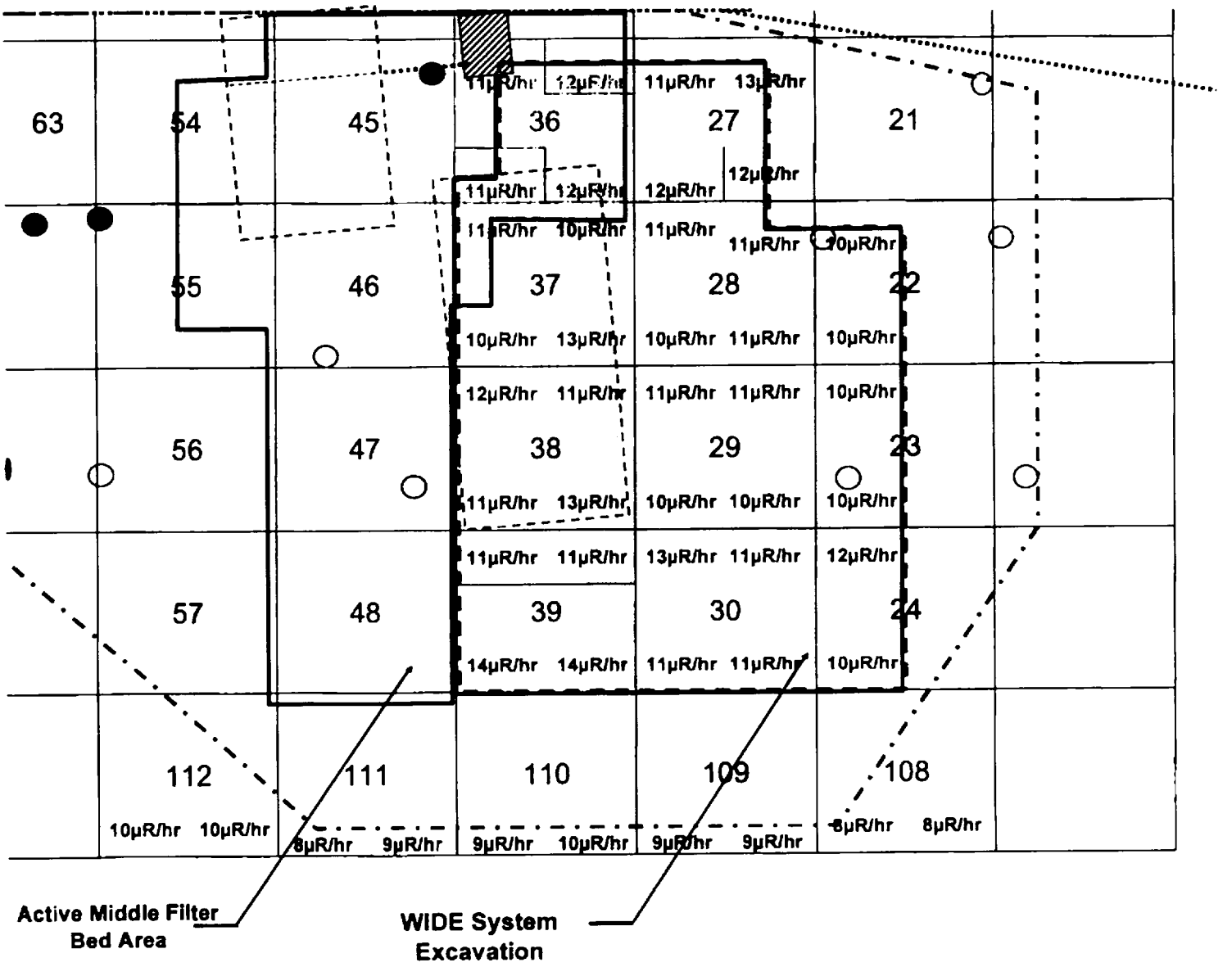


Table 8
WIDE System Excavation
Soil Sample Results

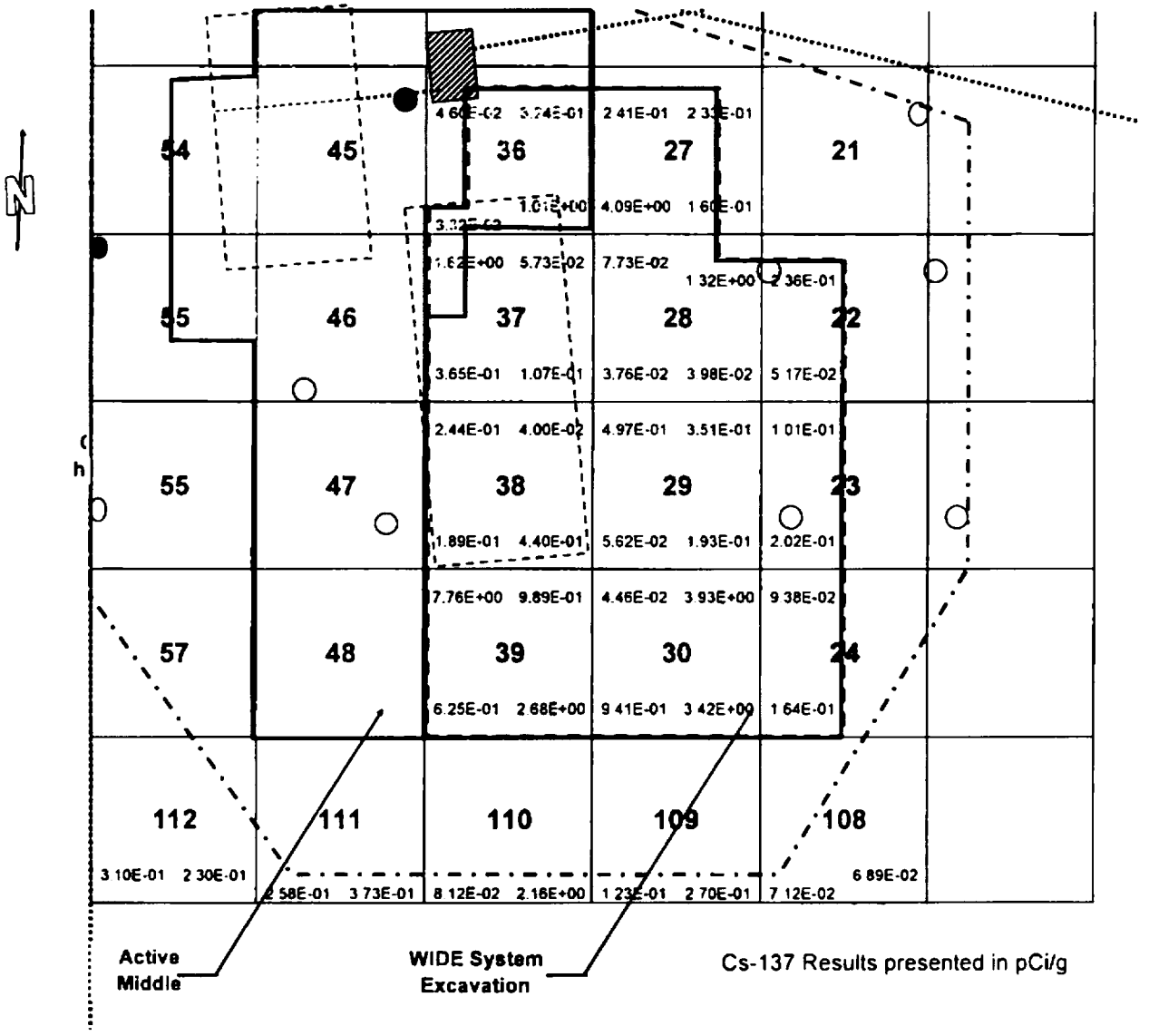


Table 9
WIDE System Excavation
Walkover Gamma Scan Survey

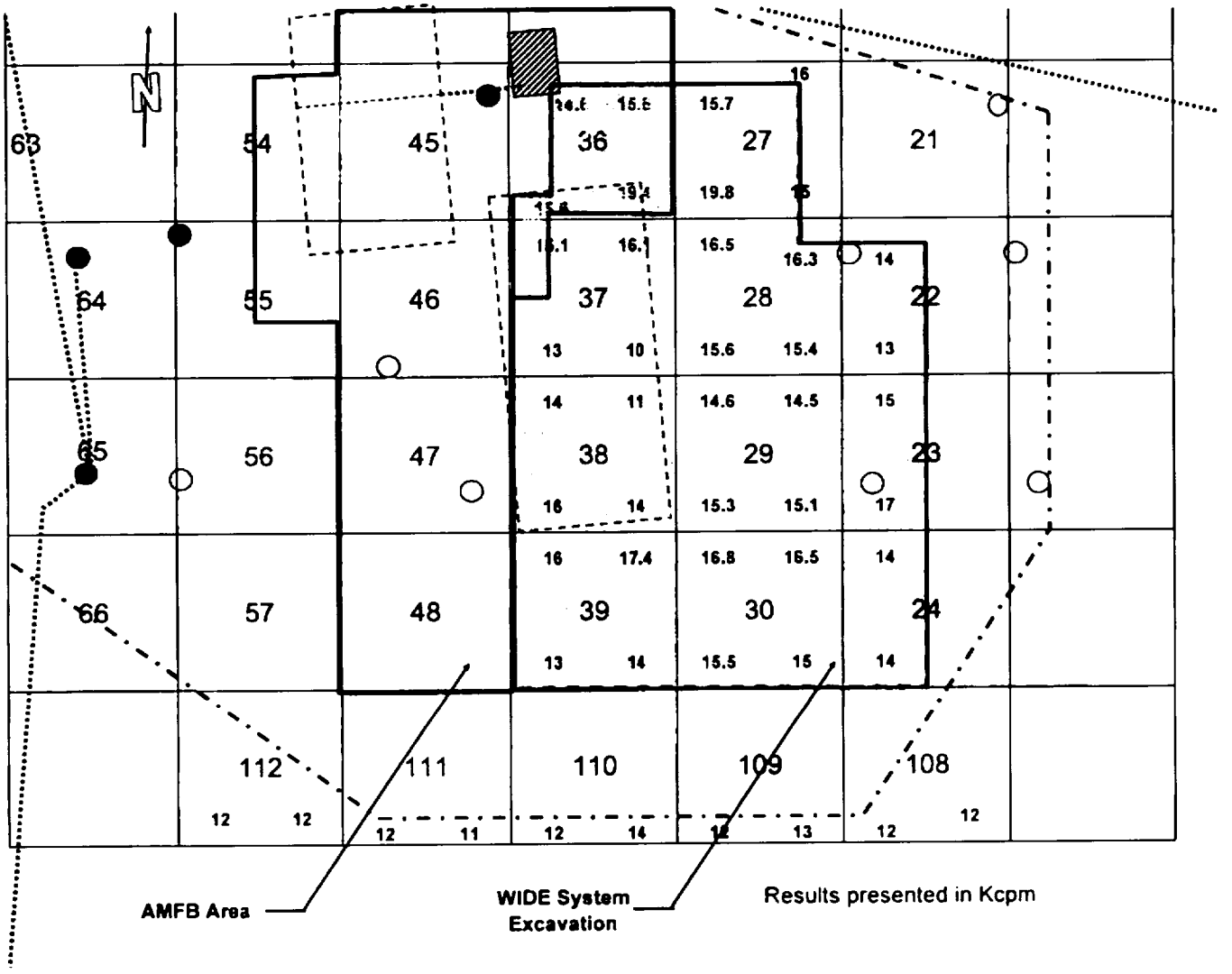


Table 10
Remaining Area of Affected Filter Bed Area - Final Status Survey Results

Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1933-2270	Grid 100 NE	6/8/2005	9720	22000	7	0.0434
RL05-2028-2355	Grid 100 NW	6/8/2005	9900	24000	7	0.0633
RL05-2004-2373	Grid 100 SE	6/8/2005	9470	22000	8	0.0381
RL05-2001-2370	Grid 100 SW	6/8/2005	10100	24000	8	0.0731
RL05-2002-2371	Grid 101 NE	6/8/2005	9700	22000	8	0.0523
RL05-2003-2372	Grid 101 NW	6/8/2005	10200	23000	7	0.0479
RL05-1998-2367	Grid 101 SE	6/8/2005	9610	24000	8	0.0613
RL05-1999-2368	Grid 101 SW	6/8/2005	10100	25000	8	0.0615
RL05-1987-2357	Grid 102 NE	6/14/2005	9730	13000	11	0.0735
RL05-2061-2391	Grid 102 NW	6/14/2005	10000	14000	12	0.175
RL05-1935-2272	Grid 102 SE	6/14/2005	10200	13000	12	0.149
RL05-1936-2273	Grid 102 SW	6/14/2005	9940	14000	12	1.5
RL05-1939-2276	Grid 103 NE	6/20/2005	10400	15000	12	0.244
RL05-1940-2277	Grid 103 NW	6/20/2005	10400	15000	12	0.241
RL05-1941-2278	Grid 103 SE	6/20/2005	10400	13000	13	0.279
RL05-1942-2278	Grid 103 SW	6/20/2005	10100	15000	12	0.063
RL05-1934-2271	Grid 105 NE	6/10/2005	9750	14000	11	0.208
RL05-1937-2274	Grid 105 NW	6/10/2005	9310	13000	10	0.156
RL05-2005-2374	Grid 105 SE	6/10/2005	9910	14000	12	0.0887
RL05-2006-2375	Grid 105 SW	6/10/2005	9800	14000	12	0.21
RL05-1894-2214	Grid 106 NE	6/10/2005	10100	14000	11	0.16
RL05-1993-2362	Grid 106 NW	6/10/2005	9350	12000	10	0.0135
RL05-1994-2363	Grid 106 SE	6/10/2005	9800	14000	12	0.152
RL05-1995-2364	Grid 106 SW	6/10/2005	10300	15000	11	0.534
RL05-1989-2359	Grid 107 NE	10/6/2004	11300	14900	12	0.137
RL05-2062-2392	Grid 107 NW	10/6/2004	11100	14500	12	0.28
RL05-2064-2394	Grid 107 SE	10/6/2004	11900	16300	12	0.301
RL05-1871-2249	Grid 107 SW	10/6/2004	11300	14300	12	0.216
RL05-1872-2250	Grid 108 NE	6/17/2005	11000	17000	6	0.065
RL05-1928-2265	Grid 108 NW	6/17/2005	11300	14000	13	0.0703
RL05-1931-2268	Grid 108 SE	6/17/2005	11200	12000	8	0.0689
RL05-1932-2269	Grid 108 SW	6/17/2005	10800	12000	8	0.0712
RL05-1614-1987	Grid 109 NE	6/17/2005	10800	11000	9	0.0736
RL05-1615-1988	Grid 109 NW	6/17/2005	11100	13000	11	0.118
RL05-1616-1989	Grid 109 SE	6/17/2005	11000	13000	9	0.27
RL05-1617-1990	Grid 109 SW	6/17/2005	11000	12000	9	0.123
RL05-1619-1992	Grid 110 NE	6/17/2005	11000	12000	10	0.263
RL05-1866-2244	Grid 110 NW	6/17/2005	10800	13000	8	0.0393
RL05-1943-2280	Grid 110 SE	6/17/2005	11400	14000	10	2.16
RL05-1944-2281	Grid 110 SW	6/17/2005	11000	12000	9	0.0812
RL05-1916-2253	Grid 111 NE	6/20/2005	10400	14000	10	0.472
RL05-1920-2257	Grid 111 NW	6/20/2005	10400	15000	10	0.0927
RL05-1921-2258	Grid 111 SE	6/20/2005	9440	11000	9	0.373
RL05-1795-2146	Grid 111 SW	6/20/2005	10600	12000	8	0.258
RL05-1879-2199	Grid 112 NE	6/20/2005	10100	11000	9	0.0674
RL05-1848-2222	Grid 112 NW	6/20/2005	10400	10000	10	0.0919
RL05-1603-1976	Grid 112 SE	6/20/2005	10800	12000	10	0.23
RL05-1792-2143	Grid 112 SW	6/20/2005	9690	12000	10	0.31
RL05-1815-2165	Grid 113 NE	10/6/2004	10300	14600	12	0.306

Table 10
Remaining Area of Affected Filter Bed Area - Final Status Survey Results

Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1876-2196	Grid 113 NW	10/6/2004	13600	14700	12	0.325
RL05-1860-2238	Grid 113 SE	10/6/2004	11000	14500	11	0.477
RL05-1812-2162	Grid 113 SW	10/6/2004	10100	14400	12	0.163
RL05-1853-2231	Grid 114 NE	6/21/2005	13100	14600	14	1.14
RL05-1855-2233	Grid 114 NW	6/10/2005	10600	14000	14	0.0795
RL05-1938-2275	Grid 114 SE	6/10/2005	11400	10000	10	4.51
RL05-2031-2332	Grid 114 SW	6/10/2005	10500	12000	11	0.0906
RL05-2027-2354	Grid 115 NE	10/6/2004	11300	14600	12	0.361
RL05-2029-2356	Grid 115 NW	10/6/2004	10200	15200	10	0.126
RL05-1807-2157	Grid 115 SE	10/6/2004	10400	14800	12	0.179
RL05-1897-2227	Grid 115 SW	10/6/2004	11500	15000	11	0.393
RL05-1898-2228	Grid 116 NE	11/23/2004	9770	14400	12	0.257
RL05-2007-2376	Grid 116 NW	11/23/2004	11400	15900	12	0.0701
RL05-2000-2369	Grid 116 SE	11/23/2004	9140	15200	12	0.125
RL05-2023-2350	Grid 116 SW	11/23/2004	8570	16200	12	0.0164
RL05-2025-2352	Grid 117 NE	10/6/2004	10500	14700	12	0.0326
RL05-1834-2184	Grid 117 NW	10/6/2004	10500	15900	11	0.952
RL05-1959-2303	Grid 117 SE	10/6/2004	10100	15500	13	0.584
RL05-1961-2305	Grid 117 SW	10/6/2004	10600	15800	12	0.0653
RL05-2010-2337	Grid 118 NE	10/6/2004	10100	14600	11	0.0452
RL05-1975-2319	Grid 118 NW	10/6/2004	10600	12900	11	0.0203
RL05-1673-2033	Grid 118 SE	10/6/2004	10400	14400	11	0.0328
RL05-1676-2036	Grid 118 SW	10/6/2004	10200	13000	10	0.0365
RL05-1695-2055	Grid 119 NE	10/6/2004	9640	15400	10	0.126
RL05-1698-2058	Grid 119 NW	10/6/2004	9560	14600	11	0.0321
RL05-1701-2061	Grid 119 SE	10/6/2004	10800	15100	11	0.0726
RL05-1703-2063	Grid 119 SW	10/6/2004	9660	13600	10	0.0415
RL05-1704-2064	Grid 120 NE	6/10/2005	10100	13000	10	0.102
RL05-1709-2065	Grid 120 NW	6/10/2005	10200	14000	12	0.0597
RL05-1718-2074	Grid 120 SE	6/10/2005	10500	16000	12	0.0585
RL05-1770-2125	Grid 120 SW	6/10/2005	10100	15000	12	0.0527
RL05-1766-2121	Grid 121 NE	6/10/2005	10200	14000	10	0.604
RL05-1988-2358	Grid 121 NW	6/10/2005	9970	15000	11	0.0988
RL05-1990-2360	Grid 121 SE	6/10/2005	10600	15000	12	0.0742
RL05-2059-2389	Grid 121 SW	6/10/2005	9860	15000	11	0.0124
RL05-2060-2390	Grid 122 NE	6/21/2005	9840	15000	12	0.236
RL05-2063-2393	Grid 122 NW	6/21/2005	9670	15000	12	0.245
RL05-2065-2395	Grid 122 SE	6/21/2005	9930	15000	12	0.173
RL05-2066-2396	Grid 122 SW	6/21/2005	9900	15000	11	0.19
RL05-1765-2120	Grid 123 NE	6/21/2005	9950	14000	11	0.156
RL05-1444-0475	Grid 123 NW	6/21/2005	9990	14000	10	0.199
RL05-1450-0481	Grid 123 SE	6/21/2005	10100	14000	11	0.162
RL05-1441-0472	Grid 123 SW	6/21/2005	10000	13000	12	0.202
RL05-1442-0473	Grid 130 NE	11/22/2004	10700	15100	11	0.126
RL05-1755-2110	Grid 130 NW	11/22/2004	10300	16200	11	0.0762
RL05-1759-2114	Grid 130 SE	11/22/2004	10300	14800	11	0.0379
RL05-2081-2403	Grid 131 NE	10/6/2004	10100	13100	12	0.0224
RL05-1775-2130	Grid 131 NW	10/6/2004	9780	14600	11	0.0225
RL05-1777-2132	Grid 131 SE	10/6/2004	10600	15100	12	0.136

Table 10
Remaining Area of Affected Filter Bed Area - Final Status Survey Results

Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1927-2264	Grid 132 NE	10/6/2004	10600	14800	12	0.837
RL05-1930-2267	Grid 132 NW	10/6/2004	10500	15500	11	0.409
RL05-1643-2005	Grid 132 SE	10/6/2004	10200	14900	12	0.282
RL05-1914-2251	Grid 133 NE	6/10/2005	9740	16000	10	0.0626
RL05-1915-2252	Grid 133 NW	6/10/2005	9910	18000	12	0.0997
RL05-1917-2254	Grid 133 SE	6/10/2005	9500	16000	10	0.0713
RL05-1918-2255	Grid 133 SW	6/10/2005	9910	15000	11	0.0526
RL05-1919-2256	Grid 134 NE	6/13/2005	10400	17000	12	0.0955
RL05-2020-2347	Grid 134 NW	6/13/2005	9810	17000	12	0.0485
RL05-2085-2407	Grid 134 SE	6/13/2005	9900	17000	13	0.0952
RL05-1796-2147	Grid 134 SW	6/13/2005	10100	17000	12	0.0533
RL05-1797-2148	Grid 19 NE	6/14/2005	11500	13000	12	0.174
RL05-1821-2171	Grid 19 NW	6/14/2005	11600	14000	12	0.0664
RL05-1845-2219	Grid 19 SE	6/14/2005	12000	14000	10	0.109
RL05-1846-2220	Grid 19 SW	6/14/2005	11800	13000	10	0.138
RL05-1847-2221	Grid 20 NE	6/15/2005	10400	13000	12	0.239
RL05-1607-1980	Grid 20 NW	6/15/2005	10200	14000	12	0.104
RL05-1851-2225	Grid 20 SE	6/15/2005	10400	12000	10	0.238
RL05-1843-2217	Grid 20 SW	6/15/2005	10200	12000	11	0.154
RL05-1844-2218	Grid 21 NE	6/15/2005	9860	13000	11	0.185
RL05-1791-2142	Grid 21 NW	6/15/2005	10100	15000	12	0.157
RL05-1817-2167	Grid 21 SE	6/15/2005	9970	13000	10	0.341
RL05-1857-2235	Grid 21 SW	6/15/2005	9890	14000	10	0.303
RL05-1858-2236	Grid 22 NE	6/15/2005	9470	12000	9	0.0347
RL05-1784-2135	Grid 22 SE	6/15/2005	9440	12000	9	0.422
RL05-2015-2342	Grid 23 NE	6/15/2005	9820	13000	9	0.503
RL05-1967-2311	Grid 23 SE	6/15/2005	10000	12000	9	0.104
RL05-1969-2313	Grid 24 NE	6/15/2005	9780	12000	9	0.0537
RL05-2008-2335	Grid 24 SE	6/15/2005	9330	12000	9	0.0726
RL05-1965-2309	Grid 25 NE	6/14/2005	11600	13000	10	0.0858
RL05-1976-2320	Grid 25 NW	6/14/2005	11600	14000	12	0.0395
RL05-1674-2034	Grid 25 SE	6/14/2005	11800	13000	12	0.0521
RL05-1675-2035	Grid 25 SW	6/14/2005	11500	14000	12	0.0486
RL05-1677-2037	Grid 26 NE	6/15/2005	9940	12000	10	0.191
RL05-1678-2038	Grid 26 NW	6/15/2005	9720	14000	10	0.0377
RL05-1679-2039	Grid 26 SE	6/15/2005	9310	14000	12	0.573
RL05-1681-2041	Grid 26 SW	6/15/2005	9510	14000	12	0.735
RL05-1719-2075	Grid 31 NE	6/13/2005	10600	15000	10	1.09
RL05-1720-2076	Grid 31 NW	6/13/2005	10300	14000	12	0.0191
RL05-1722-2078	Grid 31 SE	6/13/2005	10500	15000	11	0.137
RL05-1882-2202	Grid 31 SW	6/13/2005	10600	14000	11	0.732
RL05-1771-2126	Grid 32 NE	6/14/2005	9960	13000	12	0.278
RL05-1767-2122	Grid 32 NW	6/14/2005	10200	14000	12	0.0642
RL05-1768-2123	Grid 32 SE	6/14/2005	10000	14000	12	0.0248
RL05-1992-2361	Grid 32 SW	6/14/2005	9700	14000	11	0.0702
RL05-1455-0486	Grid 33 NE	6/14/2005	9990	14000	12	0.0563
RL05-1764-2119	Grid 33 NW	6/14/2005	10200	14000	12	0.229
RL05-1446-0477	Grid 33 SE	6/14/2005	9600	14000	12	0.0461
RL05-1460-0491	Grid 33 SW	6/14/2005	9940	14000	10	0.104

Table 10
Remaining Area of Affected Filter Bed Area - Final Status Survey Results

Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1448-0479	Grid 34 NE	6/14/2005	11700	14000	13	0.0353
RL05-1449-0480	Grid 34 NW	6/14/2005	11700	14000	14	0.0623
RL05-1451-0482	Grid 34 SE	6/14/2005	11600	14000	12	0.0601
RL05-1440-0471	Grid 34 SW	6/14/2005	11500	14000	13	0.047
RL05-1929-2266	Grid 40 NE	6/13/2005	11000	14000	11	0.0312
RL05-1618-1991	Grid 40 NW	6/13/2005	10300	16000	12	0.0645
RL05-1865-2243	Grid 40 SE	6/13/2005	10600	12000	12	0.268
RL05-1867-2245	Grid 40 SW	6/13/2005	10800	14000	10	0.0476
RL05-1868-2246	Grid 41 NE	6/13/2005	10800	14000	12	0.113
RL05-1945-2282	Grid 41 NW	6/13/2005	10400	14000	10	0.0584
RL05-1946-2283	Grid 41 SE	6/13/2005	10400	14000	12	0.129
RL05-1645-2007	Grid 41 SW	6/13/2005	10800	14000	11	0.161
RL05-1646-2008	Grid 42 NE	6/14/2005	9520	14000	12	0.264
RL05-1794-2145	Grid 42 NW	6/14/2005	9920	15000	12	0.19
RL05-1819-2169	Grid 42 SE	6/14/2005	10000	15000	10	0.0427
RL05-1820-2170	Grid 42 SW	6/14/2005	9750	14000	13	0.0899
RL05-1822-2172	Grid 43 NE	6/14/2005	11300	14000	11	0.0541
RL05-1877-2197	Grid 43 NW	6/14/2005	11700	15000	11	0.0718
RL05-1878-2198	Grid 43 SE	6/14/2005	11700	14000	10	0.127
RL05-1880-2200	Grid 43 SW	6/14/2005	11600	14000	12	0.138
RL05-1640-2002	Grid 49 NE	6/13/2005	10500	14000	12	0.0504
RL05-1642--2004	Grid 49 NW	6/13/2005	10400	14000	12	0.0348
RL05-1790-2141	Grid 49 SE	6/13/2005	10900	17000	11	0.0622
RL05-1793-2144	Grid 49 SW	6/13/2005	10200	15000	12	0.0345
RL05-1816-2166	Grid 50 NE	6/13/2005	10400	14000	10	0.0932
RL05-1818-2168	Grid 50 NW	6/13/2005	10800	14000	12	0.0475
RL05-1873-2193	Grid 50 SE	6/13/2005	10500	14000	12	0.129
RL05-1874-2194	Grid 50 SW	6/13/2005	10500	15000	12	0.229
RL05-1859-2237	Grid 51 NE	6/14/2005	9880	15000	7	0.343
RL05-1786-2137	Grid 51 NW	6/14/2005	9880	14000	8	0.296
RL05-1787-2138	Grid 51 SE	6/14/2005	9840	15000	7	0.046
RL05-1788-2139	Grid 51 SW	6/14/2005	9760	14000	7	0.0505
RL05-1811-2161	Grid 52 NE	6/14/2005	11800	14000	12	0.0516
RL05-1813-2163	Grid 52 NW	6/14/2005	11700	14000	10	0.126
RL05-1814-2164	Grid 52 SE	6/14/2005	11600	15000	12	0.233
RL05-1854-2232	Grid 52 SW	6/14/2005	11600	15000	10	0.038
RL05-1856-2234	Grid 53 NW	6/15/2005	8540	12000	8	0.0903
RL05-2030-2331	Grid 53 SW	6/15/2005	9120	12000	9	0.0365
RL05-2032-2333	Grid 54 NW	6/15/2005	8770	12000	9	0.45
RL05-2033-2334	Grid 54 SW	6/15/2005	9770	11000	10	0.0591
RL05-2016-2343	Grid 55 NE	6/16/2005	9210	14000	10	0.349
RL05-2017-2344	Grid 55 NW	6/16/2005	9810	16000	12	0.0616
RL05-2018-2345	Grid 55 SE	6/16/2005	9980	15000	12	0.183
RL05-2019-2346	Grid 55 SW	6/16/2005	10300	15000	12	0.0924
RL05-2026-2353	Grid 56 NE	6/17/2005	9500	15000	12	0.274
RL05-1783-2134	Grid 56 NW	6/17/2005	10200	15000	12	0.128
RL05-1785-2136	Grid 56 SE	6/17/2005	9410	15000	12	0.22
RL05-1808-2158	Grid 56 SW	6/17/2005	10300	15000	12	0.127
RL05-1809-2159	Grid 57 NE	6/17/2005	9620	13000	10	0.0981

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Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1810-2160	Grid 57 NW	6/17/2005	9480	14000	12	0.086
RL05-1836-2186	Grid 57 SE	6/17/2005	9870	14000	10	0.0502
RL05-1838-2188	Grid 57 SW	6/17/2005	9610	14000	8	0.186
RL05-1899-2229	Grid 58 NE	6/13/2005	10900	15000	12	0.1
RL05-1900-2230	Grid 58 NW	6/13/2005	10900	17000	13	0.131
RL05-1983-2327	Grid 58 SE	6/13/2005	10400	15000	12	0.399
RL05-1984-2328	Grid 58 SW	6/13/2005	10800	15000	11	0.529
RL05-1985-2329	Grid 59 NE	6/13/2005	10100	14000	12	0.0736
RL05-2012-2339	Grid 59 NW	6/13/2005	10200	15000	10	0.0377
RL05-2013-2340	Grid 59 SE	6/13/2005	9870	14000	12	0.0689
RL05-2014-2341	Grid 59 SW	6/13/2005	10100	16000	12	0.0865
RL05-2022-2349	Grid 60 NE	6/14/2005	10200	15000	12	0.131
RL05-2024-2351	Grid 60 NW	6/14/2005	9660	15000	13	0.423
RL05-1802-2153	Grid 60 SE	6/14/2005	10000	14000	12	0.101
RL05-1805-2156	Grid 60 SW	6/14/2005	10100	14000	13	0.0793
RL05-1831-2181	Grid 61 NE	6/14/2005	10000	15000	10	0.0857
RL05-1833-2183	Grid 61 NW	6/14/2005	10100	15000	10	0.219
RL05-1895-2215	Grid 61 SE	6/14/2005	9720	15000	12	0.0537
RL05-1896-2216	Grid 61 SW	6/14/2005	10100	15000	12	0.0524
RL05-1958-2302	Grid 62 NE	6/17/2005	10600	14000	9	0.0922
RL05-1960-2304	Grid 62 NW	6/17/2005	11000	11000	8	0.109
RL05-1979-2323	Grid 62 SE	6/17/2005	10500	11000	10	0.0329
RL05-1981-2325	Grid 62 SW	6/17/2005	11400	12000	9	0.134
RL05-1982-2326	Grid 63 NE	6/17/2005	11000	14000	8	0.116
RL05-2011-2338	Grid 63 NW	6/17/2005	11200	14000	10	0.219
RL05-1823-2173	Grid 63 SE	6/17/2005	11000	11000	8	0.0642
RL05-1824-2174	Grid 63 SW	6/17/2005	10700	11000	8	0.107
RL05-1826-2176	Grid 64 NE	6/16/2005	9580	14000	12	0.161
RL05-1889-2209	Grid 64 NW	6/16/2005	9210	16000	12	0.116
RL05-1955-2299	Grid 64 SE	6/16/2005	9270	16000	11	0.171
RL05-1956-2300	Grid 64 SW	6/16/2005	9380	15000	12	0.133
RL05-1957-2301	Grid 65 NE	6/17/2005	10200	15000	12	0.0781
RL05-1962-2306	Grid 65 NW	6/17/2005	10700	16000	12	0.0867
RL05-1963-2307	Grid 65 SE	6/17/2005	10100	15000	11	0.0871
RL05-1977-2321	Grid 65 SW	6/17/2005	10700	14000	12	0.0696
RL05-1978-2322	Grid 66 NE	6/17/2005	9560	14000	10	0.0579
RL05-1827-2177	Grid 66 NW	6/17/2005	9850	14000	12	0.141
RL05-1829-2179	Grid 66 SE	6/17/2005	9800	16000	10	0.0915
RL05-1680-2040	Grid 66 SW	6/17/2005	9870	14000	12	0.115
RL05-1684-2044	Grid 67 NE	6/13/2005	10200	16000	12	0.274
RL05-1687-2047	Grid 67 NW	6/13/2005	10000	16000	13	0.0677
RL05-1689-2049	Grid 67 SE	6/13/2005	9760	16000	7	0.403
RL05-1691-2051	Grid 67 SW	6/13/2005	9950	16000	12	0.188
RL05-1711-2067	Grid 68 NE	6/14/2005	9880	15000	12	0.172
RL05-1714-2070	Grid 68 NW	6/14/2005	9770	14000	7	0.124
RL05-1724-2080	Grid 68 SE	6/14/2005	10300	14000	12	0.318
RL05-1734-2090	Grid 68 SW	6/14/2005	10100	15000	10	0.192
RL05-1735-2091	Grid 69 NE	6/14/2005	9680	15000	9	0.265
RL05-1736-2092	Grid 69 NW	6/14/2005	10000	16000	13	0.133

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Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1881-2201	Grid 69 SE	6/14/2005	9760	15000	12	0.125
RL05-1883-2203	Grid 69 SW	6/14/2005	10000	15000	12	0.0959
RL05-1884-2204	Grid 70 NE	6/15/2005	10100	15000	10	0.18
RL05-2055-2385	Grid 70 NW	6/15/2005	10100	17000	12	0.182
RL05-2056-2386	Grid 70 SE	6/15/2005	9980	15000	10	0.256
RL05-2057-2387	Grid 70 SW	6/15/2005	9860	16000	12	0.297
RL05-1772-2127	Grid 71 NE	6/15/2005	10100	16000	11	0.208
RL05-1773-2128	Grid 71 NW	6/15/2005	10300	17000	11	0.197
RL05-1769-2124	Grid 71 SE	6/15/2005	10200	16000	11	0.291
RL05-1456-0487	Grid 71 SW	6/15/2005	10300	17000	11	0.282
RL05-1457-0488	Grid 72 NE	6/16/2005	9650	14000	11	0.174
RL05-1458-0489	Grid 72 NW	6/16/2005	9560	17000	12	0.258
RL05-1459-0490	Grid 72 SE	6/16/2005	9630	15000	12	0.178
RL05-1452-0483	Grid 72 SW	6/16/2005	9260	15000	12	0.0218
RL05-1453-0484	Grid 73 NE	6/17/2005	10000	15000	11	0.093
RL05-1454-0485	Grid 73 NW	6/17/2005	10500	15000	11	0.0539
RL05-1445-0476	Grid 73 SE	6/17/2005	10500	15000	12	0.119
RL05-1447-0478	Grid 73 SW	6/17/2005	10300	18000	10	0.0608
RL05-1659-0636	Grid 74 NE	6/14/2005	9730	16000	12	0.1
RL05-1660-0637	Grid 74 NW	6/14/2005	10400	17000	12	0.0432
RL05-1661-0638	Grid 74 SE	6/14/2005	9800	15000	12	0.0865
RL05-1662-0639	Grid 74 SW	6/14/2005	9410	17000	14	0.184
RL05-1461-0492	Grid 75 NE	6/14/2005	10000	15000	13	0.106
RL05-1462-0493	Grid 75 NW	6/14/2005	9760	15000	12	0.127
RL05-1754-2109	Grid 75 SE	6/14/2005	9760	18000	13	0.226
RL05-1756-2111	Grid 75 SW	6/14/2005	9680	17000	13	0.143
RL05-1757-2112	Grid 76 NE	6/15/2005	9900	16000	7	0.637
RL05-1761-2116	Grid 76 NW	6/15/2005	9980	17000	12	0.116
RL05-2077-2399	Grid 76 SE	6/15/2005	9540	16000	12	0.495
RL05-2078-2400	Grid 76 SW	6/15/2005	9550	16000	12	0.0846
RL05-2080-2402	Grid 77 NE	6/15/2005	9410	16000	12	0.231
RL05-2083-2405	Grid 77 NW	6/15/2005	9440	18000	12	0.0296
RL05-1465-0496	Grid 77 SE	6/15/2005	9130	16000	6	0.0892
RL05-1466-0497	Grid 77 SW	6/15/2005	9610	17000	11	0.144
RL05-1468-0499	Grid 78 NE	6/16/2005	9190	17000	10	0.353
RL05-1469-0500	Grid 78 NW	6/16/2005	9220	17000	11	0.0291
RL05-1774-2129	Grid 78 SE	6/16/2005	9070	16000	12	0.0294
RL05-1798-2149	Grid 78 SW	6/16/2005	8360	14000	12	0.126
RL05-1799-2150	Grid 79 NE	6/14/2005	9600	16000	12	0.0195
RL05-1800-2151	Grid 79 NW	6/14/2005	9620	17000	13	0.0775
RL05-1644-2006	Grid 79 SE	6/14/2005	9890	15000	12	0.273
RL05-1922-2259	Grid 79 SW	6/14/2005	9280	15000	7	0.323
RL05-1604-1977	Grid 80 NE	6/14/2005	9790	18000	8	0.0934
RL05-1875-2195	Grid 80 NW	6/17/2005	10300	16000	7	0.0387
RL05-1782-2133	Grid 80 SE	6/14/2005	10100	17000	7	0.0507
RL05-1835-2185	Grid 80 SW	6/14/2005	10500	17000	7	0.407
RL05-1837-2187	Grid 81 NE	6/15/2005	9420	18000	13	0.183
RL05-1803-2154	Grid 81 NW	6/15/2005	9540	17000	8	0.185
RL05-1893-2213	Grid 81 SE	6/15/2005	9920	14000	13	0.341

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Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1890-2210	Grid 81 SW	6/15/2005	9290	17000	13	0.284
RL05-1891-2211	Grid 82 NE	6/8/2005	9560	16000	11	0.123
RL05-1892-2212	Grid 82 NW	6/8/2005	9550	16000	10	0.0549
RL05-1828-2178	Grid 82 SE	6/8/2005	9690	16000	10	0.0816
RL05-2042-2381	Grid 82 SW	6/8/2005	9570	17000	11	0.0817
RL05-1888-2208	Grid 83 NE	6/8/2005	9690	17000	11	0.0531
RL05-1950-2294	Grid 83 NW	6/8/2005	9540	17000	11	0.0683
RL05-1712-2068	Grid 83 SE	6/8/2005	9950	17000	12	0.0831
RL05-1713-2069	Grid 83 SW	6/8/2005	9550	17000	11	0.0361
RL05-1715-2071	Grid 84 NE	6/8/2005	9760	17000	11	0.0664
RL05-1716-2072	Grid 84 NW	6/8/2005	9550	17000	11	0.0281
RL05-1721-2077	Grid 84 SE	6/8/2005	9780	17000	12	0.0589
RL05-1723-2079	Grid 84 SW	6/8/2005	9940	17000	11	0.0707
RL05-1725-2081	Grid 85 NE	6/8/2005	9850	18000	11	0.0918
RL05-1726-2082	Grid 85 NW	6/8/2005	9700	20000	11	0.0507
RL05-1729-2085	Grid 85 SE	6/8/2005	10100	18000	11	0.111
RL05-1732-2088	Grid 85 SW	6/8/2005	9620	18000	12	0.0494
RL05-1733-2089	Grid 86 NE	6/8/2005	9710	19000	11	0.105
RL05-2058-2388	Grid 86 NW	6/8/2005	10000	18000	12	0.0301
RL05-1997-2366	Grid 86 SE	6/8/2005	9940	18000	11	0.0533
RL05-1463-0494	Grid 86 SW	6/8/2005	10100	18000	12	0.064
RL05-18012152	Grid 87 NE	6/8/2005	9270	16000	11	0.0403
RL05-1861-2239	Grid 87 NW	6/8/2005	9620	17000	11	0.0446
RL05-1862-2240	Grid 87 SE	6/8/2005	9840	17000	11	0.0824
RL05-1863-2241	Grid 87 SW	6/8/2005	8900	17000	10	0.0297
RL05-1864-2242	Grid 88 NE	6/8/2005	9450	18000	10	0.0404
RL05-1613-1986	Grid 88 NW	6/8/2005	8980	17000	11	0.0264
RL05-1804-2155	Grid 88 SE	6/8/2005	9120	17000	11	0.0161
RL05-1832-2182	Grid 88 SW	6/8/2005	9200	17000	11	0.0148
RL05-1825-2175	Grid 89 NE	6/8/2005	9400	17000	11	0.0182
RL05-1954-2298	Grid 89 NW	6/8/2005	9270	17000	10	0.0189
RL05-1964-2308	Grid 89 SE	6/8/2005	9740	17000	10	0.0647
RL05-1830-2180	Grid 89 SW	6/8/2005	10000	17000	10	0.0114
RL05-1886-2206	Grid 90 NE	6/8/2005	10000	17000	11	0.273
RL05-1951-2295	Grid 90 NW	6/8/2005	9260	17000	10	0.0219
RL05-1953-2297	Grid 90 SE	6/8/2005	9890	18000	13	0.0889
RL05-1727-2083	Grid 90 SW	6/8/2005	10000	18000	12	0.0414
RL05-1728-2084	Grid 91 NE	6/8/2005	10200	19000	12	0.0285
RL05-1730-2086	Grid 91 NW	6/8/2005	9910	21000	13	0.043
RL05-1738-2094	Grid 91 SE	6/8/2005	10100	19000	13	0.0455
RL05-1739-2095	Grid 91 SW	6/8/2005	9950	20000	13	0.0482
RL05-1740-2096	Grid 92 NE	6/8/2005	9170	16000	10	0.0483
RL05-1742-2098	Grid 92 NW	6/8/2005	9060	16000	11	0.029
RL05-1744-2100	Grid 92 SE	6/8/2005	9090	17000	11	0.0253
RL05-1746-2102	Grid 92 SW	6/8/2005	9560	16000	11	0.0222
RL05-1762-2117	Grid 93 NE	6/8/2005	9300	17000	11	0.0302
RL05-2086-2408	Grid 93 NW	6/8/2005	10100	20000	13	0.0494
RL05-1839-2189	Grid 93 SE	6/8/2005	9080	18000	12	0.037
RL05-1840-2190	Grid 93 SW	6/8/2005	9100	19000	13	0.0228

Table 10
Remaining Area of Affected Filter Bed Area - Final Status Survey Results

Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1841-2191	Grid 94 NW	6/8/2005	10100	19000	13	0.054
RL05-1887-2207	Grid 94 SW	6/8/2005	10200	20000	13	0.0268
RL05-1731-2087	Grid 95 NW	6/8/2005	10100	18000	6	0.0378
RL05-1737-2093	Grid 95 SW	6/8/2005	10300	21000	7	0.0406
RL05-1741-2097	Grid 96 NE	6/8/2005	10100	20000	13	0.0242
RL05-1748-2104	Grid 96 NW	6/8/2005	10100	21000	7	0.0619
RL05-1750-2106	Grid 96 SE	6/8/2005	9940	21000	7	0.0424
RL05-1752-2108	Grid 96 SW	6/8/2005	9830	22000	13	0.0583
RL05-1996-2365	Grid 97 NE	6/8/2005	9350	17000	13	0.0311
RL05-1842-2192	Grid 97 NW	6/8/2005	9760	22000	12	0.0495
RL05-1743-2099	Grid 97 SE	6/8/2005	9540	18000	12	0.0795
RL05-1745-2101	Grid 97 SW	6/8/2005	9440	22000	12	0.0819
RL05-1747-2103	Grid 98 NE	6/8/2005	10100	20000	6	0.0371
RL05-1952-2296	Grid 98 NW	6/8/2005	9900	22000	6	0.0469
RL05-1749-2105	Grid 98 SE	6/8/2005	10100	20000	6	0.0385
RL05-1751-2107	Grid 98 SW	6/8/2005	9620	23000	7	0.0676
RL05-1606-1979	Grid 99 NE	6/8/2005	10000	20000	6	0.0409
RL05-1612-1985	Grid 99 NW	6/8/2005	10000	24000	7	0.0598
RL05-1924-2261	Grid 99 SE	6/8/2005	10000	20000	6	0.0443
RL05-1605-1978	Grid 99 SW	6/8/2005	10500	24000	7	0.0611

Table 11
WIDE System Excavation - Final Status Survey Results

Sample ID	Location	Collection Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity (pCi/g)
RL05-1857-2235	Grid 21 SW	6/15/2005	9890	14000	10	0.303
RL05-1789-2140	Grid 22 NW	6/3/2005	10200	14000	10	0.236
RL05-1986-2330	Grid 22 SW	6/3/2005	10000	13000	10	0.0517
RL05-1966-2310	Grid 23 NW	6/3/2005	10300	15000	10	0.101
RL05-1968-2312	Grid 23 SW	6/3/2005	9900	17000	10	0.202
RL05-1980-2324	Grid 24 NW	6/3/2005	10200	14000	12	0.0938
RL05-2009-2336	Grid 24 SW	6/3/2005	9490	14000	10	0.164
RL05-1682-2042	Grid 27 NE	6/6/2005	10700	16000	13	0.233
RL05-1683-2043	Grid 27 NW	6/6/2005	10900	15700	11	0.241
RL05-1685-2045	Grid 27 SE	6/6/2005	10700	15000	12	0.16
RL05-1686-2046	Grid 27 SW	6/6/2005	12000	19800	12	4.09
RL05-1688-2048	Grid 28 NE	6/15/2005	10700	16300	11	1.32
RL05-1690-2050	Grid 28 NW	6/15/2005	10500	16500	11	0.0773
RL05-1692-2052	Grid 28 SE	6/15/2005	9820	15400	11	0.0398
RL05-1693-2053	Grid 28 SW	6/15/2005	10100	15600	10	0.0376
RL05-1694-2054	Grid 29 NE	6/15/2005	10100	14500	11	0.351
RL05-1696-2056	Grid 29 NW	6/15/2005	10600	14600	11	0.497
RL05-1697-2057	Grid 29 SE	6/15/2005	10900	15100	10	0.193
RL05-1699-2059	Grid 29 SW	6/15/2005	10500	15300	10	0.0562
RL05-1924-2261	Grid 30 NE	6/15/2005	12500	16500	11	3.93
RL05-1702-2062	Grid 30 NW	6/15/2005	10800	16800	13	0.0446
RL05-1710-2066	Grid 30 SE	6/21/2005	10500	15000	11	3.42
RL05-1717-2073	Grid 30 SW	6/17/2005	10800	15500	11	0.941
RL05-1443-0474	Grid 36 NE	6/6/2005	10300	15600	12	0.324
RL05-1758-2113	Grid 36 NW	6/14/2005	10100	14600	11	0.046
RL05-1760-2115	Grid 36 SE	6/6/2005	10400	19400	12	1.01
RL05-2079-2401	Grid 36 SW	6/14/2005	10200	15600	11	0.0332
RL05-2082-2404	Grid 37 NE	6/14/2005	10400	16100	10	0.0573
RL05-2084-2406	Grid 37 NW	6/14/2005	10300	15100	11	1.62
RL05-1655-0633	Grid 37 SE	6/3/2005	9870	10000	13	0.107
RL05-1656-0634	Grid 37 SW	6/3/2005	9600	13000	10	0.365
RL05-1657-0635	Grid 38 NE	6/3/2005	9830	11000	11	0.04
RL05-1606-1979	Grid 38 NW	6/3/2005	9760	14000	12	0.244
RL05-1605-1978	Grid 38 SE	6/3/2005	9820	14000	13	0.44
RL05-1776-2131	Grid 38 SW	6/14/2005	9280	16000	11	0.189
RL05-1869-2247	Grid 39 NE	6/14/2005	9590	17400	11	0.989
RL05-1870-2248	Grid 39 NW	6/14/2005	11800	16000	11	7.76
RL05-1925-2262	Grid 39 SE	6/3/2005	9730	14000	14	2.68
RL05-1612-1985	Grid 39 SW	6/3/2005	9300	13000	14	0.625

Table 12

Gamma Spectroscopy Nominal MDA Value for Gamma-Emitting Radionuclides of Concern

Cs-137 MDA (pCi/g)	Co-60 MDA (pCi/g)	Eu-152 MDA (pCi/g)	Eu-154 MDA (pCi/g)	Am-241 MDA (pCi/g)
0.024 +/- 0.013	0.022 +/- 0.012	0.067 +/- 0.030	0.055 +/- 0.039	0.451 +/- 0.30

Table 13
Evaluation of FSS Soil Sample Distribution

Location	Number of Samples	Average (pCi/g)	Standard Deviation (pCi/g)	Range (pCi/g)	Modified Screening Criteria (pCi/g)
FB / WIDE Grounds	401	2.78E-01	0.655	1.64E-02 to 7.76E+00	11

Table 14
Fraction of Limit Evaluation of RL05-1870-2248

Fraction Of Limit Evaluation

	RL05-1870-2248
Analytical Parameter	Result[a] (pCi/g)
Co-60[a]	5.240E-02
Sr-90[b]	1.687E-01
Cs-137	[illegible]
Eu-152[a]	1.586E-01
Eu-154[a]	1.110E-01
Pu-238[b]	9.700E-03
Pu-239[b]	3.104E-01
Am-241[a]	5.173E-01
Pu-241[c]	2.771E+00
Fraction of Limit	**6.990E-01**

[a] - Activity Concentration based on MDA value in absence of a positive result
[b] - Estimated, based on activity concentration of ratios of specific isotopes to Cs-137 presented in Table 3.
[c] - Pu-241 is calculated using the values obtained form the ORIGEN2.1-derived data values

Attachment A
Post Final Status Survey Supplemental Evaluation

Attachment A
Post Final Status Survey Supplemental Evaluation

1. Introduction

On June 29, 2005. the Closure Services (CS) Characterization Crew performed a final verification scan survey of the Affected Filter Bed Area and the WIDE System excavation. The CS Characterization Crew detected two (2) small areas of elevated residual radioactive contamination that exceeded the DLV limit for the excavation. The DLV limit for the scanning survey was 18,374 counts per minute (cpm). CS Characterization Crews then directed the remediation of the two locations and then performed post-remediation scan surveys and soil sampling. Post-remediation scans indicated successful removal of the two (2) locations.

On June 29, 2005. the Independent Verification Contractor (IVC) performed verification surveys of the Affected Filter Bed Area and the WIDE System excavation. The IVC collected ten (10) soil samples from the excavation. Field screens were performed for each of the ten (10) soil samples. Elevated concentrations of residual radioactivity were detected in two (2) of the ten (10) screened samples. The IVC transferred the two (2) samples to the CS Characterization Crew for analysis by the Onsite Radioanalytical Laboratory (RAL). The RAL then returned the samples to the IVC. The IVC then sent all ten (10) samples collected from the excavation to the Environmental Site Survey and Assessment Program (ESSAP) for analysis.

The two (2) elevated samples collected by the IVC originated from southwest quadrant of Grid 27 and the northwest quadrant of Grid 30. The IVC directed the CS Characterization Crew to the locations that the two (2) samples were obtained. The CS Characterization Crew then directed the excavation and removal of material from the locations and then performed post-remediation surveys.

On July 25. 2005, the IVC provided the DOE and Closure Services preliminary analytical results of the eight (8) samples that did not exhibit elevated residual radioactivity above 11 pCi/g, following the field screen. Analytical results of three (3) of the eight (8) samples exhibited elevated Cs-137 activity concentrations slightly above 11 pCi/g.

Closure Services performed an elevated area activity evaluation of the preliminary analytical results reported by the IVC. The evaluation indicated that the sample results were within the acceptable guidance of NUREG/CR-5849 and available for unrestricted release.

2. Pre-IVC Remediation Activities

Table A lists the results of the final verification survey performed by the CS Characterization Crew within Grid 39. Soil samples and exposure rate readings were not obtained prior to remediation as the two locations were immediately excavated and removed.

Table A, Pre-Remediation Survey		
Grid Location	Sample Date	Walkover Scan (cpm)
39 NE	6/28/2005	26.000
39 NE	6/28/2005	36.000

Table B lists the results of the post-remediation surveys within Grid 39 that were performed by the CS Characterization Crew. Post-remediation surveys included walkover scans, exposure rate surveys, and collection of soil samples. Results of the post-remediation survey demonstrated that the excavation and removal met the unrestricted release criteria.

Table B, Post-Remediation Survey						
CS Sample ID	Grid Location	Sample Date	Field Screen (cpm)	Walkover Scan (cpm)	Exposure Rate (μR/hr)	Cs-137 Activity Conc. (pCi/g)
RL05-2127-2431	39 NE	6/29/2005	11,500	16500	13	9.08E-02
RL05-2128-2432	39 NE	6/29/2005	11,800	17500	13	2.90E-01

3. IVC Remediation Activities

Table C details pertinent information concerning the two (2) IVC samples that field screening indicated elevated residual radioactivity. Analytical results reported by the RAL and the ESSAP are included in the table.

Closure Services remediated the two (2) locations identified by the IVC. **Table D** presents the post-remediation surveys performed following the excavation and removal of the two (2) locations on June 29, 2005. Results of the post-remediation survey demonstrated that the excavation and removal met the unrestricted release criteria.

4. Analysis of ESSAP Analytical Results

July 25, 2005, the IVC provided the DOE and Closure Services preliminary analytical results of the eight (8) samples that did not exhibit elevated residual radioactivity above 11 pCi/g, following the field screen. Analytical results of three (3) of the eight (8) samples exhibited elevated Cs-137 activity concentrations slightly above 11 pCi/g. **Table E** presents the preliminary analytical results provided by the ESSAP Laboratory.

Table F summarizes the initial evaluation of the impact of each of the samples. As noted in **Table F**, three (3) of the eight (8) samples were determined to require further evaluation as to compliance to the unrestricted release criteria.

Table C, Analytical Parameters of Elevated Field Screen Samples								
ESSAP Analytical Parameters								
ESSAP Sample ID	**Sample Location**	**Grid Location**	**Sample Date**	**Am-241 Activity Conc. (pCi/g)**	**Co-60 Activity Con. (pCi/g)**	**Cs-137 Activity Conc. (pCi/g)**	**Eu-152 Activity Conc. (pCi/g)**	**Eu-154 Activity Conc. (pCi/g)**
0442S0001	Latitude (N39^0) 58.0349 Longitude (W83^0) 14.8148	27 SW	6/28/05	0.57	0.03	10.59	-0.03	0.01
0442S0002	Latitude (N39^0) 58.0240 Longitude (W83^0) 14.8100	30 NW	6/28/05	0.30	0.01	8.63	0.01	0.01
RAL Analytical Parameters								
CS Sample ID	**Sample Location**	**Grid Location**	**Sample Date**	**Am-241 Activity Conc. (pCi/g)**	**Co-60 Activity Con. (pCi/g)**	**Cs-137 Activity Conc. (pCi/g)**	**Eu-152 Activity Conc. (pCi/g)**	**Eu-154 Activity Conc. (pCi/g)**
	Latitude (N39^0) 58.0349 Longitude (W83^0) 14.8148	27 SW	6/28/05	0.844	0.032(ND)	14.4	0.098(ND)	0.069(ND)
	Latitude (N39^0) 58.0240 Longitude (W83^0) 14.8100	30 NW	6/28/05	0.309	0.016(ND)	11.3	0.064(ND)	0.043(ND)

Table D, Post-Remediation Survey of IVC Locations						
CS Sample ID	**Grid Location**	**Sample Date**	**Field Screen (cpm)**	**Walkover Scan (cpm)**	**Exposure Rate (μR/hr)**	**Cs-137 Activity Conc. (pCi/g)**
RL05-2310-2625	Grid 27 SW	7/8/2005	7820	15200	15	1.72E+00
RL05-2311-2626	Grid 30 NW	7/8/2005	8420	17100	15	4.69E-02 (ND)

Table E, Remaining ESSAP Samples Analytical Parameters								
ESSAP Sample ID	**Sample Location**	**Grid Location**	**Sample Date**	**Am-241 Activity Conc. (pCi/g)**	**Co-60 Activity Con. (pCi/g)**	**Cs-137 Activity Conc. (pCi/g)**	**Eu-152 Activity Conc. (pCi/g)**	**Eu-154 Activity Conc. (pCi/g)**
0442S0003	Latitude (N39^0) 58.0303 Longitude (W83^0) 14.8082	26 SW	6/28/2005	0.10	0.02	1.26	0.00	-0.18
0442S0004	Latitude (N39^0) 58.0231 Longitude (W83^0) 14.8165	38 SE	6/28/2005	0.03	0.00	0.12	0.00	-0.02
0442S0005	Latitude (N39^0) 58.0225 Longitude (W83^0) 14.8146	39 NE	6/28/2005	0.32	-0.01	25.59	0.04	0.01
0442S0006	Latitude (N39^0) 58.0210 Longitude (W83^0) 14.8085	30 SE	6/28/2005	2.15	0.01	11.15	-0.02	-0.13
0442S0007	Latitude (N39^0) 58.0453 Longitude (W83^0) 14.8074	26 SW	6/28/2005	0.83	0.01	10.07	0.63	-0.02
0442S0008	Latitude (N39^0) 58.0687 Longitude (W83^0) 14.8764	58 NW	6/28/2005	0.02	0.02	0.06	-0.01	-0.02
0442S0009	Latitude (N39^0) 58.075 Longitude (W83^0) 14.8764	119 NE	6/28/2005	0.04	0.04	0.04	0.00	-0.08
0442S00010	Latitude (N39^0) 58.0411 Longitude (W83^0) 14.8402	W of 77	6/28/2005	0.02	0.02	0.35	0.00	0.01

Table F, Disposition of ESSAP Preliminary Analytical Results				
ESSAP Sample ID	**Sample Location**	**Grid Location**	**Sample Date**	**Evaluation**
0442S0003	Latitude (N39^0): 58.0303 Longitude (W83^0): 14.8082	26 SW	6/28/2005	Sample results are below Table 1 values and modified screening criteria of 11 pCi/g for Cs-137
0442S0004	Latitude (N39^0): 58.0231 Longitude (W83^0): 14.8165	38 SE	6/28/2005	Sample results are below Table 1 values and modified screening criteria of 11 pCi/g for Cs-137
0442S0005	Latitude (N39^0); 58.0225 Longitude (W83^0); 14.8146	39 NE	6/28/2005	Value exceeds the modified screening criteria of 11 pCi/g for Cs-137. Sample evaluated for greater than 3 times the modified screening criteria as provided in NUREG/CR-5849, Section 8.5. Elevated area within acceptable limits.
0442S0006	Latitude (N39^0): 58.0210 Longitude (W83^0): 14.8085	30 SE	6/28/2005	Value exceeds the modified screening criteria of 11 pCi/g for Cs-137. Sample evaluated for greater than 3 times the modified screening criteria as provided by NUREG/CR-5849. Section 8.5. Elevated area within acceptable limits.
0442S0007	Latitude (N39^0); 58.0453 Longitude (W83^0); 14.8074	26 SW	6/28/2005	Sample results are below Table 1 values and modified screening criteria of 11 pCi/g for Cs-137. Sum of Fractions performed with a value less then 1.0. Reported value within acceptable limits.
0442S0008	Latitude (N39^0); 58.0687 Longitude (W83^0); 14.8764	58 NW	6/28/2005	Sample results are below Table 1 values and modified screening criteria of 11 pCi/g for Cs-137
0442S0009	Latitude (N39^0); 58.075 Longitude (W83^0); 14.8764	119 NE	6/28/2005	Sample results are below Table 1 values and modified screening criteria of 11 pCi/g for Cs-137
0442S00010	Latitude (N39^0); 58.0411 Longitude (W83^0); 14.8402	W of 77	6/28/2005	Sample results are below Table 1 values and modified screening criteria of 11 pCi/g for Cs-137

4.1 ESSAP Sample Number 0442S0005:

Guidance provided in NUREG/CR-5849 for elevated area activity evaluations has been performed for ESSAP Sample Number 0442S0005. The sample was collected from Grid 39 within the northeast quadrant. Reported activity concentration for Cs-137 was 25.59 pCi/g Cs-137:

Section 8.5.2, *Elevated Areas of Activity*: of NUREG/CR-5849 provides that:

> "*If* the limit for soil activity at any location is three times the average guideline value...Areas of elevated activity between one and three times the guideline value are

then tested to assure that the average concentration is less than $(100/A)^{1/2}$ times the guideline value, where A is the area of the elevated activity in m^2."

As discussed in the Draft Final Status Survey Report for the area of concern, the modified screening criterion is 11 pCi/g Cs-137.

As provided by Section 8.5.2 of NUREG/CR-5849, the Cs-137 activity concentration was first calculated for the areas within Grid 39 that were exclusive of the elevated location. **Table G** presents the location of each of the samples and the average concentration. The average Cs-137 activity concentration was also calculated for the northeast quadrant using the three reported samples and then used to calculate the average of Grid 39.

Table G, Elevated Activity Evaluation of ESSAP 00442S005			
CS Sample ID	**Location**	**Samples Date**	**Cs-137 Activity Conc. (pCi/g)**
RL05-1869-2247	Grid 39 NE	6/14/2005	9.89E-01
RL05-2127-2431	Grid 39 NE	6/29/2005	9.08E-02
RL05-2128-2432	Grid 39 NE	6/29/2005	2.90E-01
	Average Cs-137 Activity (pC/g) for Grid 39 NE		*4.56 E-01*
RL05-1870-2248	Grid 39 NW	6/14/2005	7.76E+00
RL05-1925-2262	Grid 39 SE	6/3/2005	2.68E+00
RL05-1612-1985	Grid 39 SW	6/3/2005	6.25E-01
	Average Cs-137 Activity (pCi/g) for Grid 39		*2.88 E+00*
ESSAP ID 00442S005	Grid 39 NE	6/28/05	2.559 E+01

The surface area of the elevated activity location was assumed to be at least one-seventh that of the entire grid:

$$A_{\text{elevated activity}} = (1/7)\,(A_{\text{grid}})$$

$$A_{\text{elevated activity}} = (1/7)(100\ m^2)$$

$$A_{\text{elevated activity}} = 14.29\ m^2)$$

The average activity concentration of Cs-137 within the elevated area is set equal to the ESSAP Sample Number 0442S0005 analytical result of 25.59 pCi/g for Cs-137. The permitted average activity concentration for the area of elevated activity is then calculated using the modified screening criteria for Cs-137 of 11 pCi/g.

$$X_{\text{elevated area average conc}} = (100/A_{\text{elevated activity}})^{1/2} \times 11\ \text{pCi/g Cs-137}$$

$$X_{\text{elevated area average conc}} = (100/14.29\ m^2)^{1/2} \times 11\ \text{pCi/g Cs-137}$$

$$X_{\text{elevated area average conc}} = 29.15\ \text{pCi/g Cs-137}$$

ESSAP Sample Number 0442S0005 analytical result of 25.59 pCi/g for Cs-137, is less that the permitted average activity of 29.15 pCi/g for Cs-137.

The weighted average activity concentration for Cs-137 for Grid 39, including the elevated area of activity, is calculated as:

$$X_w = [2.88 \text{ pCi/g } [1-(14.29/100)]] + [25.59 \text{ pCi/g } [14.29/100]]$$
$$X_w = 2.47 \text{ pCi/g} + 3.66 \text{ pCi/g}$$
$$X_w = 6.13 \text{ pCi/g}$$

The weighted average activity concentration for Cs-137 is less than the modified screening criteria of 11 pCi/g for Cs-137.

4.2 ESSAP Sample Number 0442S0006

Guidance provided in NUREG/CR-5849 for elevated area activity evaluations has been performed for ESSAP Sample Number 0442S0006. The sample was collected from Grid 30 within the southeast quadrant. Reported activity concentration for Cs-137 was 11.15 pCi/g for Cs-137:

Section 8.5.2, *Elevated Areas of Activity*; of NUREG/CR-5849 provides that:

> "*If* the limit for soil activity at any location is three times the average guideline value...Areas of elevated activity between one and three times the guideline value are then tested to assure that the average concentration is less than $(100/A)^{1/2}$ times the guideline value, where A is the area of the elevated activity in m^2."

As discussed in the Final Status Survey Report for the area of concern, the modified screening criteria is 11 pCi/g for Cs-137.

As provided by Section 8.5.2 of NUREG/CR-5849, the Cs-137 activity concentration was first calculated for the areas within Grid 30 that were exclusive of the elevated location. **Table H** presents the location of each of the samples and the average concentration. The average Cs-137 activity concentration was also calculated for the northwest quadrant using the two reported samples and then used to calculate the average of Grid 30.

Table H, Elevated Activity Evaluation of ESSAP 00442S006

CS Sample ID	Location	Samples Date	Cs-137 Activity Conc. (pCi/g)
RL05-1702-2062	Grid 30 NW	6/15/2005	4.46E-02 (ND)
RL05-2311-2626	Grid 30 NW	7/8/2005	4.69E-02 (ND)
Average Cs-137 Activity (pCi/g) for Grid 30 NW			*4.57E-02*
RL05-1924-2261	Grid 30 NE	6/15/2005	3.93E+00
RL05-1710-2066	Grid 30 SE	6/21/2005	3.42E+00
RL05-1717-2073	Grid 30 SW	6/17/2005	9.41E-01
Average Cs-137 Activity (pCi/g) for Grid 30			*2.08E+00*
ESSAP ID 00442S006	Grid 30 SE	6/28/05	1.115 E+01

The surface area of the elevated activity location was assumed to be at least one-fifth that of the entire grid:

$A_{elevated\ activity} = (1/5)\ (A_{grid})$

$A_{elevated\ activity} = (1/5)(100\ m^2)$

$A_{elevated\ activity} = 20\ m^2)$

The average activity concentration of Cs-137 within the elevated area is set equal to the ESSAP Sample Number 0442S0006 analytical result of 11.15 pCi/g for Cs-137. The permitted average activity concentration for the area of elevated activity is then calculated using the modified screening criteria for Cs-137 of 11 pCi/g.

$X_{elevated\ area\ average\ conc} = (100/A_{elevated\ activity})^{1/2} \times 11$ pCi/g Cs-137

$X_{elevated\ area\ average\ conc} = (100/20\ m^2)^{1/2} \times 11$ pCi/g Cs-137

$X_{elevated\ area\ average\ conc} = 24.64$ pCi/g Cs-137

ESSAP Sample Number 0442S0006 analytical result of 11.15 pCi/g for Cs-137. is less that the permitted average activity of 24.64 pCi/g for Cs-137.

The weighted average activity concentration for Cs-137 for Grid 30. including the elevated area of activity, is calculated as:

$X_w = [2.08\ pCi/g\ [1-(20/100)]] + [11.15\ pCi/g\ [20/100]]$
$X_w = 1.66\ pCi/g + 2.23\ pCi/g$
$X_w = 3.89\ pCi/g$

The weighted average activity concentration for Cs-137 is less than the modified screening criteria of 11 pCi/g for Cs-137.

4.3 ESSAP Sample Number 0442S0007

A "fraction of limit" evaluation was performed using the preliminary analytical results of ESSAP Sample Number 0442S0007. Preliminary analytical results are 10.07 pCi/g for Cs-137. **Table I** presents the results of the evaluation.

Table I, Fraction of Limit Evaluation for ESSAP 0442S0007	
Analytical Parameter	**ESSAP 0442S0007 Result (pCi/g)[a]**
Co-60	1.000E-02
Sr-90[b]	2.189E-01
Cs-137	1.007E+01
Eu-152	6.300E-01
Eu-154	0.000E+00
Pu-238[b]	1.259E-02
Pu-239[b]	4.028E-01
Am-241	8.300E-01
Pu-241[c]	3.596E+00
Fraction of Limit	**9.057E-01**

[a] - Activity Concentration based on MDA value in absence of a positive result
[b] - Estimated, based on activity concentration of ratios of specific isotopes to Cs-137.
[c] - Pu-241 is calculated using the values obtained form the ORIGEN2.1-derived data values

5. Conclusion

The evaluation performed following the guidance of Section 8.5.2 of NUREG/CR-5849 and the "fraction of the limit" calculation indicate that the ESSAP sample results are within the established release criteria.