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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Gentlemen,

Subject Saxton Nuclear Experimental Corporation (SNEC)
Operating License No., DPR-4
Docket No. 50-146
FSS Report for Open Land Area OL13

The purpose of this letter is to submit for your review the attached FSS Report for Open Land Area OL13. One CD-ROM is included in this submission. The CD-ROM labeled: "FSS Report for Open Land Area OL13 – Publicly Available" contains the following 6 files:

Document Title	File Name	File Size (Mbytes)
Main Report	001 FSS Report – OL13.pdf	0.199
Appendix A (pages 1 to 9)	002 OL13 – Appendix A (1-9).pdf	38.2
Appendix A (attachments 1-1 to 5-1)	003 OL13 – Appendix A (attachments 1-1 to 5-1).pdf	24.0
Appendix A (attachment 6-1 to 6-6)	004 OL13 – Appendix A (attachments 6-1 to 6-6).pdf	14.2
Appendix A (attachment 7-1 to 9-3)	005 OL13 – Appendix A (attachments 7-1 to 9-3).pdf	36.3
Appendix B to Appendix D	006 OL13 – Appendix B to Appendix D.pdf	10.2

If you have any questions on this information, please contact Mr. Art Paynter at (814) 635-4384.

Sincerely,

G. A. Kuehn

Program Director, SNEC

cc: NRC Project Manager
NRC Project Scientist, Region 1
Mr. Tim Bauer, ORISE Project Leader

A020

Final Status Survey Report

For

Saxton Nuclear Experimental Corporation
Open Land Area OL13



Prepared by GPU Nuclear, Inc.

June, 2005

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Executive Summary

This report presents the results and conclusions of the final status survey (FSS) of the Class 3 open land areas on the eastern side of the Saxton Nuclear Experimental Corporation (SNEC) facility designated as OL13. This FSS survey was conducted in April and May of 2005.

The FSS was performed in accordance with the SNEC License Termination Plan (LTP). The survey area (OL13) was divided into 3 survey units. Each unit consisted of relatively flat open land. Data was collected from each survey unit in accordance with the specific survey design data collection requirements. The following is a summary of the measurements performed:

- 1) Direct NaI(Tl) scans of all or part of 28 100-square meter grids covering about 10% of the actual land area
- 2) 41 soil samples collected and then analyzed by laboratory gamma spectroscopy

The collected FSS survey data demonstrate that the 27,600 square meters of the OL13 survey area meets the radiological release criteria for unrestricted use specified in 10CFR20.1402. Therefore, GPU Nuclear, Inc. concludes that the area meets the NRC requirements and may be released for unrestricted use.

1.0 Purpose and Scope

This report presents the results and conclusions of the final status survey of the open land area designated OL13 of the SNEC facility. It provides the information required by 10CFR50.82(a)(11) and the SNEC license termination plan (LTP) to demonstrate that this area meets the radiological criteria for unrestricted use specified in 10CFR20.1402.

This report describes the radiological data collected in three Class 3 survey units of open land. This report only addresses the FSS performed on the specific land area designated as OL13 on reference 9.1. The format of this report follows the guidance contained in reference 9.2.

2.0 Survey Area Description

Survey Area OL13 is a Class 3 impacted, open land area on the southeast portion of the SNEC Site. The survey unit encompasses about 27,600 square meters of open land. Because the area exceeds the size guidance in the SNEC LTP for Class 3 survey units (10000 square meters recommended maximum), the survey area was divided into three survey units. Layout of the survey area and individual units, relative to the site layout, are shown in Attachment 1-1 of Appendix A. The three survey units are discussed below. The OL13 designation is taken from the drawing, reference 9.1.

Survey Unit OL13-1 is an open land area in the southeast section of the site. The survey unit is approximately 9800 square meters. Appendix A contains drawings showing the layout of the survey unit.

Survey Unit OL13-2 is an open land area in the east, southeast section of the site. The survey unit is approximately 8800 square meters. Appendix A contains drawings showing the layout of the survey unit.

Survey Unit OL13-3 is an open land area in the east section of the site. The survey unit is approximately 9000 square meters. Appendix A contains drawings showing the layout of the survey unit.

3.0 Operating History

3.1 Plant Operation

The Saxton Nuclear Experimental Corporation (SNEC) facility included a pressurized water reactor (PWR), which was licensed to operate at 23.5 megawatts thermal (23.5 MWTh). The reactor, containment vessel and support

buildings have all been removed. The facility is owned by the Saxton Nuclear Experimental Corporation and is licensed by GPU Nuclear, Inc. The SNEC facility is maintained under a Title 10 Part 50 license and associated Technical Specifications. In 1972, the license was amended to possess but not operate the SNEC reactor.

The facility was built from 1960 to 1962 and operated from 1962 to 1972 primarily as a research and training reactor. After shutdown in 1972, the facility was placed in a condition equivalent to the current SAFSTOR status. Since then, it has been maintained in a monitored condition. The fuel was removed in 1972 and shipped to a (now DOE) facility at Savannah River, SC, who is now the owner of the fuel. As a result of this, neither SNEC nor GPU Nuclear, Inc. has any further responsibility for the spent fuel from the SNEC facility. The building and structures that supported reactor operation were partially decontaminated by 1974.

In the late 1980s and through the 1990s, additional decontamination and disassembly of the containment vessel and support buildings and final equipment and large component removal was completed. Final decontamination and dismantlement of the reactor support structures and buildings was completed in 1992. Large component structures, pressurizer, steam generator, and reactor vessel were removed in late 1998. Containment vessel removal (to below grade) and backfill was completed in late 2003. Currently, decontamination, disassembly and demolition of the SNEC facility buildings and equipment has been completed and the facility is in the process of Final Status Survey for unrestricted release and license termination.

3.2 Survey Area Remediation Status

There has been no remediation performed in any of the three units in OL13.

4.0 Site Release Criteria

The site release criteria applied to the open land areas of OL13 correspond to the radiological dose criteria for unrestricted use per 10CFR20.1402. The dose criteria is met "if the residual radioactivity that is distinguishable from background radiation results in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem/yr, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA)".

Levels of residual radioactivity that correspond to the allowable dose to meet the site or survey unit release criteria for open land were derived by analyses using a resident farmer family scenario. The dose modeling for this scenario is explained in the SNEC LTP (reference 9.3). The derived concentration guideline levels

(DCGL) shown in Table 5-1 of the SNEC LTP form the basis for satisfying the site release criteria.

Residual radioactivity sample results for the soils were used to calculate a surrogate Cs137 DCGL. The adjusted surrogate DCGL was developed using the methodology described in the SNEC LTP section 5.2.3.2.3 based on nuclide specific DCGLs from Table 5-1 of the LTP.

An adjustment was made to the surrogate Cs137 DCGL to address the de-listed radionuclides as described in the LTP section 6.2.2.3. SNEC has instituted an administrative limit of 75% of the DCGL for all measurement results. The de-listed radionuclides are conservatively accounted for in this 25% reduction since the de-listed radionuclides were only 4.7% of the dose contribution. These adjustment factors are discussed in section 6 of the SNEC LTP.

5.0 Final Status Survey Design / DQO Process

The SNEC calculation providing the design of the survey for these survey units is provided in Appendix A. Since the survey units were all Class 3, scan measurements were conducted over approximately 10% of the surface of each survey unit. Scans were conducted using an NaI detector with a narrow window optimized for Cs137 to reduce background.

The number of sample points was determined by using the COMPASS computer program (reference 9.6, attachment 7 of appendix A). These points were located on survey maps using the Visual Sample Plan program (reference 9.7, attachment 6 of appendix A). Samples are collected to a depth of 1 meter to match the site surface dose model used in the SNEC LTP (reference 9.3).

The survey design uses a surrogate Cs137 effective DCGL developed from a radionuclide mix analysis, from soil samples collected before the Final Status Survey, in the vicinity of the survey unit. The radionuclide mix for all units in OL13 was based on data (including the hard-to-detects listed in Table 5-1 of the LTP) from OL4 (attachment 2 of appendix A). OL4 survey area data were chosen because they were greater than MDA, whereas all data from OL13 was less than MDA which led to an unrealistic DCGL.

Cs137, Co-60, Pu-238, Pu-239, and Sr-90 were positively detected and are accounted for in the adjusted surrogate DCGL. The following table (Table 1) presents the Data Quality Objectives (DQO) and other relevant information from the survey design package.

Table 1 – DQO/Design

DQO/Design Parameter	OL13-1	OL13-2	OL13-3
SNEC Design Calc. #	E900-05-017	E900-05-017	E900-05-017
MARSSIM Classification	3	3	3
Survey Unit Area (m ²)	9800	8800	9000
Statistical Test	Sign	Sign	Sign
Type 1 decision error (α)	0.05	0.05	0.05
Type 2 decision error (β)	0.1	0.1	0.1
LBGR (pCi/gm)	3.7	3.6	4.0
Estimated σ (pCi/gm)	0.40	0.44	0.31
Relative Shift (Δ/σ)	2.85	2.84	2.74
Number of static points	11	11	11
DCGLw (Cs137 pCi/gm)	6.46	6.46	6.46
Action Level (Cs-137 pCi/gm)	4.84	4.84	4.84
Scan MDC (pCi/gm)	5.67	5.67	5.67
SNEC Survey Request #	SR206	SR207	SR208
Scan Survey Instrument	L2350-1 w/ 44-10	L2350-1 w/ 44-10	L2350-1 w/ 44-10

6.0 Final Status Survey Results

The following sections provide the survey summary results for each survey unit as required by the respective design. Summary data was taken from references 9.10, 9.11, and 9.12 which are filed in the SNEC history files.

6.1 Summary for Survey Unit OL13-1

6.1.1 Scan survey

Scan measurements were made in 10 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 5.67 pCi/gm (Table 2 on page 3 of appendix A). The action level was 4.84 pCi/gm (Table 1 on page 2 of appendix A) and the adjusted surrogate Cs137 DCGLw for this survey unit was 6.46 pCi/gm (Table 1 on page 2 of appendix A). Since this is a Class 3 impacted survey unit, the EMC does not apply.

Of the 10 grids scanned, one small portion was inaccessible due to a telephone pole-cum-fence post at the south site perimeter. Of the 10 grids, a total of about

0.7 square meters was not scanned due to interferences, resulting in approximately 999.3 square meters actually scanned in the 9800 square meter survey unit. This is slightly greater than 10 percent of the unit surface area.

The scans conducted in all 10 grids did not identify any activity in the soils greater than the MDCscan. The action level was >160 ncpm. No area greater than 160 ncpm was found in OL13-1.

6.1.2 Soil samples

A total of 14 random start, triangular grid, systematic soil sample locations were defined for the survey unit based on a conservative relative shift of about 2.85. Using the typical LBGR of 50% of the DCGL, only 11 samples would have been required, which includes a 20% adjustment. Three additional sample points were included in the total to account for potential interferences. Given the variability used for the survey design (0.4 pCi/gm) and the Action Level of 4.84 pCi/gm, the LBGR used was conservative. No biased samples were required.

None of the design fixed point soil samples in OL13-1 showed activity in excess of the adjusted surrogate DCGLw. The table below (Table 2) shows the Cs137 results (no other licensed isotopes were detected) for each sample along with the mean, standard deviation, and range of the soil sample data. Results that are less than MDA are assumed to be positive at the MDA value for the statistics in the table thereby overestimating the mean.

The standard deviation of the samples collected from the survey unit was less than the variability assumed in the survey design, therefore the assessment of variability, relative shift, and number of samples required is consistent between the survey design and the survey results. Based on this assessment, neither changes to the survey design nor additional sampling is required.

Table 2 - Soil sample results for OL13-1

Sample Number	Cs137 pCi/gm
1	<0.14
2	<0.17
3	<0.18
4	0.37
5	<0.14
6	<0.16
7	0.25
8	0.12
9	<0.21
10	<0.15
11	<0.16

12	<0.15
13	0.16
14	<0.14
Mean	0.18
Std Dev	0.07
Min	<0.12
Max	0.37

6.2 Summary for Survey Unit OL13-2

6.2.1 Scan survey

Scan measurements were made in nine grids using a 2 inch by 2 inch NaI detector with an MDCscan of 5.67 pCi/gm (Table 2 on page 3 of appendix A). The action level was 4.84 pCi/gm (Table 1 on page 2 of appendix A) and the adjusted surrogate Cs137 DCGLw for this survey unit was 6.46 pCi/gm (Table 1 on page 2 of appendix A). Since this is a Class 3 impacted survey unit, the EMC does not apply.

Of the 9 grids scanned, portions of three grids were inaccessible due to stands of trees. Of the 9 grids, a total of about 15.2 square meters was not scanned due to interferences, resulting in approximately 884.8 square meters actually scanned in the 8800 square meter survey unit. This is slightly greater than 10 percent of the unit surface area.

The scans conducted in all 9 grids did not identify any activity in the soils greater than the MDCscan. The action level was >160 ncpm. No area greater than 160 ncpm was found in OL13-2.

6.2.2 soil samples

A total of 14 random start, triangular grid, systematic soil sample locations were defined for the survey unit based on a conservative relative shift of about 2.84. One of the samples was not taken due to standing water in the survey unit. Using the typical LBGR of 50% of the DCGL, only 11 samples would have been required, which includes a 20% adjustment. Three additional sample points were included in the total to account for potential interferences. Given the variability used for the survey design (0.44 pCi/gm) and the Action Level of 4.84 pCi/gm, the LBGR used was conservative. No biased samples were required.

None of the design fixed point soil samples in OL13-2 showed activity in excess of the adjusted surrogate DCGLw. The table below (Table 3) shows the Cs137 results (no other licensed isotopes were detected) for each sample along with the mean, standard deviation, and range of the soil sample data. Results that are less than MDA are assumed to be positive at the MDA value for the statistics in the table thereby overestimating the mean.

The standard deviation of the samples collected from the survey unit was less than the variability assumed in the survey design, therefore the assessment of variability, relative shift, and number of samples required is consistent between the survey design and the survey results. Based on this assessment, neither changes to the survey design nor additional sampling is required.

Table 3 - Soil sample results for OL13-2

Sample Number	Cs137 pCi/gm
1	<0.12
2	<0.13
3	<0.13
4	<0.17
5	<0.15
6	<0.13
7	<0.15
8	<0.14
9	*
10	<0.13
11	<0.19
12	<0.16
13	<0.17
14	<0.10
Mean	0.15
Std Dev	0.03
Min	<0.10
Max	0.19

* Sample 9 was not taken as it was located in standing water

6.3 Summary for Survey Unit OL13-3

6.3.1 Scan survey

Scan measurements were made in nine grids using a 2 inch by 2 inch NaI detector with an MDCscan of 5.67 pCi/gm (Table 2 on page 3 of appendix A). The action level was 4.84 pCi/gm (Table 1 on page 2 of appendix A) and the adjusted surrogate Cs137 DCGLw for this survey unit was 6.46 pCi/gm (Table 1 on page 2 of appendix A). Since this is a Class 3 impacted survey unit, the EMC does not apply.

Of the 9 grids scanned, portions of six grids were inaccessible due to stands of trees or, in one case, an electric utility pole. Of the 9 grids, a total of about 1.5 square meters was not scanned due to interferences, resulting in approximately

898.5 square meters actually scanned in the 9000 square meter survey unit. This is slightly less than 10 percent of the unit surface area.

The scans conducted in all 9 grids did not identify any activity in the soils greater than the MDCscan. The action level was >160 ncpm. No area greater than 160 ncpm was found in OL13-3.

6.3.2 soil samples

A total of 14 random start, triangular grid, systematic soil sample locations were defined for the survey unit based on a conservative relative shift of about 2.74. Using the typical LBGR of 50% of the DCGL, only 11 samples would have been required, which includes a 20% adjustment. Three additional sample points were included in the total to account for potential interferences. Given the variability used for the survey design (0.31 pCi/gm) and the Action Level of 4.84 pCi/gm, the LBGR used was conservative. No biased samples were required.

None of the design fixed point soil samples in OL13-3 showed activity in excess of the adjusted surrogate DCGLw. The table below (Table 4) shows the Cs137 results (no other licensed isotopes were detected) for each sample along with the mean, standard deviation, and range of the soil sample data. Results that are less than MDA are assumed to be positive at the MDA value for the statistics in the table thereby overestimating the mean.

The standard deviation of the samples collected from the survey unit was less than the variability assumed in the survey design, therefore the assessment of variability, relative shift, and number of samples required is consistent between the survey design and the survey results. Based on this assessment, neither changes to the survey design nor additional sampling is required.

Table 4 - Soil sample results for OL13-3

Sample Number	Cs137 pCi/gm
1	<0.11
2	<0.10
3	<0.07
4	<0.09
5	<0.12
6	<0.14
7	<0.05
8	<0.13
9	<0.14
10	<0.09
11	<0.13
12	<0.12

13	<0.09
14	0.32
Mean	0.12
Std Dev	0.06
Min	<0.05
Max	0.32

7.0 Data Assessment

7.1 Assessment Criteria

The final status survey data has been reviewed to verify authenticity, appropriate documentation, quality, and technical acceptability. The review criteria for data acceptability are:

- 1) The instruments used to collect the data were capable of detecting the radiation of the radionuclide of interest at or below the investigation levels.
- 2) The calibration of the instruments used to collect the data was current and radioactive sources used for calibration were traceable to recognized standards or calibration organizations.
- 3) Instrument response was checked before and, when required, after instrument use each day data was collected.
- 4) Survey team personnel were properly trained in the applicable survey techniques and training was documented.
- 5) The MDCs and the assumptions used to develop them were appropriate for the instruments and the survey methods used to collect the data.
- 6) The survey methods used to collect the data were appropriate for the media and types of radiation being measured.
- 7) Special instrument methods used to collect data were applied as warranted by survey conditions, and were documented in accordance with an approved site Survey Request procedure.
- 8) The custody of samples that were sent for off-site analysis were tracked from the point of collection until final results were provided.
- 9) The final status survey data consists of qualified measurement results representative of current facility status and were collected in accordance with the applicable survey design package.

If a discrepancy existed where one or more criteria were not met, the discrepancy was reviewed and corrective action taken (as appropriate) in accordance with site procedures.

The statistical test does not need to be performed for this final status survey since the data clearly show that the survey unit meets the release criteria because all measurements in the survey units are less than or equal to the DCGLw; however, the statistical tests (DQA Process) are shown in Appendices B, C, and D.

7.2 Summary of Overall Results

OL13-1 had no alarm points during scan surveys of 10% of the surface. Scan MDCs were adequate. Fourteen soil samples were all less than the DCGLw. Both the scan fraction and number of soil samples meet the LTP and MARSSIM requirements.

OL13-2 had no alarm points during scan surveys of 10% of the surface. Scan MDCs were adequate. Thirteen soil samples were all less than the DCGLw. Both the scan fraction and number of soil samples meet the LTP and MARSSIM requirements.

OL13-3 had no alarm points during scan surveys of slightly less than 10% of the surface. Scan MDCs were adequate. Fourteen soil samples were all less than the DCGLw. Both the scan fraction and number of soil samples meet the LTP and MARSSIM requirements.

7.3 Survey Variations (Design, survey request, LTP)

7.3.1 Approximately 0.7 square meters of the grids scanned for OL13-1 was inaccessible. The remaining scanned portion constituted slightly greater than 10 percent of the survey unit area: well within coverage requirements for class 3 survey units.

7.3.2 Approximately 15.2 square meters of the grids scanned for OL13-2 was inaccessible. Grid AQ101 was scanned instead of AQ100 due to the presence of standing water. The remaining scanned portion constituted slightly greater than 10 percent of the survey unit area: well within coverage requirements for class 3 survey units. Sample point 9, located in grid AP-100, was deleted due to standing water. Both the change in grid scanning and deleting the sample point were approved by the survey design engineer in accordance with Reference 9.8.

7.3.3 Approximately 1.5 square meters of the grids scanned for OL13-3 was inaccessible. The remaining scanned portion constituted slightly less than 10 percent of the survey unit area: well within coverage requirements for class 3 survey units. Sample point 9, located in grid AW-105, was moved approximately

one meter south to avoid guide wires from a utility pole. The sample point movement was approved by the survey design engineer.

7.4 QC comparisons

7.4.1 Scan surveys

Numerous grids were partially rescanned as QC duplicates. The QC rescans did not identify any activity above alarm points and so are in agreement with the primary scans. QC scans were conducted on 60 m² in each survey unit. This represents about 6.0, 6.8, and 6.7 percent of survey units, OL13-1, OL13-2, and OL13-3, respectively and exceeds the minimum 5% required.

7.4.2 Soil Samples

Two soil samples from each of the three survey units received QC split gamma spectroscopy analyses. These duplicates had good agreement as shown in the Table 5 below. Six QC splits out of 41 samples exceeds the 5% minimum criterion.

Table 5 – OL13 QC Split Comparison

Sample Point	Sample Result (pCi/gm)	QC Result (pCi/gm)
OL13-1, SP5	<0.135	<0.146
OL13-1, SP10	<0.147	<0.123
OL13-2, SP3	<0.130	<0.169
OL13-2, SP13	<0.173	<0.163
OL13-3, SP5	<0.094	<0.103
OL13-3, SP5	<0.319	<0.149

8.0 Final Survey Conclusions

The Open Land Areas OL13-1, OL13-2, and OL13-3 final status surveys were performed in accordance with the LTP, site procedures, design calculations, and Survey Request requirements. FSS data was collected to meet and/or exceed the quantity specified or required for each survey unit design. The survey data for each survey unit meets the following conditions:

- 1) The average residual radioactivity in the soils is less than the derived surrogate DCGLw in all three survey units.
- 2) All measurements in all survey units were less than the DCGLw.

These conditions satisfy the release criteria established in the SNEC LTP and the radiological criteria for unrestricted use given in 10CFR20.1402. Therefore it is concluded that the SNEC Open Land Area designated OL13 is suitable for unrestricted release.

9.0 References

- 9.1 SNEC Facility Site area grid map Drawing number SNECRM-020
- 9.2 SNEC procedure E900-ADM-4500.60 "Final Status Survey Report"
- 9.3 SNEC License Termination Plan
- 9.4 NUREG 1575 "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), revision 1 August 2000
- 9.5 SNEC Calculation E900-05-017, "Open Land FSS Design – OL13", Revision 1
- 9.6 COMPASS computer program, Version 1.0.0, Oak Ridge Institute for Science and Education
- 9.7 VISUAL SAMPLE PLAN computer program, Version 3.0, Battelle Memorial Institute
- 9.8 SNEC procedure E900-IMP-4500.59, "Final Site Survey Planning and DQA"
- 9.9 SNEC procedure E900-IMP-4520.04, "Survey Methodology to Support SNEC License Termination"
- 9.10 SNEC SR206 for FSS of OL13-1
- 9.11 SNEC SR207 for FSS of OL13-2
- 9.12 SNEC SR208 for FSS of OL13-3

10.0 Appendices

- Appendix A - SNEC Calculation E900-05-017, "Open Land FSS Design – OL13", Revision 1 (9 pages plus numerous attachments)
- Appendix B - COMPASS DQA Surface Soil Report OL13-1 (2 pages)
- Appendix C - COMPASS DQA Surface Soil Report OL13-2 (2 pages)
- Appendix D - COMPASS DQA Surface Soil Report OL13-3 (2 pages)