ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

August 17, 2005

Mr. Thomas Dragoun
NRR/DRIP
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

**SUBJECT: FINAL SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT NO. 4 FOR THE SAXTON NUCLEAR EXPERIMENTAL CORPORATION, SAXTON, PENNSYLVANIA (DOCKET NO. 50-146; TASK 1)**

Dear Mr. Dragoun:

Enclosed is the final Site-Specific Decommissioning Inspection Report for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania, for activities performed on-site during the period May 24 and 25, 2005.

Please contact me at (865) 576-3356 or Alex J. Boerner at (865) 574-0951 should you require any additional information.

Sincerely,

Timothy J. Bauer
Health Physicist
Environmental Survey and
Site Assessment Program

TJB:ar

Enclosure

cc: A. Adams, NRC/NRR/OWFN 12G13
S. Adams, NRC/NRR/OWFN O-12E5
E. Abelquist, ORISE/ESSAP
A. Boerner, ORISE/ESSAP
D. Condra, ORISE/ESSAP
File/0968

| Distribution approval and concurrence: | Initials |
|---|---|
| Technical Management Team Member | |
| Laboratory Manager | |
| Quality Manager | |

JE01
A020

P. O. BOX 117, OAK RIDGE, TENNESSEE 37831-0117

Operated by Oak Ridge Associated Universities for the U.S. Department of Energy

Rec'd 10/13/05
Procedure
A. Adams

# FINAL
# SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT NO. 4 FOR THE SAXTON NUCLEAR EXPERIMENTAL CORPORATION SAXTON, PENNSYLVANIA

At the request of the Nuclear Regulatory Commission's (NRC) Office of Nuclear Reactor Regulation, the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed site-specific decommissioning inspection activities at the Saxton Nuclear Experimental Corporation (SNEC) in Saxton, Pennsylvania. This report describes the inspection activities performed on site during the period May 24 and 25, 2005 pertaining to the SNEC open land area final status surveys. Four SNEC soil samples were also collected to perform a second interlaboratory comparison after the SNEC laboratory was retrofitted to repair damage caused during inclement weather; the first interlaboratory comparison was described in *Final Site-Specific Decommissioning Inspection Report No. 3* (ORISE 2004a). Attachment A provides the results of the NRC requested in-process inspection survey of open land areas; SNEC had completed remediation and final status surveys in the subject areas but final status survey reports had not been issued to the NRC and therefore these activities could not be considered confirmatory surveys.

The following applicable checklist items were taken from the Site-Specific Decommissioning Inspection Plan (ORISE 2003a). Bulleted observations and recommendations are noted under each checklist item. ESSAP reviewed SNEC Calculations E900-05-19, *First Energy-Penelec Site NE Open Land Area OL4 – Survey Design* (GPU 2005a); E900-05-016, *Northeast Dump Open Land Area OL5 – Survey Design* (GPU 2005b); and, E900-05-027, *OL6 and OL10 Open Land Areas – Survey Design* (GPU 2005c). These three documents will be referred to as "Calculations" in this document.

## 1.0 GENERAL

1.1 Review past records of spills or other releases of radioactive material and documentation of cleanup.

**Observations:** Survey area OL5 was used for disposal of SNEC materials. SNEC surveys identified elevated activity in the area and SNEC extensively sampled and excavated the area for remediation. The area was originally a Class 3 but was reclassified to Class 1 per the License Termination Plan (LTP, GPU 2004).

**Recommendations:** None.

1.2 Tour plant areas to obtain familiarity with the facility, surrounding areas, and decommissioning work completed. Review the licensee's plans and schedule for completing further decontamination work and surveying of the facility.

**Observations:** ESSAP staff toured SNEC open land final status survey areas. SNEC was generally performing final status surveys of outlying areas first with continuing progress inward toward the higher contaminated areas. SNEC staff discussed the tentative schedule for submitting final status survey reports to the NRC for review. A revised schedule was to be submitted to the NRC indicating

that all reports were planned to be submitted in the late July to early August timeframe.

**Recommendations:** None.

## 2.0 IDENTIFICATION OF CONTAMINANTS AND DCGLS

2.1 Review previous measurement and analytical results to confirm the nature of the site information and contaminants at the site. In particular, review the data that relate to the licensee's determination of radionuclide ratios, fractional contributions to total activity and variability.

**Observations:** ESSAP provided observations and recommendations in Final Site-Specific Decommissioning Inspection Report No. 2 (ORISE 2003b) for this checklist item. SNEC has modified their calculational approach since Report No. 2 and has incorporated the new approach into the reviewed Calculations. The determination of the radionuclide ratios was considered appropriate. In addition, sample data provided in the Calculations that were used for determining contamination information (e.g. radionuclide ratios) were reviewed and considered appropriate.

**Recommendations:** None.

2.2 Review the derived concentration guideline levels (DCGLs) that the licensee will use for outdoor soil areas, structure surfaces, and/or rubblized structures. Verify that the licensee has accounted for all media for which final status surveys will be designed.

**Observations:** DCGLs presented in the Calculations for outdoor soil areas were reviewed and considered appropriate. Media in the reviewed survey areas consisted of only soil.

**Recommendations:** None.

2.3 Evaluate how the DCGLs will be implemented—e.g., use of surrogate measurements and modified DCGLs, gross activity DCGLs, $DCGL_{EMC}$s—to determine how samples/measurements will be compared, implementation of the unity rule, and how radionuclide variabilities—specifically modification of $\sigma$—will be integrated in DCGL implementation.

**Observations:** A modified Cs-137 DCGL was presented in the Calculations and was properly calculated per the LTP. The number of samples to collect in each survey unit was properly calculated, and laboratory analysis of the soil samples for Cs-137 was to be compared to the Action Level (75% of the modified Cs-137 DCGL) to account for de-listed radionuclides.

**Recommendations:** None.

## 4.0 FINAL STATUS SURVEY PROCEDURES AND INSTRUMENTATION

### 4.1 Land Area Survey Instrumentation

4.1.1 Evaluate the instrument sensitivity for scan surveys of land areas. Review the scan MDC in terms of the soil DCGL(s). Ensure that *a priori* scan MDCs adequately account for modified DCGLs if a surrogate approach or the unity rule is used.

**Observations:** In the Calculations, SNEC specifically calculated an *a priori* scan MDC that adequately accounted for the modified DCGL, as well as the 75% Action Level. The calculation included the determination of the detector response to Cs-137 when using the coupled instrument in a windowed mode. For Class 1 areas, SNEC compared the actual scan MDC to the required scan MDC using the approved area factors from the LTP.

**Recommendations:** None.

4.1.2 Review the equipment set up and performance check procedures.

**Observations:** SNEC Calculation E900-03-018, *Optimize Window and Threshold Settings for the detection of Cs-137 using the Ludlum 2350-1 and a 44/10 NaI Detector* (GPU 2003), was reviewed. SNEC showed in this calculation that the use of a Cs-137 window for scanning increased the signal-to-noise ratio. A concern also addressed in this calculation included temperature stability; SNEC performed experiments that demonstrated temperature effects on the instrument/detector system as set up for field survey work and showed that the selected instrument parameters accounted for changes in environmental conditions. In addition, a copy of SNEC calibration contractor's calibration procedures was reviewed. Discussion with SNEC Radiological Technicians performing gamma surface scans using the Cs-137 window indicated that SNEC monitors instrument performance periodically throughout the day.

**Recommendations:** None.

### 4.3 Final Status Survey Procedures

Review final status survey procedures and planning documents for the following:

4.3.1 Verify the adequacy of reference areas selected by the licensee for assessing background contributions to surface activity levels and radionuclides in soils or other volumetric media.

**Observations:** SNEC elected to not account for background levels of Cs-137; therefore, no reference areas were required.

**Recommendations:** None.

4.3.2 Review procedures for establishing survey unit boundaries. Review maps showing preliminary survey unit designations.

**Observations:** Survey areas (e.g. OL5) were based on the LTP listing (Table 5-2) showing initial survey areas with area classification. Review of the survey units designated in each area followed the LTP requirements and in many cases the survey unit sizes were conservative. For example, a 2,000 $m^2$ area in OL5 could have been one survey unit per the LTP but SNEC created two survey units which had the effect of doubling the sampling density.

**Recommendations:** None.

4.3.3 Review available radionuclide variability ($\sigma$) data that will be used for calculating required sample size. Additionally, determine whether the analytical methods and instrumentation used for the initial $\sigma$ calculations are comparable to those that will be used during final status surveys.

**Observations:** Radionuclide variability data was presented in the Calculations and was properly used in calculating the required sample size. Gamma spectroscopy was used to determine the concentrations of the main contaminants of concern. Additional analyses were used, e.g. alpha spectroscopy, to determine concentrations of hard-to-detect radionuclides. Gamma spectroscopy was the only analysis to be used during analysis of final status survey samples.

**Recommendations:** None.

4.3.4 Review procedures for required scan coverage based on survey unit classification.

**Observations:** Scan coverage noted in the Calculations implemented the requirements described in the LTP (Table 5-5).

**Recommendations:** None.

4.3.5 Review methods for determining area factors that will be used for evaluating areas of elevated activity detected during scans.

**Observations:** Area factors to be used were approved and provided in the LTP. The reviewed Calculations utilized the approved area factors when necessary, for example Class 1 survey units.

**Recommendations:** None.

4.3.6 Review proposed investigation levels and adequacy relative to the required and actual scan MDCs.

**Observations:** Proposed investigation levels for scans were set at the actual scan MDC. When appropriate, the actual scan MDCs were shown to be less than the scan MDC times the area factor when the scan MDC was greater than the DCGL.

**Recommendations:** None.

4.3.7 Review selection process for sample locations in survey units.

**Observations:** Sampling locations were determined per the LTP (Table 5-5).

**Recommendations:** None.

4.3.8 Review proposed procedures and any associated factors for surveying embedded piping or other difficult to access or inaccessible areas.

**Observations:** No embedded piping or other difficult to access or inaccessible areas were reviewed.

**Recommendations:** None.

## 5.0 ANALYTICAL PROCEDURES

ESSAP performed an inspection of the SNEC analytical procedures during the period March 27 through 29, 2001 (ORISE 2001). The following items will be reviewed for additions and/or modifications that have been incorporated since the 2001 inspection.

5.3 Analyze split-samples of media such as soil, building debris, and water for comparison with SNEC's on-site laboratory results.

**Observations**: Four SNEC 1-liter soil samples were returned to ESSAP's laboratory in Oak Ridge, Tennessee. Samples were analyzed in accordance with the ESSAP Laboratory Procedures and Quality Assurance Manuals (ORISE 2004b and c). The ESSAP and SNEC results are provided in Table 1. ESSAP's gamma spectroscopy instrumentation is not calibrated to the 1-liter Marinelli geometry for solid samples; ESSAP uses a 0.5-liter geometry instead. Therefore, aliquots were taken from the SNEC samples, each aliquot was analyzed individually, and the subsequent results averaged and compared to the licensee's data. Two of the samples did not have enough material to obtain two 0.5-liter aliquots and therefore only a portion of the sample was analyzed. Two of the samples, from which two aliquots were taken did not show statistical agreement between the two initial ORISE measurement results. The two aliquots for each sample were reconstituted, re-homogenized, and re-analyzed. The second data sets showed improved agreement, but results of the aliquots were not statistically comparable due to the inhomogeneity of the SNEC samples. It is ESSAP's opinion that the data show general agreement between the two data analyses and

that SNEC properly implemented their laboratory procedures for sample preparation and analysis.

**Recommendations:** None.

## 6.0 IN-PROCESS AUDIT OF RADIOLOGICAL SURVEY TECHNICIANS

Review the licensee's radiological survey technician's implementation of the final status survey. Specifically:

6.1 Understanding of the concepts of the License Termination Plan (LTP) and associated documents and procedures as outlined in the Final Status Survey Training Manual.

**Observations:** SNEC radiological technicians were generally trained to perform scanning or sampling, but not both. Technicians carried a copy of the appropriate Survey Request (SR) for the area they were tasked to survey. Several technicians were interviewed and found to be knowledgeable of procedures with awareness of varying survey design parameters not only between survey areas but within individual survey units comprising the larger survey areas. It was evident that the requirements of the LTP, written into the SRs for field implementation, were conveyed to the technicians performing the work. In addition, the technicians attend a daily briefing of their assigned survey area(s) and associated SRs.

**Recommendations:** None.

6.2 Adherence to the specification of the Survey Requests (SR) generated by the licensee for final status survey field implementation.

**Observations:** SNEC radiological technicians were given guidance to strictly follow SRs. While the technicians were knowledgeable of design parameters, they were not authorized to make modifications to the SR scope. Any problems encountered in the implementation of the SR were to be brought to the attention of SNEC management.

**Recommendations:** None.

6.3 Performance of surface scans using the audible output—in particular, that the radiological survey technician passing the detector over the surface being measured is the individual listening to the audible output.

**Observations:** ESSAP noted that technicians listened to the audible output of the Ludlum 2350 through headphones while performing the surveys. Technicians passed the NaI detector as close as possible to the ground at a speed of 25 centimeters per second, as specified on the SR. While on site, SNEC identified an alarm point while surveying in OL4 Survey Unit 1. ESSAP's survey in the area where the alarm point occurred indicated that the elevated gamma radiation was

constrained to a small area, about the size of the detector, thus indicating that the SNEC procedures, SRs, and field implementation were effective.

**Recommendations:** None.

# ORISE TABLE 1

## COMPARISON OF GAMMA SPECTROSCOPY RESULTS OF RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES PROCEDURE CP1, REVISION 14 SAXTON NUCLEAR EXPERIMENTAL CORPORATION SAXTON, PENNSYLVANIA

| ORISE Sample ID[a] | SNEC Sample ID | Radionuclide Concentrations (pCi/g dry weight) | | | Cs-137 Comparison Ratio[c] |
|---|---|---|---|---|---|
| | | ORISE Values[b] | | SNEC Value for Cs-137 | |
| | | Cs-137 | Cs-137 Average | | |
| 0968S012A | SX-SL-9257 | 2.07 ± 0.10[d] | 3.32 ± 0.11 | 3.83 ± 0.39[e] | 0.87[f] |
| 0968S012B | | 4.56 ± 0.20 | | | |
| 0968S012P | | 2.83 ± 0.13 | 3.58 ± 0.12 | | 0.93 |
| 0968S012R | | 4.33 ± 0.19 | | | |
| 0968S013 | SX-SL-10437 | 0.38 ± 0.06 | --[g] | 0.36 ± 0.09 | 1.1 |
| 0968S014 | SX-SL-10390 | 0.16 ± 0.03 | -- | 0.13 ± 0.05 | 1.2 |
| 0968S015A | SX-SL-9267 | 2.08 ± 0.11 | 2.64 ± 0.09 | 2.67 ± 0.29 | 0.99 |
| 0968S015B | | 3.19 ± 0.15 | | | |
| 0968S015P | | 2.70 ± 0.13 | 2.58 ± 0.09 | | 0.97 |
| 0968S015R | | 2.45 ± 0.12 | | | |

[a]SNEC provided 1-Liter soil samples. ORISE split the samples into two 0.5-Liter samples for measurement when enough sample material was available. The last letter of the ORISE sample ID indicates the measured aliquot of the SNEC 1-Liter sample: "A" and "B" indicate the initial two aliquots and "P" and "R" indicate two aliquots taken after the sample was reconstituted and homogenized.

[b]The average MDC for a 1-hour count of soil in a 0.5-Liter Marinelli for Cs-137 is 0.05 pCi/g.

[c]Calculated by dividing the ORISE result (average value when calculated) by the SNEC result.

[d]ORISE uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[e]SNEC uncertainties represent the 95% confidence level, based on counting statistics.

[f]Uncertainties were not propagated for the Comparison Ratio calculation because ORISE and SNEC errors were not determined in the same manner.

[g]Not applicable because only one aliquot was taken from the SNEC sample.

## REFERENCES


GPU Nuclear, Inc. (GPU). SNEC Calculation E900-03-018, Optimize Window and Threshold Settings for the detection of Cs-137 using the Ludlum 2350-1 and a 44/10 NaI Detector, Revision 0. Saxton, Pennsylvania; August 7, 2003.

GPU Nuclear, Inc. Saxton Nuclear Experimental Corporation Facility License Termination Plan, Revision 3. Saxton, Pennsylvania; February 2004.

GPU Nuclear, Inc. SNEC Calculation E900-05-019, First Energy-Penelec Site NE Open Land Area OL4 – Survey Design, Revision 1. Saxton, Pennsylvania; May 10, 2005a.

GPU Nuclear, Inc. SNEC Calculation E900-05-016, Northeast Dump Open Land Area OL5 – Survey Design, Revision 0. Saxton, Pennsylvania; April 21, 2005b.

GPU Nuclear, Inc. SNEC Calculation E900-05-027, OL6 and OL10 Open Land Areas – Survey Design, Revision 0. Saxton, Pennsylvania; April 22, 2005c.

Oak Ridge Institute for Science and Education (ORISE). Input for the Site-Specific Decommissioning Inspection for the Saxton Nuclear Experimental Corporation (SNEC), Saxton, Pennsylvania (Docket No. 50-146, RFTA No. 01-003). Oak Ridge, Tennessee; July 30, 2001.

Oak Ridge Institute for Science and Education. Final Site-Specific Decommissioning Inspection Plan for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania (Docket No. 50-146, Task 1). Oak Ridge, Tennessee; March 13, 2003a.

Oak Ridge Institute for Science and Education. Final Site-Specific Decommissioning Inspection Report No. 2 for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania (Docket No. 50-146, Task 3). Oak Ridge, Tennessee; September 25, 2003b.

Oak Ridge Institute for Science and Education. Final Site-Specific Decommissioning Inspection Report No. 3 for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania (Docket No. 50-146, Task 1). Oak Ridge, Tennessee; September 29, 2004a.

Oak Ridge Institute for Science and Education. Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; August 31, 2004b.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; August 31, 2004c.

# ATTACHMENT A

# IN-PROCESS INSPECTION SURVEY RESULTS FOR OPEN LAND AREAS SAXTON NUCLEAR EXPERIMENTAL CORPORATION SAXTON, PENNSYLVANIA

## INTRODUCTION

The U.S. Nuclear Regulatory Commission's (NRC) Office of Nuclear Reactor Regulation requested that the Oak Ridge Institute for Science and Education's (ORISE) Environmental Survey and Site Assessment Program (ESSAP) perform in-process inspection surveys of open land soil survey units (SU) as part of Inspection No. 4 of the Saxton Nuclear Experimental Corporation (SNEC) in Saxton, Pennsylvania (see Figure A-1). Three SUs from three survey areas were surveyed during the period May 24 through 25, 2005: survey area OL4, SU 3 (OL4-3, 1,200 $m^2$); survey area OL5, SU 3 (OL5-3, 1,000 $m^2$); and, survey area OL10, SU 1 (OL10-1, approximately 6,800 $m^2$).

## PROCEDURES

The in-process inspection surveys were performed in accordance with the ORISE/ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 2004a and b). Measurement and sampling locations were noted on SNEC-provided figures. Gamma surface scans were performed over 100 percent of accessible portions of Class 1 SUs OL4-3 and OL5-3 and over approximately six percent of Class 2 SU OL10-1 using NaI scintillation detectors coupled to ratemeters with audible indicators; areas surveyed in OL10-1 corresponded to areas that SNEC did not cover in their 50% scan survey. Scans were performed in each area with and without utilizing a Cs-137 window instrument setup. Figure A-2 provides scan data observed during the audible scans of OL5-3 with an open window and Figure A-3 provides the scan data using a Cs-137 window; this data is provided for informational purposes only. Six soil samples (0 to 1 m) were collected from elevated areas identified during gamma scans as well as at other judgmental locations (see Figures A-4 through A-6).

## SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ESSAP's laboratory in Oak Ridge, Tennessee for analysis and interpretation. Soil samples were analyzed by gamma spectroscopy for Cs-137, the primary gamma emitting radionuclide of concern—the data were also reviewed for other fission and activation products, e.g. Co-60. Sample analyses were performed in accordance with the ESSAP Laboratory Procedures Manual (ORISE 2004c). Radionuclide concentrations were reported in picocuries per gram (pCi/g). The analytical results were compared to SNEC's Action Level for Cs-137, which was 75% of the site-specific derived concentration guideline level ($DCGL_W$) for each survey area: 4.8 pCi/g for OL4 (GPU 2005a), 4.7 pCi/g for OL5 (GPU 2005b), and 4.9 pCi/g for OL10 (GPU 2005c).

## FINDINGS AND RESULTS

Two elevated areas in OL5-3 and one area in OL10-1 were identified during gamma surface scans. Concentrations of radionuclides in soil samples collected are provided in Table A-1. Concentrations ranged from 0.02 to 0.32 pCi/g for Cs-137 and from -0.01 to 0.03 pCi/g for Co-60. A review of other gamma-emitting radionuclide concentrations did not note any significant findings.

## COMPARISON OF RESULTS WITH GUIDELINES

A comparison of Cs-137 radionuclide concentrations to the site's Action Level for each survey area, based on a reduction of the site-specific $DCGL_W$, indicated that the concentrations are below the guideline.

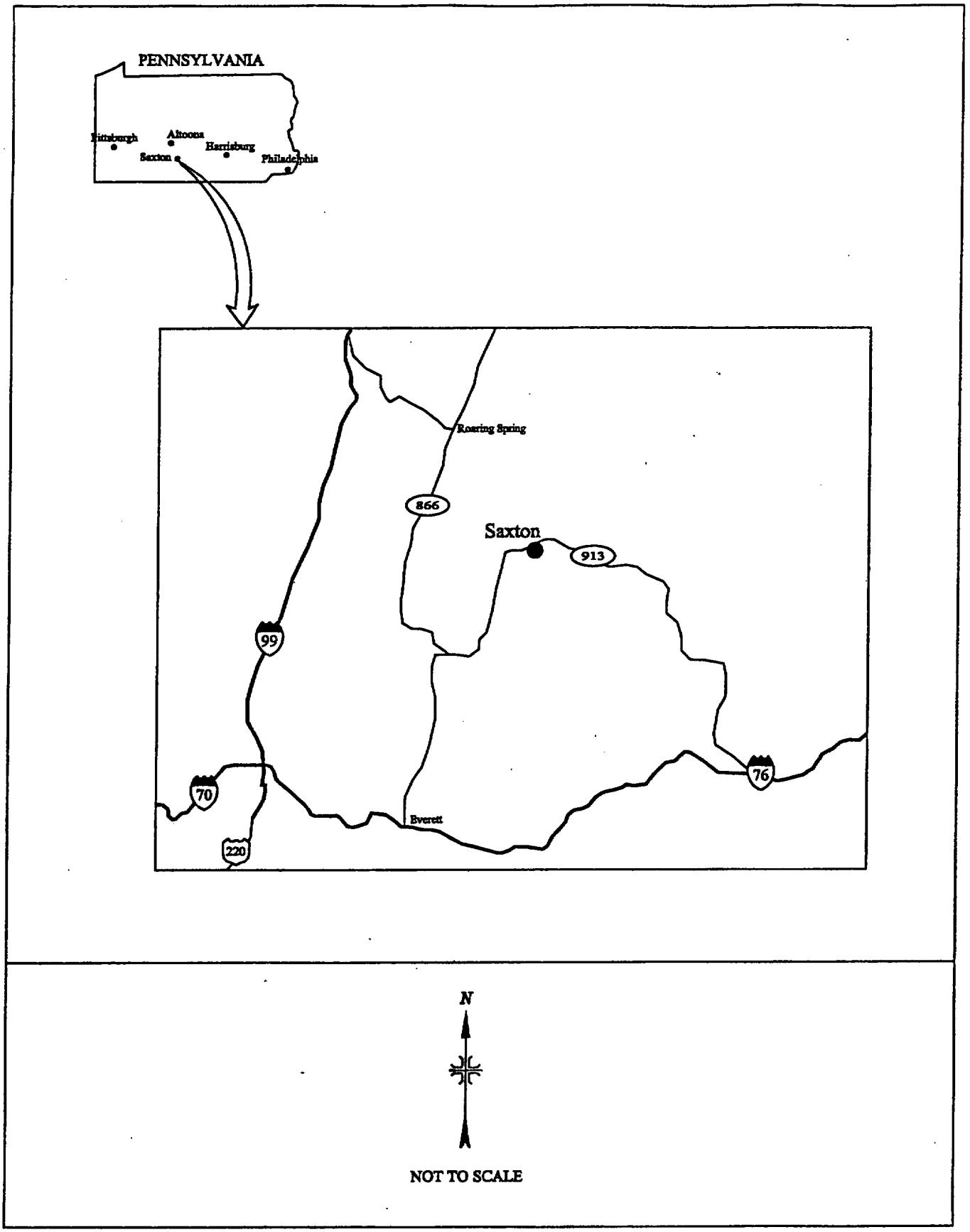



FIGURE A-1: Location of the Saxton Nuclear Experimental Corporation - Saxton, Pennsylvania

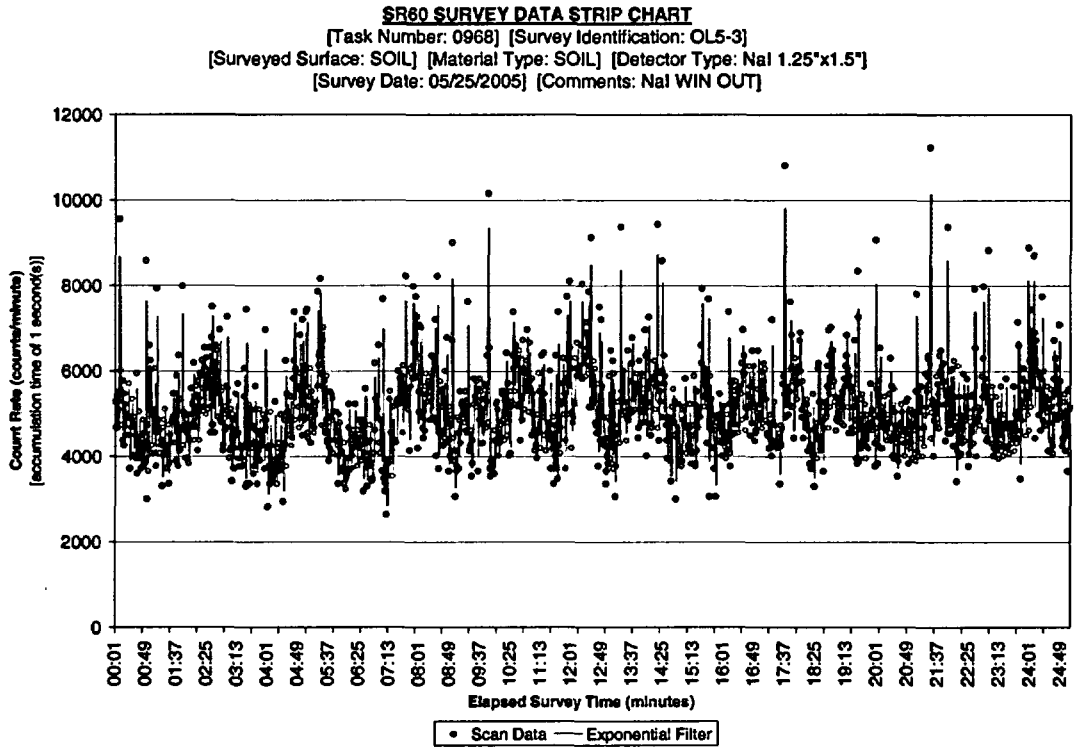



FIGURE A-2: Scan data for SU OL5-3 (window out)

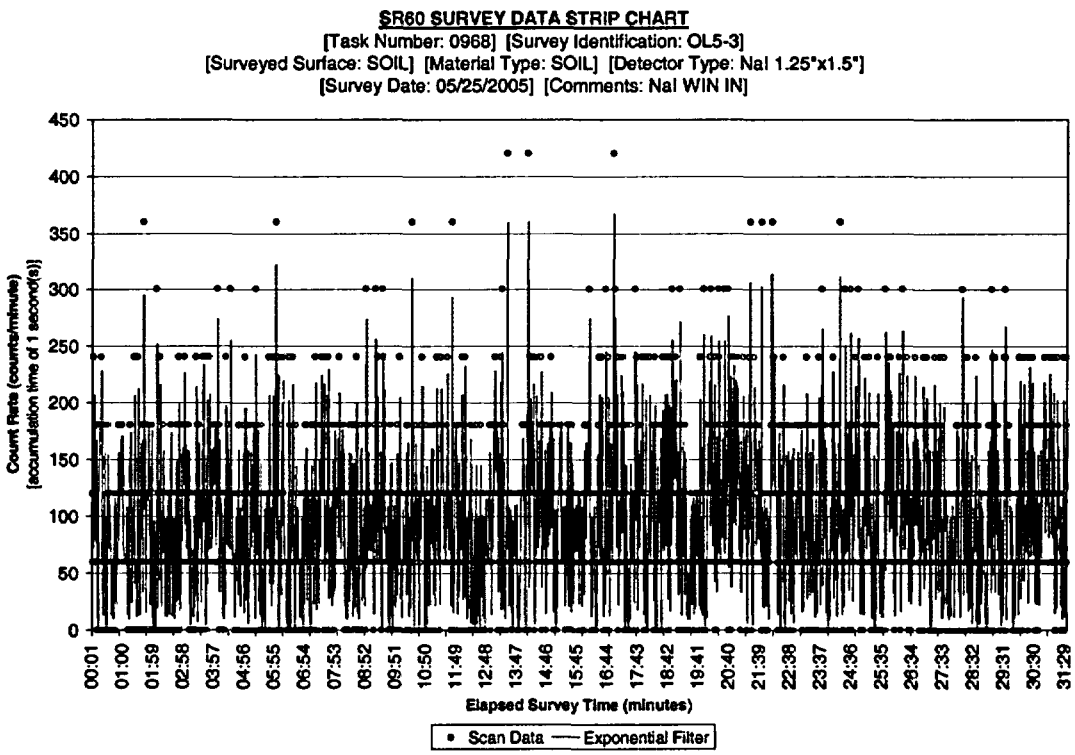
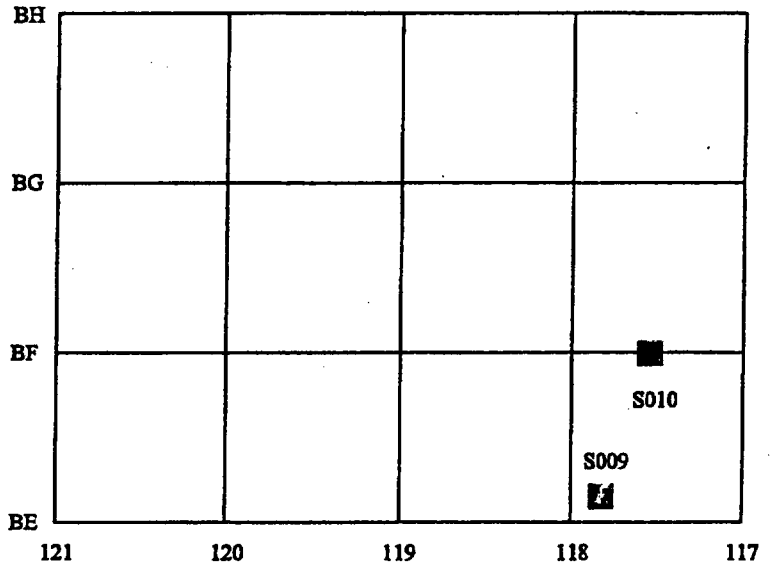



FIGURE A-3: Scan data for SU OL5-3 (Cs-137 window in)




SAMPLING LOCATIONS

# SURFACE SOIL (0-1m)

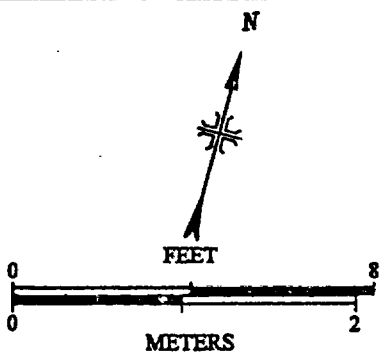
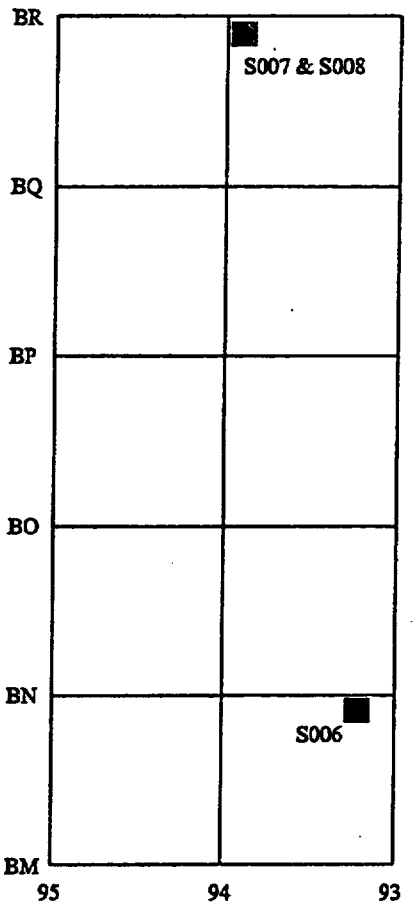



FIGURE A-4: Survey Area OL4 Survey Unit 3 - Sampling Locations




SAMPLING LOCATIONS

# SURFACE SOIL (0-1m)

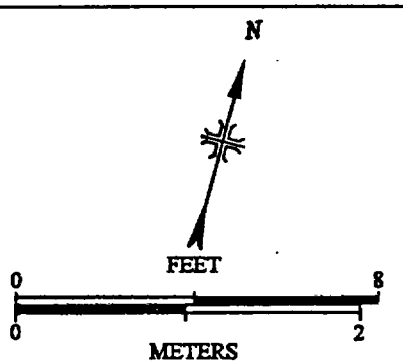



FIGURE A-5: Survey Area OL5 Survey Unit 3 - Sampling Locations

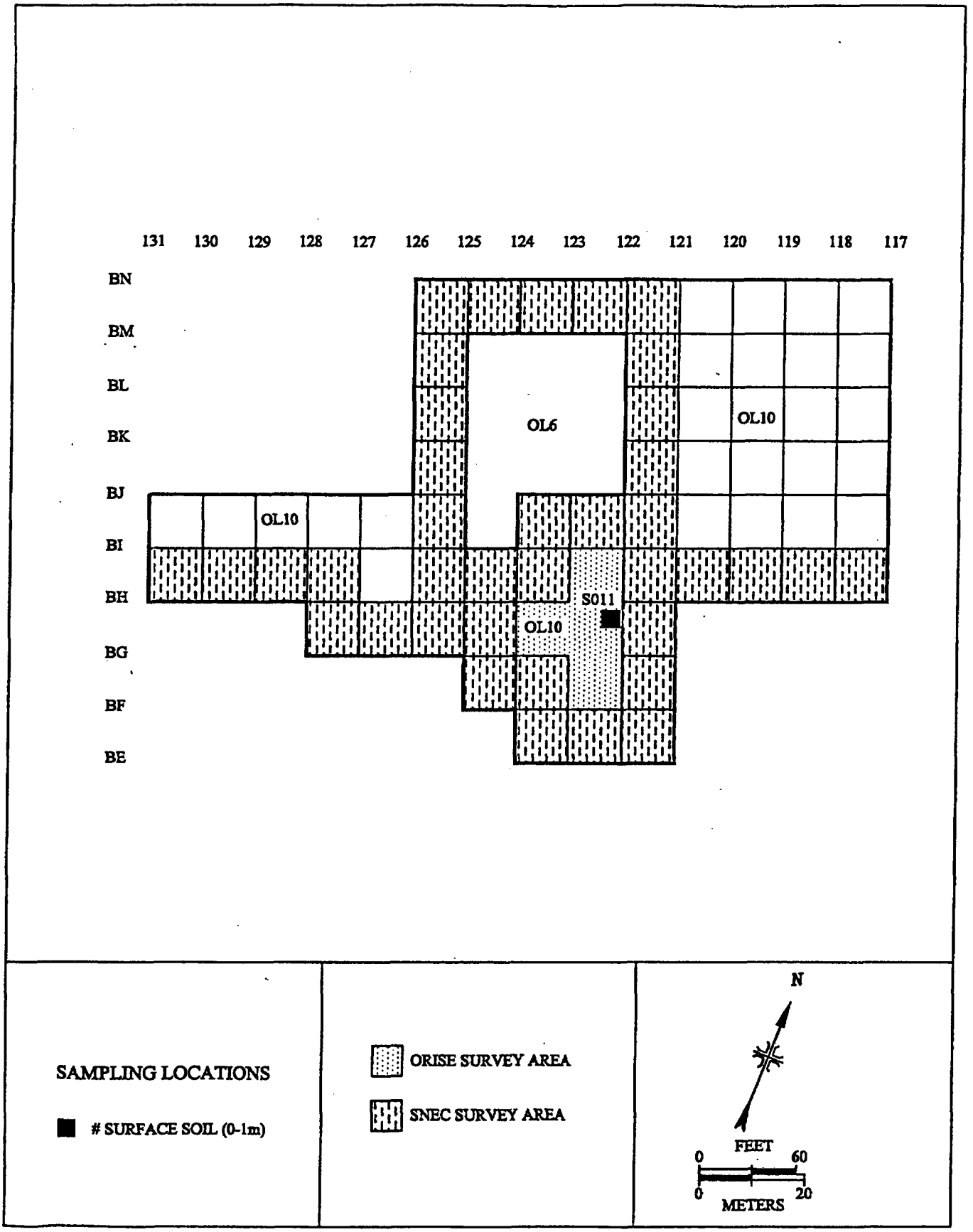



FIGURE A-6: Survey Area OL10 Survey Unit 1 - Sampling Locations

## TABLE A-1

## RADIONUCLIDE CONCENTRATIONS IN SOIL DETERMINED BY GAMMA SPECTROSCOPY SAXTON NUCLEAR EXPERIMENTAL CORPORATION SAXTON, PENNSYLVANIA

| Sample[a] | Radionuclide Concentration (pCi/g)[b] | |
|---|---|---|
| | Cs-137 | Co-60 |
| 0968S006 | 0.32 ± 0.05[c] | 0.00[d] ± 0.03 |
| 0968S007 | 0.03 ± 0.03 | -0.01 ± 0.04 |
| 0968S008 | 0.07 ± 0.05 | 0.01 ± 0.04 |
| 0968S009 | 0.05 ± 0.03 | -0.01 ± 0.03 |
| 0968S010 | 0.08 ± 0.03 | 0.03 ± 0.02 |
| 0968S011 | 0.02 ± 0.03 | -0.01 ± 0.03 |

[a]Refer to Figures A-4 through A-6.
[b]The average MDC for a 1-hour count of soil in a 0.5-Liter Marinelli for Cs-137 and Co-60 is 0.05 pCi/g.
[c]Uncertainties represent the 95% confidence level based on total propagated uncertainties.
[d]Zero value due to rounding.