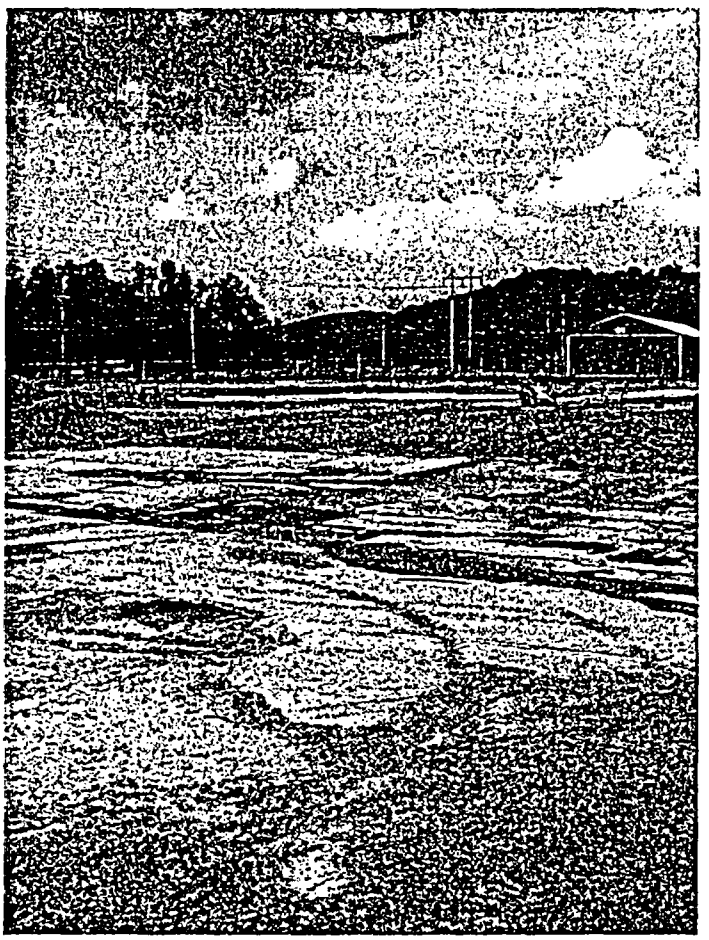
Final Status Survey Report

For

Saxton Nuclear Experimental Corporation
Open Land Area OL1



Prepared by GPU Nuclear, Inc.

July 2005

Table Of Contents

Executive Summary

This report presents the results and conclusions of the final status survey (FSS) of the Class 1 open land areas around the Saxton Nuclear Experimental Corporation (SNEC) facility designated as OL1. This FSS report includes surveys of open land areas primarily in the original SNEC site area but also includes open land around the Penelec line shack and the Saxton Steam Generating Station. The surveys were conducted in June of 2005.

The FSS was performed in accordance with the SNEC License Termination Plan (LTP) (reference 9.3). The survey area (OL1) was divided into multiple survey units. Six units (OL1-8 through OL1-13) consisted of relatively flat open land and are included in this report. Multiple survey units of residual macadam and concrete as well as the survey for the east yard excavation are reported elsewhere. 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 one-hundred 100 square meter grids covering about 100% of the actual land area

2) Ninety-six soil samples collected from seventy-eight random and biased selected locations and then analyzed by laboratory gamma spectroscopy plus one additional sub-surface sample

Three alarm point areas were identified during NaI soil scanning. The alarm points were extensively sampled and all sample results were less than the DCGLw.

The collected FSS survey data demonstrate that the 8300 square meters of soil of the OL1 survey area open land meet 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 OL1 including surveys of open land areas primarily in the original Saxton Nuclear Experimental Corporation (SNEC) site area, open land around the Penelec line shack, and open land around the Saxton Steam Generating Station. 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 six Class 1 survey units of open land surface. This report only addresses the FSS performed on these specific open land areas designated as OL1 on reference 9.1 derived from reference 9.3 table 5-2. FSS results of additional areas in OL1 consisting of concrete and macadam surfaces and the survey unit for the east yard excavation are provided in separate reports. The format of this report follows the guidance contained in reference 9.2.

2.0 Survey Area Description

Survey Area OL1 consists of the area of the original SNEC one acre site, soil areas immediately around the Penelec line shack, and the northern portion of the Saxton Steam Generating Station (SSGS). This report addresses six survey units of the SNEC site and areas adjacent to the SNEC site to the east and west. The survey area encompasses about 8300 square meters of open land in 100 grids. Because the area exceeds the size guidance in the SNEC LTP for Class 1 soil survey units (up to 2000 square meters recommended), the survey area was divided into six open land survey units. Layout of the survey area and individual units relative to the site layout are shown in Attachment 1 of Appendices A and B. The six survey units are discussed below. They are all Class 1 impacted survey units.

Approximately 200 square meters of the area shown as OL1 and highlighted as Class 1 on reference 9.1 is within the switchyard fence. OL1 area definition was intended to be bounded by the switchyard fence and reference 9.1 reflects difficulties in layout rather than changes in classification. Those areas inside the switchyard fence that appear on reference 9.1 to be part of OL1 were surveyed with the switchyard survey area as intended and are reported with the switchyard area survey as part of survey units PS4-1 and PS4-2. The OL1 designation is taken from the drawing, reference 9.1.

This report begins at unit OL1-8. Survey unit OL1-7 was assigned to the east yard excavation and was separately reported (reference 9.15. Survey units OL1-1 to OL1-6 were assigned to CV exterior surveys and excavations around and

near the containment vessel (CV). The FSS results for these survey units will be provided in a separate report(s).

Survey unit OL1-8 is an open land area in the central section of the site. It is immediately adjacent to and west of the original SNEC site area. The survey unit is the west portion of the survey area. Initial design estimated approximately 1448 square meters of open land contained in all or part of 20 grids. Residual concrete and macadam cover the remainder of the 20 grid area. An additional soil area of about 86 square meters was surveyed which consisted of small soil areas as holes in the concrete pad. Small portions of the northernmost five grids are part of the switchyard survey area. The survey area boundary is the fence rather than the gridline. The OL1-8 survey layout was added to the survey area design by revision 1 of the survey design (appendix B) but the survey parameters (e.g. DCGLs, MDCs) were those from the initial, revision 0 of the design. Appendix B contains drawings (Attachments 1-2 and 6-1) showing the layout of the survey unit.

Survey unit OL1-9 is an open land area in the central section of the site. It consists of the northwest portion of the original SNEC site and includes the area where the CV was located. The survey unit is approximately 1300 square meters of open land. A small area within OL1-9 is residual concrete surface and FSS of this portion is reported separately. One entire grid and portions of three others shown as part of OL1 on reference 9.1 are actually part of the switchyard survey area and not a part of OL1-9. These areas are within the switchyard fence and were surveyed with and will be reported with the switchyard survey. Small portions of two grids (BA129 and BA130) not initially in the survey design were added because they were actually outside of the switchyard fence and had not been surveyed as part of switchyard unit PS4-1. Appendix A contains drawings (Attachments 1-3 and 6-3) showing the layout of the survey unit.

Survey unit OL1-10 is an open land area in the central section of the site. It consists of the northeast portion of the original SNEC site and includes the area where the east yard excavation, pipe tunnel, and the north portion of the RadWaste Disposal Facility (RWDF) were located. The survey unit is 1200 square meters of open land. Appendix A contains drawings (Attachments 1-4 and 6-5) showing the layout of the survey unit.

Survey unit OL1-11 is an open land area in the central section of the site. It consists of the southeast portion of the original SNEC site and includes the area where the radwaste barrel storage bunker and the south portion of the RWDF were located. The survey unit is 1200 square meters of open land. Appendix A contains drawings (Attachments 1-5 and 6-7) showing the layout of the survey unit.

Survey unit OL1-12 is an open land area in the central section of the site. It consists of the open land around the existing Penelec line department building

('line shack') east of the original SNEC site. The line shack and concrete and macadam paved surfaces are not included in the unit and are separately reported. The survey unit is approximately 1575 square meters of open land. Appendix A contains drawings (Attachments 1-6 and 6-9) showing the layout of the survey unit.

Survey unit OL1-13 is an open land area in the central section of the site. It consists of the open land generally in the southern portion of the original SNEC site along the south border of OL1 with OL3 and around the remaining Dismantlement Support Building (DSB) pad. The DSB pad and concrete and macadam paved surfaces are not included in the unit and are separately reported. The survey unit is approximately 1540 square meters of open land. An additional soil area of about 60 square meters was surveyed which consisted of small soil areas as holes in the macadam areas. Appendix A contains drawings (Attachments 1-7 and 6-11) 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. Steam from the SNEC reactor was directed to the adjacent Saxton Steam Generating Station (SSGS) to generate electricity. 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

OL1 is an open land area that has been extensively excavated for remediation in several campaigns. Activity greater than the DCGLw was present in the soil in multiple locations throughout the survey area. Extensive excavations took place around the CV, to remove underground tanks (the east yard excavation), and to remove the barrel bunker. Additional excavations removed contaminated soils and other subsurface equipment.

4.0 Site Release Criteria

The site release criteria applied to the open land of OL1 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 were derived by analyses using a resident farmer family scenario for the open land. 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 for soil concentrations and concrete surface activity. The adjusted surrogate DCGLs were 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 DCGLs 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 and DQO

The SNEC calculations providing the design of the survey for these survey units are provided in Appendix A, Appendix B, and Appendix C. Since all six of the soil survey units were Class 1, scan measurements were conducted over approximately 100% of the surface of each of the soil survey units. The number of sample points was determined by using the COMPASS computer program (reference 9.5 and attachment 7 of appendices A and B). These points were located on survey maps using the Visual Sample Plan program (reference 9.6 and attachment 6 of appendices A and B).

The survey design uses a surrogate Cs137 effective DCGL developed from radionuclide mix analyses from soil samples collected before the Final Status Survey in the vicinity of the survey unit. For all of survey area OL1 the mix was based on radionuclide mix data (including the hard-to-detects listed in Table 5-1 of the LTP) from samples from OL1 and OL2 (attachment 2 of appendix A).

Cs137, Co60, H3, and Sr90 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	OL1-8, OL1-9, OL1-10, OL1-11, OL1-12, OL1-13
SNEC Design Calc. #	E900-05-014
MARSSIM Classification	1
Survey Unit Area (m^2)	1534,1290,1200,1200,1575,1540
Statistical Test	Sign
Type 1 decision error (α)	0.05
Type 2 decision error (β)	0.1
LBGR (pCi/gm)	3.4
Estimated σ (pCi/gm)	0.3
Relative Shift (Δ/σ)*	3.0
Number of static points	18, 11, 11, 11, 11, 16
DCGLw (Cs137 pCi/gm)	5.73
75% Administrative Limit(pCi/gm)	4.3
Scan MDC (pCi/gm)	6.2
SNEC Survey Request #	SR240, SR241, SR242, SR243, SR244, SR245
Scan Survey Instrument	L2350-1 w/ 44-10

* Uses the Admin Limit rather than the DCGLw

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 9,9, 9.10, 9.11, 9.12, 9.13, and 9.14 which are filed in the SNEC history files.

6.1 Survey Unit OL1-8

6.1.1 Scan survey

Scan measurements were made in all or part of 18 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 6.2 pCi/gm (attachment 4 of appendix A). portions of the survey area were not scanned because they were reassigned to PS4-2 or were residual concrete and macadam surfaces. Two grids of the 20 in the area were entirely residual concrete. The scan 75% administrative limit was 4.3 pCi/gm and the adjusted surrogate Cs137 DCGLw for this survey unit was 5.73 pCi/gm (table 1, page 3 of appendix A). The area factor can be used to compare the MDCscan to the 75% administrative limit. In this case, the MDCscan was below the 75% administrative limit times the limiting area factor so no sample number adjustment was needed.

Some of the soil areas, particularly in the northwest portion of the survey unit (grids AX135, AY135, AX134, AY134, AX133, and AY133) consisted of relatively thin layers of recent soil cover (about 6 inches thick) over residual concrete. The soils in these areas were scanned and sampled prior to removal to allow survey of the residual concrete. Results for the scanning and sampling of the soil in these areas are included here.

Of the 20 full or partial grids in the survey unit there were soil areas in 18. All of the soil area was scanned. In addition, there were several small areas of soil within the large concrete pad in the southern portion of the survey unit. About 86 square meters of additional soil area was scanned. This results in approximately 1534 square meters actually scanned in the 1534 square meter survey unit. This represents 100 percent scan coverage.

The scans conducted in the 18 soil grids did not identify any activity in the soils greater than the MDCscan. The action level was >175 net cpm (table 2, page 3 of appendix A). No area greater than 175 net cpm was found in OL1-8.

6.1.2 Fixed point soil samples

Eighteen soil sample locations were defined for the survey unit, based on a conservative relative shift of about 3.0. The number of samples was increased because of uncertainty in the soil layout and underlying concrete, presence of

concrete under some thin soil layers, and to force sample points in all of the larger separate soil areas.

None of the design fixed point soil samples in OL1-8 had results in excess of the adjusted surrogate 75% administrative limit. 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. Two samples were collected from sample point 3. The higher of the two results is reported here. Results that are less than MDA are assumed to be positive at the MDA value for the statistics in the table. This will overestimate 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, no changes to the survey design or additional samples are required.

Table 2 - Soil sample results for OL1-8

Sample Number	Cs137 pCi/gm
1	<0.10
2	0.15
3	0.09
4	<0.08
5	0.19
6	0.50
7	<0.06
8	<0.07
9	<0.16
10	0.07
11	<0.10
12	<0.09
13	<0.09
14	<0.07
15	0.11
16	<0.12
17	<0.09
18	0.06
Mean	0.12
Std Dev	0.10
Min	0.06
Max	0.50

6.2 Survey Unit OL1-9

6.2.1 Scan survey

Scan measurements were made in all or part of 16 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 6.2 pCi/gm (attachment 4 of appendix A). The initial design included 14 grids. Small portions of two grids (BA129 and BA130) totaling about 16 square meters were added to the survey unit based on field observation of the layout of the switchyard fence in those grids. Portions of the survey area were not scanned because they were reassigned to PS4-1 or were residual concrete and macadam surfaces. The scan 75% administrative limit was 4.3 pCi/gm and the adjusted surrogate Cs137 DCGLw for this survey unit was 5.73 pCi/gm (table 1, page 3 of appendix A). The area factor can be used to compare the MDCscan to the 75% administrative limit. In this case, the MDCscan was below the 75% administrative limit times the limiting area factor so no sample number adjustment was needed.

Some of the soil areas, particularly in the west portion of the survey unit (grids AX131 and AY131) consisted of relatively thin layers of recent soil cover (about 6 inches thick) over residual concrete. The soils in these areas were scanned and sampled prior to removal to allow survey of the residual concrete. Results for the scanning and sampling of the soil in these areas are included here.

Of the 16 full or partial grids in the survey unit all of the soil area was scanned. This results in approximately 1300 square meters actually scanned in the 1300 square meter survey unit. This represents 100 percent scan coverage.

The scans conducted in the 16 soil grids did not identify any activity in the soils greater than the MDCscan. The action level was >175 net cpm (table 2, page 3 of appendix A). No area greater than 175 net cpm was found in OL1-9.

6.2.2 Fixed point soil samples

Eleven soil sample locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point soil samples in OL1-9 had results in excess of the adjusted surrogate 75% administrative limit. 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. This will overestimate 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, no changes to the survey design or additional samples are required.

Table 3 - Soil sample results for OL1-9

Sample Number	Cs137 pCi/gm
1	<0.07
2	<0.08
3	<0.09
4	1.00
5	<0.11
6	<0.14
7	0.26
8	<0.13
9	<0.12
10	<0.11
11	0.45
Mean	0.23
Std Dev	0.28
Min	<0.07
Max	1.00

6.3 Survey Unit OL1-10

6.3.1 Scan survey

Scan measurements were made in all of 12 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 6.2 pCi/gm (attachment 4 of appendix A). The scan 75% administrative limit was 4.3 pCi/gm and the adjusted surrogate Cs137 DCGLw for this survey unit was 5.73 pCi/gm (table 1, page 3 of appendix A). The area factor can be used to compare the MDCscan to the 75% administrative limit. In this case, the MDCscan was below the 75% administrative limit times the limiting area factor so no sample number adjustment was needed.

A portion of this survey unit consisted of backfill soils placed into the east yard excavation. An FSS report on the backfill soils is provided separately but the survey of OL1-10 included the backfill area for completeness.

Of the 12 grids in the survey unit all of the soil area was scanned. This results in approximately 1200 square meters actually scanned in the 1200 square meter survey unit. This represents 100 percent scan coverage.

The scans conducted the 12 soil grids did not identify any activity in the soils greater than the MDCscan. The action level was >175 net cpm (table 2, page 3 of appendix A). No area greater than 175 net cpm was found in OL1-10.

6.3.2 Fixed point soil samples

Eleven soil sample locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point soil samples in OL1-10 had results in excess of the adjusted surrogate 75% administrative limit. 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. This will overestimate the mean.

The standard deviation of the samples collected from the survey unit was greater than the variability assumed in the survey design. The LBGR assumed in the survey design was conservative and much higher than the typical 50% of the DCGL. The slightly higher variability observed in the survey unit, combined with a slightly less conservative LBGR would still result in a relative shift of 3. 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, no changes to the survey design or additional samples are required.

Table 4 - Soil sample results for OL1-10

Sample Number	Cs137 pCi/gm
1	0.33
2	0.17
3	0.17
4	0.31
5	0.25
6	0.26
7	0.12
8	0.21
9	0.25
10	<0.06
11	1.3
Mean	0.31
Std Dev	0.34
Min	<0.06
Max	1.3

6.4 Survey Unit OL1-11

6.4.1 Scan survey

Scan measurements were made in all of 12 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 6.2 pCi/gm (attachment 4 of appendix A). The scan 75% administrative limit was 4.3 pCi/gm and the adjusted surrogate Cs137 DCGLw for this survey unit was 5.73 pCi/gm (table 1, page 3 of appendix A). The area factor can be used to compare the MDCscan to the 75% administrative limit.

In this case, the MDCscan was below the 75% administrative limit times the limiting area factor so no sample number adjustment was needed.

Of the 12 grids in the survey unit all of the soil area was scanned. This results in approximately 1200 square meters actually scanned in the 1200 square meter survey unit. This represents 100 percent scan coverage.

The scans conducted in one of the grids (AU125) did identify activity in the soils greater than the action level. The action level was >175 net cpm. One alarm point was found which measured about 346 cpm. This exceeded the background plus the action level. The remainder of survey unit OL1-11 was less than the action level.

6.4.2 Fixed point soil samples

Eleven soil sample locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point soil samples in OL1-11 had results in excess of the adjusted surrogate 75% administrative limit. The table below (Table 5) 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. This will overestimate the mean.

The standard deviation of the samples collected from the survey unit was greater than the variability assumed in the survey design. The LBGR assumed in the survey design was conservative and much higher than the typical 50% of the DCGL. The slightly higher variability observed in the survey unit, combined with a slightly less conservative LBGR would still result in a relative shift of 3. 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, no changes to the survey design or additional samples are required.

Table 5 - Soil sample results for OL1-11

Sample Number	Cs137 pCi/gm
1	<0.06
2	<0.06
3	<0.12
4	<0.08
5	0.10
6	0.11
7	<0.11
8	1.10
9	0.30
10	<0.08
11	0.37
Mean	0.23
Std Dev	0.31
Min	<0.06
Max	1.10

6.4.3 Elevated measurement investigation

During scan measurements in OL1-11 grid AU125, one alarm point (in excess of the action level of 175 net cpm) was identified. The bounded area was small. An area of about 0.1 square meter was defined around the alarm points to the edge where the count rate was back down to normal background. This 0.1 square meter, therefore is not all at the elevated activity of the alarm point (AP) but represent the area needed for the count rate to be unaffected by the elevated spot.

In order to assess the residual radioactivity in the elevated measurement areas, a sample was collected exactly at the AP location. The table below (Table 6) shows the Cs137 results (no other licensed isotopes were detected) of this sample.

Table 6 – OL1-11 elevated area investigation sampling

Sample location	Activity (pCi/gm)
AP	0.22

The AP soil sample result was well below the 75% administrative limit. Since the result of the AP soil sample is consistent with the survey unit sample range from Table 5 of <0.06 to 1.10 pCi/g and does not exceed the 75% administrative limit, no elevated measurement comparison test is required.

6.5 Survey Unit OL1-12

6.5.1 Scan survey

Scan measurements were made in all or part of 19 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 6.2 pCi/gm (attachment 4 of appendix A). The scan 75% administrative limit was 4.3 pCi/gm and the adjusted surrogate Cs137 DCGLw for this survey unit was 5.73 pCi/gm (table 1, page 3 of appendix A). The area factor can be used to compare the MDCscan to the 75% administrative limit. In this case, the MDCscan was below the 75% administrative limit times the limiting area factor so no sample number adjustment was needed.

Of the 19 grids in the survey unit all of the soil area was scanned except for a small portion of about 8 square meters blocked by bushes. Portions of 7 grids included concrete or macadam pavements and the Penelec line department building ('line shack'). This results in approximately 1567 square meters actually scanned in the 1575 square meters of soil in the survey unit. This represents 99.5 percent scan coverage and 100 percent of the accessible area.

The scans conducted in one of the grids (AY121) did identify activity in the soils greater than the action level. The action level was >175 net cpm. Two alarm points within a single elevated area were found which measured 304 and 306 cpm. These exceeded the background plus the action level. The remainder of survey unit OL1-12 was less than the action level.

6.5.2 Fixed point soil samples

Eleven soil sample locations were defined for the survey unit, based on a conservative relative shift of about 3.0. Because of the gravel of the roadways, sample points that fell on the gravel roads had two samples collected, one from the gravel layer, and one from the soil layer below the gravel down to 1 meter. In addition, three biased soil sample locations were selected. These were located because of the presence of a narrow strip of undisturbed soil between the line shack and the remediated area in OL1-11 and because of the potential for contamination transfer in the travel path in the gravel roads present in the survey unit. Twenty-two soil samples were collected from the eleven random and three biased locations.

None of the design fixed point soil samples in OL1-12 had results in excess of the adjusted surrogate 75% administrative limit. The table below (Table 7) 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. In those locations where samples were collected from both the gravel and soil layers, the highest result of the two is reported. Results that are less than MDA are assumed to be positive at the MDA value for the statistics in the table. The biased point results are listed but are not included in the sample statistics.

Inclusion of MDA values as positive and selecting the highest of the double samples will overestimate the mean.

The standard deviation of the samples collected from the survey unit was greater than the variability assumed in the survey design. The LBGR assumed in the survey design was conservative and much higher than the typical 50% of the DCGL. The slightly higher variability observed in the survey unit, combined with a slightly less conservative LBGR would still result in a relative shift of 3. 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, no changes to the survey design or additional samples are required.

Table 7 - Soil sample results for OL1-12

Sample Number	Cs137 pCi/gm
1	0.16
2	0.11
3	1.19
4	<0.08
5	<0.15
6	0.25
7	0.21
8	0.19
9	<0.09
10	0.62
11	0.11
Mean	0.29
Std Dev	0.33
Min	<0.08
Max	1.19
Biased 1	0.33
Biased 2	0.18
Biased 3	0.12

6.5.3 Elevated measurement investigation

During scan measurements in OL1-12 grid AY121, two alarm points (in excess of the action level of 175 net cpm) were identified close together in a single elevated area. The bounded area of about 10 square meters was defined around the alarm points to the edge where the count rate was back down to normal background. This 10 square meters, therefore is not all at the elevated activity of the alarm points (APs) but represents the area needed for the count rate to be unaffected by the elevated spot.

In order to assess the residual radioactivity in the elevated measurement area, a sample was collected exactly at each AP location. In addition, in order to demonstrate that the elevated area was adequately bounded by the 10 square

meter area, three samples were collected at the edge of the area boundary. Because this elevated area was in a gravel roadway, separate samples were collected of the gravel and the soil beneath down to 1 meter. The table below (Table 8) shows the Cs137 results (no other licensed isotopes were detected) of this samples.

Table 8 – OL1-12 elevated area investigation sampling

Sample location	Activity (pCi/gm)
AP1 gravel	<0.11
AP1 soil	<0.09
AP2 gravel	<0.05
AP2 soil	<0.11
Boundary 1 gravel	<0.07
Boundary 1 soil	<0.15
Boundary 2 gravel	<0.09
Boundary 2 soil	<0.11
Boundary 3 gravel	<0.08
Boundary 3 soil	<0.12

The results of the soil samples at the APs were well below the 75% administrative limit. Since results of the AP soil samples and the boundary samples are consistent with the survey unit sample range from Table 7 of <0.08 to 1.19 pCi/g and do not exceed the 75% administrative limit, no elevated measurement comparison test is required.

6.6 Survey Unit OL1-13

6.6.1 Scan survey

Scan measurements were made in all or part of 23 grids using a 2 inch by 2 inch NaI detector with an MDCscan of 6.2 pCi/gm (attachment 4 of appendix A). The scan 75% administrative limit was 4.3 pCi/gm and the adjusted surrogate Cs137 DCGLw for this survey unit was 5.73 pCi/gm (table 1, page 3 of appendix A). The area factor can be used to compare the MDCscan to the 75% administrative limit. In this case, the MDCscan was below the 75% administrative limit times the limiting area factor so no sample number adjustment was needed.

Of the 23 grids in the survey unit all of the soil area was scanned. Portions of 15 grids included concrete or macadam pavements. In addition, there were several small areas of soil within the large concrete pad in the southern portion of the survey unit. About 60 square meters of additional soil area was scanned. This results in approximately 1540 square meters actually scanned in the 1540 square meters of soil in the survey unit. This represents 100 percent scan coverage.

The scans conducted in one of the grids (AW129) did identify activity in the soils greater than the action level. The action level was >175 net cpm. One alarm point was found which measured 277 cpm. This exceeded the background plus the action level. The remainder of survey unit OL1-13 was less than the action level.

6.6.2 Fixed point soil samples

Sixteen soil sample locations were defined for the survey unit, based on a conservative relative shift of about 3.0. The number of samples was increased because of uncertainty in the soil/concrete layout and to force sample points in all of the larger separate soil areas. Because of the presence of gravel on and near the roadways, sample points that fell on the gravel had two samples collected, one from the gravel layer, and one from the soil layer below the gravel down to 1 meter.

None of the design fixed point soil samples in OL1-13 had results in excess of the adjusted surrogate 75% administrative limit. The table below (Table 9) 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. In those locations where samples were collected from both the gravel and soil layers, the highest result of the two is reported. Results that are less than MDA are assumed to be positive at the MDA value for the statistics in the table. Inclusion of MDA values as positive and selecting the highest of the double gravel area samples will overestimate 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, no changes to the survey design or additional samples are required.

Table 9 - Soil sample results for OL1-13

Sample Number	Cs137 pCi/gm
1	0.25
2	<0.09
3	<0.08
4	0.30
5	0.40
6	0.55
7	0.54
8	0.36
9	0.19
10	<0.12
11	<0.12
12	0.08
13	0.12
14	0.11
15	<0.08
16	<0.08
Mean	0.22
Std Dev	0.17
Min	<0.08
Max	0.55

6.6.3 Elevated measurement investigation

During scan measurements in OL1-13 grid AW129, one alarm point (in excess of the action level of 175 net cpm) was identified. The bounded area of about 0.2 square meters was defined around the alarm point to the edge where the count rate was back down to normal background. This 0.2 square meters, therefore is not all at the elevated activity of the alarm point (AP) but represents the area needed for the count rate to be unaffected by the elevated spot.

In order to assess the residual radioactivity in the elevated measurement area, a sample was collected exactly at the AP location. In addition, in order to demonstrate that the elevated area was adequately bounded by the 0.2 square meter area, three samples were collected at the edge of the area boundary at about 2 feet from the alarm point location. The table below (Table 10) shows the Cs137 results (no other licensed isotopes were detected) of this samples.

Table 10 – OL1-13 elevated area investigation sampling

Sample location	Activity (pCi/gm)
AP	0.07
Boundary 1	0.27
Boundary 2	0.29
Boundary 3	0.09

The results of the soil samples at the AP and from the boundary were well below the 75% administrative limit. Since results of the AP soil sample and the boundary samples are consistent with the survey unit sample range from Table 9 of <0.08 to 0.55 pCi/g and do not exceed the 75% administrative limit, no elevated measurement comparison test is required.

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.

7.2 Summary of Overall Results

OL1-8 had no alarm points during scan surveys of 100% of the soil surface. Scan MDCs were adequate. Eighteen triangular grid random start soil samples were all less than the DCGLw. Scan fraction and number of soil samples meets LTP and MARSSIM requirements.

OL1-9 had no alarm points during scan surveys of 100% of the soil surface. Scan MDCs were adequate. Eleven triangular grid random start soil samples were all less than the DCGLw. Scan fraction and number of soil samples meets LTP and MARSSIM requirements.

OL1-10 had no alarm points during scan surveys of 100% of the soil surface. Scan MDCs were adequate. Eleven triangular grid random start soil samples were all less than the DCGLw. Scan fraction and number of soil samples meets LTP and MARSSIM requirements.

OL1-11 had one alarm point in grid AU125. The alarm point location was sampled and shown to be less than the DCGLw. Therefore, no elevated measurement test is required. The OL1-11 survey unit area had scan surveys of 100% of the soil surface. Scan MDCs were adequate. Eleven triangular grid random start soil samples were all less than the DCGLw. Scan fraction and number of soil samples meets LTP and MARSSIM requirements.

OL1-12 had two alarm points close together in a single elevated area in grid AY121. The alarm point area was extensively sampled and shown to be less than the DCGLw. Therefore, no elevated measurement test is required. The OL1-12 survey unit area had scan surveys of 99.5% of the soil surface which constitutes 100% of the accessible soil surface. Scan MDCs were adequate. Soil

samples from eleven triangular grid random start sample locations and three biased sample locations were all less than the DCGLw. Scan fraction and number of soil samples meets LTP and MARSSIM requirements.

OL1-13 had one alarm point in grid AW129. The alarm point area was extensively sampled and shown to be less than the DCGLw. Therefore, no elevated measurement test is required. The OL1-13 survey unit area had scan surveys of 100% of the soil surface. Scan MDCs were adequate. Soil samples from sixteen triangular grid random start sample locations were all less than the DCGLw. Scan fraction and number of soil samples meets LTP and MARSSIM requirements.

7.3 Survey Variations

7.3.1 There were several small areas of soil within the large concrete pad in the southern portion of survey unit OL1-8. Some embedded soil areas were expected in the design but specific area and layout were not specifically known in advance of the survey. About 86 square meters of additional soil area was scanned.

7.3.2 Several soil samples were not collected to the full 1 meter depth because the soil was an overburden on top of residual concrete. This was expected in the design of the surveys. The samples were from OL1-8 (points 13, 14, 15, 16, and 18) and OL1-9 (point 11),

7.3.3 Small portions of two grids (BA129 and BA130) totaling about 16 square meters were added to survey unit OL1-9. This two grid areas were small strips of soil outside of the switchyard fence. These majority of these grids was surveyed with the switchyard. The small area outside the fence was added to OL1-9 to ensure complete grid coverage.

7.3.4 There were several small areas of soil within the macadam in the south western portion of survey unit OL1-13. Some embedded soil areas were expected in the design but specific area and layout were not specifically known in advance of the survey. About 61 square meters of additional soil area was scanned.

7.3.5 Sample point 11 in OL1-13 was moved slightly to place it on soil. The original design resulted in locating the sample point on residual concrete surface.

7.4 QC comparisons

<u>7.4.1 Scan surveys</u>

Numerous areas were partially rescanned as QC duplicates. The QC rescans were consistent with the primary scans because the conclusion that the survey unit passes is supported by both the initial and QC results (reference 9.8). Approximately 480 square meters were QC scanned out of the 8300 square meters in the primary scans of the six soil survey units. This represents 5.9 percent of the area scanned. This exceeds the minimum 5% QC requirement.

A QC rescan was conducted on one of the alarm points (AP1) in OL1-12. There was good agreement between the two scan results as shown in table 6 below because the conclusion that the survey unit passes is supported by both the initial and QC results (reference 9.8). The QC rescan, however, would not have identified the area as an alarm point. The original scan was 177 net cpm, with an alarm level of >175. Resurvey with a different survey instrument at a different time, with different background and efficiency would be expected to result in slightly different results. With the alarm point essentially equal to the action level at the scan MDC, it is not considered to be a failure that the rescan did not identify the alarm point.

Table 11 – OL1 Soil QC Scan comparison

Sample Point	Scan Result (cpm)	QC Result (cpm)
OL1-12 AP1	304	239

7.4.2 Soil Samples

One sample each from the OL1-8, OL1-9, OL1-10, OL1-11, and OL1-13 and two samples from the OL1-12 survey designs received QC split gamma spectroscopy analyses on the soil samples. These duplicates had good agreement as shown in the table below (Table 12) because the conclusion that the survey unit passes is supported by both the initial and QC results (reference 9.8). Nine QC splits out of 111 samples (96 from 78 design locations and 15 from sampling for three alarm points) represents 8.1% of the samples. This exceeds the 5% minimum criterion.

Table 12 – OL1 Soil QC Split comparison

Sample Point	Sample Result (pCi/gm)	QC Result (pCi/gm)
OL1-8 10	0.07	0.10
OL1-9 3b	<0.12	<0.13
OL1-10 9	0.25	0.29
OL1-11 5	0.10	0.10
OL1-12 bias 2b	<0.12	<0.11
OL1-12 7	0.21	0.16
OL1-13 3b	<0.08	<0.07
OL1-11 AP	0.22	0.20
OL1-13 AP boundary 3	0.09	0.09

8.0 Final Survey Conclusions

The Open Land Areas OL1-8, OL1-9, OL1-10, OL1-11, OL1-12, and OL1-13 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 six survey units.

2) All measurements were less than the DCGLw in all six of the survey units.

3) Samples collected for investigation of alarm points in the OL1-11, OL1-12, and OL1-13 survey units were all 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 OL1 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 COMPASS computer program, Version 1.0.0, Oak Ridge Institute for Science and Education
9.6 VISUAL SAMPLE PLAN computer program, Version 3.0, Battelle Memorial Institute
9.7 SNEC procedure E900-IMP-4500.59, "Final Site Survey Planning and DQA"
9.8 SNEC procedure E900-IMP-4520.04, "Survey Methodology to Support SNEC License Termination"
9.9 SNEC Survey Request (SR) # SR240 for FSS of OL1-8
9.10 SNEC Survey Request (SR) # SR241 for FSS of OL1-9
9.11 SNEC Survey Request (SR) # SR242 for FSS of OL1-10
9.12 SNEC Survey Request (SR) # SR243 for FSS of OL1-11
9.13 SNEC Survey Request (SR) # SR244 for FSS of OL1-12
9.14 SNEC Survey Request (SR) # SR245 for FSS of OL1-13
9.15 GPU Nuclear Letter E910-05-019, dated 06/08/2005, "FSS Report for East Yard Excavation OL1-7"

10.0 Appendices

Appendix A - SNEC Calculation E900-05-014 "SNEC Plant Area Open Land OL1 – Survey Design" (11 pages plus numerous attachments up to attachment 9)
Appendix B - SNEC Calculation E900-05-014 "SNEC Plant Area Open Land OL1 – Survey Design" (11 pages plus numerous attachments up to attachment 9) Revision 1
Appendix C - SNEC Calculation E900-05-014 "SNEC Plant Area Open Land OL1 – Survey Design" (11 pages plus numerous attachments up to attachment 9) Revision 2
Appendix D - COMPASS DQA report for OL1-8 (2 pages)
Appendix E - COMPASS DQA report for OL1-9 (2 pages)
Appendix F - COMPASS DQA report for OL1-10 (2 pages)
Appendix G - COMPASS DQA report for OL1-11 (2 pages)
Appendix H - COMPASS DQA report for OL1-12 (2 pages)
Appendix I - COMPASS DQA report for OL1-13 (2 pages)