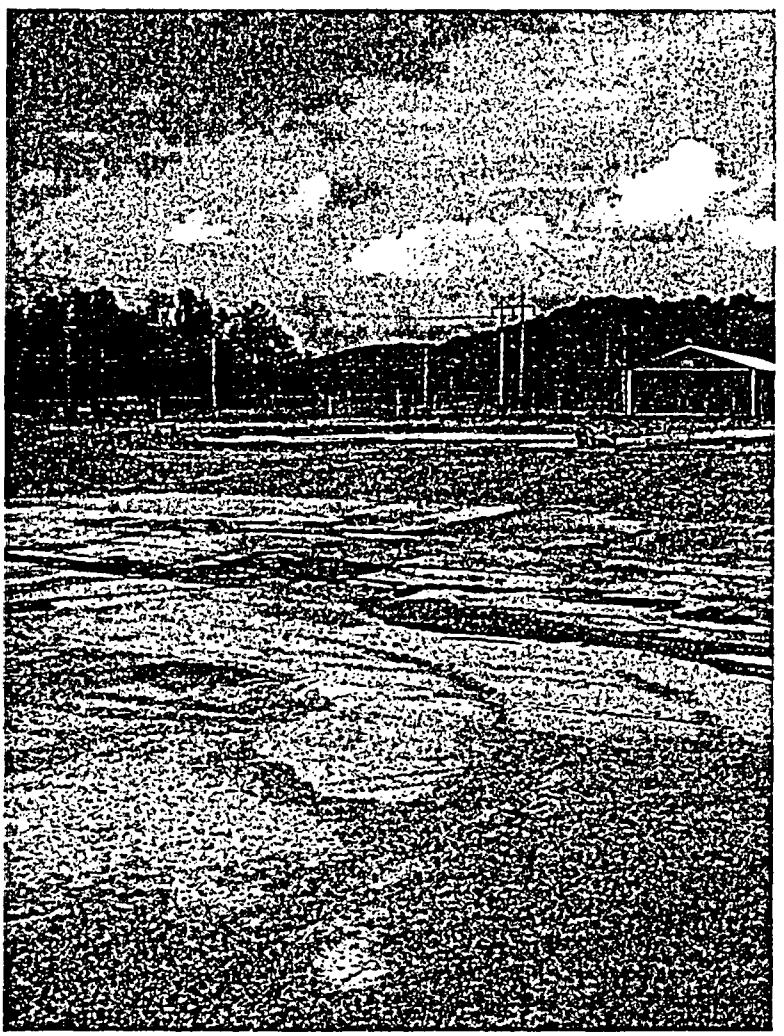
Final Status Survey Report

For

Saxton Nuclear Experimental Corporation
Residual Concrete in OL1



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Executive Summary

This report presents the results and conclusions of the final status survey (FSS) of the Class 1, 2, and 3 concrete surfaces of the Saxton Nuclear Experimental Corporation (SNEC) facility designated as numerous units in the OL1 area. This FSS includes surveys of residual concrete surfaces throughout the OL1 area of the SNEC site and soil sampling around and under the largest concrete pad. The survey was conducted in June of 2005.

The FSS was performed in accordance with the SNEC License Termination Plan (LTP). The concrete portions of the survey area were divided into nine survey units. Each of these units consisted of relatively flat residual concrete surfaces. 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 Gas Flow Proportional Counter (GFPC) scans of all or part of the concrete surfaces in 34 grids covering about 50% of the actual surface area
2) One hundred and twelve fixed point static GFPC measurements.
3) Eleven soil samples

The collected FSS survey data demonstrate that the approximately 1580 square meters of the concrete surfaces in the OL1 survey area 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 residual concrete throughout the OL1 area of SNEC facility. Survey units MA8-14, MA8-15, SS12, SS24-1, SS24-2, PF1, DB5, DB1-1, and DB1-2 are included. This report 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 five Class 1, one Class 2, and three Class 3 survey units of residual concrete. This report only addresses the FSS performed on this specific portion of the area designated as OL1. The format of this report follows the guidance contained in reference 9.2.

2.0 Survey Area Description

Survey Area OL1 is primarily the area including and surrounding the original SNEC facility, surrounding the Penelec line building (the 'line shack'), and the northern half of the Saxton Steam Generating Station (SSGS) footprint. The five concrete survey units in the original SNEC area are designated as Class 1. The concrete around the line shack is Class 2, and the exposed concrete of the SSGS is Class 3. The reference 9.1 map shows the designations of the soil areas of the OL1 survey area. Table 5-2 of reference 9.3 is used as the basis of the classification of the Class 2 and 3 areas. The survey unit encompasses about 1580 square meters of concrete surface within 34 grids of the larger OL1 area. Some OL1 grids did not contain any concrete surfaces. Layout of the survey area and individual units relative to the site layout are shown in Attachment 1 of Appendix A. The nine survey units are discussed below. The survey unit designations are derived from the sequence provided in table 5-2 of the SNEC LTP (reference 9.3).

Survey unit MA8-14 is residual concrete in the Class 1 soil areas surrounding the line shack. It has been designated Class 2 conservatively based on the other line shack classifications in table 5-2 of reference 9.3. The survey unit is approximately 33 square meters of mostly concrete (some is macadam as well) dispersed through 5 grids. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix A attachment 6-18 shows the layout of the concrete in this specific survey unit.

Survey unit MA8-15 is residual concrete in the Class 1 soil areas in the northwest portion of the original SNEC facility area. It has been designated Class 1 conservatively based on the classification of the adjacent soil and its proximity to the SNEC CV. The survey unit is approximately 37 square meters of concrete in 2 grids. Appendix A attachment 1-1 is a drawing showing the layout of the survey

area and Appendix A attachment 6-20 shows the layout of the concrete in this specific survey unit.

Survey unit PF1 is residual concrete in the Class 1 soil areas in the southern portion of the original SNEC facility area. It has been designated Class 1 in reference 9.3. The survey unit is approximately 37 square meters of concrete in 4 grids. It is a recent addition, part of the building erected to support Containment Vessel disassembly. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix A attachment 6-26 shows the layout of the concrete in this specific survey unit.

Survey unit DB1-1 is residual concrete in the Class 1 soil areas in the southern portion of the original SNEC facility area. It has been designated Class 1 in reference 9.3. The survey unit is approximately 85 square meters of concrete in 3 grids. It is a recent addition, part of the building erected to support Containment Vessel disassembly. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix A attachment 6-30 shows the layout of the concrete in this specific survey unit.

Survey unit DB1-2 is residual concrete in the Class 1 soil areas in the southern portion of the original SNEC facility area. It has been designated Class 1 in reference 9.3. The survey unit is approximately 109 square meters of concrete in 2 grids. It is a recent addition, part of the building erected to support Containment Vessel disassembly. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix A attachment 6-32 shows the layout of the concrete in this specific survey unit.

Survey unit DB5 is residual concrete in the Class 1 soil areas in the southern portion of the original SNEC facility area. It has been designated Class 1 in reference 9.3. The survey unit is approximately 54 square meters of concrete in 2 grids. It is a recent addition, part of the building erected to support Containment Vessel disassembly. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix A attachment 6-28 shows the layout of the concrete in this specific survey unit.

Survey units PF1, DB1-1, DB1-2, and DB5 are collectively referred to as the DSB (Decommissioning Support Building) pad.

Survey unit SS12 is residual concrete in the Class 1 soil areas to the south and west of the original SNEC facility area, within the SSGS footprint and is a portion of the residual concrete of the SSGS boiler pad. Additional area of the boiler pad will be reported separately with survey areas OL3 and OL7. SS12 has been designated Class 3 in reference 9.3. The survey unit is approximately 658 square meters of concrete in 8 grids. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix B attachment 6-34 shows the layout of the concrete in this specific survey unit.

Survey unit SS24-1 is residual concrete in the Class 1 soil areas to the west of the original SNEC facility area, within the SSGS footprint and is the residual portion of the north end of the SSGS. Miscellaneous SSGS concrete has been designated Class 3 in reference 9.3. The survey unit is approximately 249 square meters of concrete in 4 grids. This unit is the eastern half of the SSGS north pad area. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix B attachment 6-36 shows the layout of the concrete in this specific survey unit.

Survey unit SS24-2 is residual concrete in the Class 1 soil areas to the west of the original SNEC facility area, within the SSGS footprint and is the residual portion of the north end of the SSGS. Miscellaneous SSGS concrete has been designated Class 3 in reference 9.3. The survey unit is approximately 321 square meters of concrete in 6 grids. This unit is the western half of the SSGS north pad area. Most of this survey unit was covered with a layer of about 6 inches of soil. The soil was previously scanned and sampled per a soil survey design (survey unit OL1-8 to be reported separately with other OL1 soils), the soil was removed as necessary to then obtain the GFPC scans and fixed point readings of the concrete reported here. Appendix A attachment 1-1 is a drawing showing the layout of the survey area and Appendix B attachment 6-38 shows the layout of the concrete in this specific 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

No known remediation activities have been conducted on the residual concrete surfaces discussed here. However, surface cleaning to permit the survey was performed. Portions of the DSB pad were radiologically controlled as a contaminated area and routine operational controls included decontamination of the surfaces when needed. Some embedded piping was removed from the SSGS for characterization purposes.

4.0 Site Release Criteria

The site release criteria applied to the concrete surface areas 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 for structural surfaces were derived by analyses using a building re-use 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 from the original SNEC yard area 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 and DQO

The SNEC calculation providing the design of the survey for these survey units is provided in Appendix A. Scan measurements were conducted over approximately 100% of the Class 1 survey units. Scans were conducted using two different types of large Gas Flow Proportional Counter (GFPC). Most FSS surveys have been conducted using a model 43-68 GFPC which is about 126 square centimeters. Because of the large area of fairly flat concrete, an additional detector, a 43-37 'extra large' GFPC was used. Setpoints for the 43-37 were conservatively determined and then the detector was used only for surface scanning in a screening process. If any alarm points were found with the 43-37, follow-up would be conducted with the more 'traditional' 43-68 detector. Appendix B section 2.1.11 explains the 43-37 detector and conditions of use.

The number of fixed measurement points was determined by using the COMPASS computer program (reference 9.5, attachment 7 of appendix A). These points were located on survey maps using the Visual Sample Plan program (reference 9.6 and attachment 6 of appendices A and C). Several survey units had more fixed point measurements than the minimum COMPASS indicated. This was due to layout on unusual shapes or based on engineering judgment to improve coverage. Fixed point measurements were made using the 43-68 GFPC.

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

Cs137, Co60, H3, and Sr90 were positively detected in one or more of these samples 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	MA8-15, PF1, DB1-1, DB1-2, DB5	MA8-14	SS12, SS24-1, SS24-2
SNEC Design Calc. #	E900-05-015 E900-05-014	E900-05-015	E900-05-015
MARSSIM Classification	1	2	3
Survey Unit Area (m^2)	37, 37, 54, 85, 109	33	658, 249, 321
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 (cpm)	1180	1180	3365
Estimated σ (cpm)	23.8	23.8	44.8
Relative Shift (Δ/σ)	3.0	3.0	3.0
Number of static points*	11, 12, 13, 13, 11	11	11, 11, 18
DCGLw (Cs137 dpm/100cm^2)	26445	26445	26445
Action Level (Cs137 dpm/100cm^2)	19834	19834	19834
DCGLw (Cs137 pCi/g)**	5.73	N/A	N/A
Action Level (Cs137 pCi/g)**	4.3	N/A	N/A
Scan MDC (dpm/100cm^2)	4634 (43-68) 73 11(43-37)	4634	4634 (43-68) 7311 (43-37)
SNEC Survey Request #	SR236, SR233	SR236	SR252
Scan Survey Instrument	L2350-1 w/ 43-68B L2350-1 w/ 43-37	L2350-1 w/ 43-68B	L2350-1 w/ 43-68B L2350-1 w/ 43-37

* minimum per design was 11 in each unit
** for DSB pad sub-slab soils

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, and 9.11 which are filed in the SNEC history files.

6.1 Survey Unit MA8-14

6.1.1 Scan survey

Scan measurements were made on the residual concrete in part of 5 grids using a 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 (table 3 on page

4 of appendix A). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix A), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix A). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

All of the 33 square meters of concrete was scanned. This results in approximately 33 square meters actually scanned in the 33 square meter survey unit, or 100 percent. Although this was a Class 2 survey unit, it was 100% surface scanned due to its small size and because it consisted of several small surfaces. One hundred percent scan coverage is consistent with coverage requirements for Class 2 survey units. The scans conducted in all 33 square meters did not identify any activity greater than the action level. The action level was >1450 gross cpm (table 3 on page 4 of appendix A). No area greater than 1450 gross cpm was found in MA8-14.

6.1.2 Fixed point measurements

Eleven randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point measurements in MA8-14 had results in excess of the adjusted surrogate DCGLw. The table below (Table 2) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 2 – Fixed point results for MA8-14

Point Number	Gross beta cpm
1	427
2	445
3	437
4	396
5	464
6	448
7	516
8	365
9	394
10	391
11	439
Mean	429
Std Dev	41.8
Min	365
Max	516

6.2 Survey Unit MA8-15

6.2.1 Scan survey

Scan measurements were made on the residual concrete in part of 2 grids using a 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 (table 3 on page 4 of appendix A). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix A), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix A). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

Initial design estimate of surface area was 37 square meters. The final estimate of the area from the survey was 32 square meters. All of the 32 square meters of concrete was scanned. This results in approximately 32 square meters actually scanned in the 32 square meter survey unit, or 100 percent. One hundred percent scan coverage is consistent with coverage requirements for Class 1 survey units. The scans conducted in all 32 square meters did not identify any activity greater than the action level. The action level was >1450 gross cpm (table 3 on page 4 of appendix A). No area greater than 1450 gross cpm was found in MA8-15.

6.2.2 Fixed point measurements

Eleven randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point measurements in MA8-15 had results in excess of the adjusted surrogate DCGLw. The table below (Table 3) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 3 – Fixed point results for MA8-15

Point Number	Gross beta cpm
1	437
2	425
3	390
4	439
5	472
6	422
7	459
8	445
9	483
10	374
11	393
Mean	431
Std Dev	34.6
Min	374
Max	483

6.3 Survey Unit PF1

6.3.1 Scan survey

Scan measurements were made on the residual concrete in part of 4 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 and the 43-37 detector with an MDCscan of 7311 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the

MDCscan was below the DCGLw so no fixed point number adjustment was needed.

All of the 37 square meters of concrete was scanned. This results in approximately 37 square meters actually scanned in the 37 square meter survey unit, or 100 percent. One hundred percent scan coverage is consistent with coverage requirements for Class 1 survey units. The scans conducted in all 37 square meters did not identify any activity greater than the action level. Flat surfaces were scanned with the 43-37 and constituted about 27 square meters. Scanning of rough or uneven surfaces was performed with the 43-68 and covered about 10 square meters. The action level was >1450 gross cpm for the 43-68 and >2900 gross cpm for the 43-37 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was found in PF1 with the 43-68 or greater than 2900 cpm was found with the 43-37.

6.3.2 Fixed point measurements

Twelve randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point measurements in PF1 had results in excess of the adjusted surrogate DCGLw. The table below (Table 4) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements 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 fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 4 – Fixed point results for PF1

Point Number	Gross beta cpm
1	327
2	310
3	344
4	337
5	349
6	337
7	328
8	354
9	365
10	319
11	327
12	363
Mean	338
Std Dev	17.2
Min	310
Max	365

6.4 Survey Unit DB1-1

6.4.1 Scan survey

Scan measurements were made on the residual concrete in part of 3 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 and the 43-37 detector with an MDCscan of 7311 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

Design estimate of the area of the survey unit was 85 square meters. The estimate of the area from the survey was 81 square meters. All of the 81 square meters of concrete was scanned. This results in approximately 81 square meters actually scanned in the 81 square meter survey unit, or 100 percent. One hundred percent scan coverage is consistent with coverage requirements for Class 1 survey units. The scans conducted in all 81 square meters did not identify any activity greater than the action level. Flat surfaces were scanned with the 43-37 and constituted about 77 square meters. Scanning of rough or uneven surfaces was performed with the 43-68 and covered about 4 square meters. The action level was >1450 gross cpm for the 43-68 and >2900 gross cpm for the 43-37 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was

found with the 43-68 or greater than 2900 cpm was found with the 43-37 in DB1-1.

6.4.2 Fixed point measurements

Thirteen randomly selected fixed point measurement locations were defined for the survey unit. Based on a conservative relative shift of about 3.0 only eleven would be required, but when layout of the random locations was done, thirteen fit on the survey unit. In addition, because the random layout did not place a fixed point there, a biased point was placed on the exposed north face of the slab. None of the design fixed point measurements in DB1-1 had results in excess of the adjusted surrogate DCGLw. The table below (Table 5) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data. The result of the biased sample is not included in the statistics in table 5.

The standard deviation of the measurements 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 fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 5 – Fixed point results for DB1-1

Point Number	Gross beta cpm
Biased 1	370
1	323
2	334
3	315
4	328
5	311
6	351
7	294
8	329
9	320
10	297
11	333
12	303
13	335
Mean	321
Std Dev	16.6
Min	294
Max	351

6.5 Survey Unit DB1-2

6.5.1 Scan survey

Scan measurements were made on the residual concrete in part of 2 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 and the 43-37 detector with an MDCscan of 7311 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

Design estimate of the area of the survey unit was 109 square meters. The estimate of the area from the survey was 117 square meters. This is slightly greater than the 100 square meter guideline limit in the SNEC LTP. However, this is due to splitting DB1-1 and DB1-2 at a grid line for simplicity. The total area of DB1-1 and DB1-2 combined is less than 200 square meters, and two extra fixed point measurements were taken in DB1-2 to compensate for the slightly larger area. All of the 117 square meters of concrete was scanned. This results in approximately 117 square meters actually scanned in the 117 square meter survey unit, or 100 percent. One hundred percent scan coverage is consistent with coverage requirements for Class 1 survey units. The scans conducted in all 117 square meters did not identify any activity greater than the action level. Flat surfaces were scanned with the 43-37 and constituted about 110 square meters. Scanning of rough or uneven surfaces was performed with the 43-68 and covered about 7 square meters. The action level was >1450 gross cpm for the 43-68 and >2900 gross cpm for the 43-37 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was found with the 43-68 or greater than 2900 cpm was found with the 43-37 in DB1-2.

6.5.2 Fixed point measurements

Thirteen randomly selected fixed point measurement locations were defined for the survey unit. Based on a conservative relative shift of about 3.0 only eleven would be required, but when layout of the random locations was done, thirteen fit on the survey unit. None of the design fixed point measurements in DB1-2 had results in excess of the adjusted surrogate DCGLw. The table below (Table 6) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly

less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 6 – Fixed point results for DB1-2

Point Number	Gross beta cpm
1	283
2	351
3	364
4	352
5	342
6	324
7	336
8	339
9	331
10	331
11	343
12	385
13	363
Mean	342
Std Dev	24.2
Min	283
Max	385

6.6 Survey Unit DB5

6.6.1 Scan survey

Scan measurements were made on the residual concrete in part of 2 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 and the 43-37 detector with an MDCscan of 7311 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

Design estimate of the area of the survey unit was 54 square meters. The estimate of the area from the survey was 45 square meters. All of the 45 square meters of concrete was scanned. This results in approximately 45 square meters actually scanned in the 45 square meter survey unit, or 100 percent. One hundred percent scan coverage is consistent with coverage requirements for

Class 1 survey units. The scans conducted in all 45 square meters did not identify any activity greater than the action level. Flat surfaces were scanned with the 43-37 and constituted about 41 square meters. Scanning of rough or uneven surfaces was performed with the 43-68 and covered about 5 square meters. The action level was >1450 gross cpm for the 43-68 and >2900 gross cpm for the 43-37 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was found in DB5 with the 43-68 or greater than 2900 cpm was found with the 43-37.

6.6.2 Fixed point measurements

Eleven randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point measurements in DB5 had results in excess of the adjusted surrogate DCGLw. The table below (Table 7) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 7 – Fixed point results for DB5

Point Number	Gross beta cpm
1	361
2	364
3	371
4	415
5	373
6	372
7	333
8	387
9	372
10	361
11	429
Mean	376
Std Dev	26.4
Min	333
Max	429

6.7 Survey Unit SS12

6.7.1 Scan survey

Scan measurements were made on the residual concrete in part of 8 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 and the 43-37 detector with an MDCscan of 7311 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

The area of the survey unit was 658 square meters and 75 square meters was planned for scanning. Of this 75 square meters, about 5 square meters was not scanned because it was a hole in the concrete full of soil. This results in approximately 70 square meters actually scanned in the 658 square meter survey unit, or 11 percent, which is consistent with coverage requirements for Class 3 survey units. The scans conducted in all 70 square meters did not identify any activity greater than the action level. Flat surfaces were scanned with the 43-37 and constituted about 64 square meters. Scanning of rough or uneven surfaces was performed with the 43-68 and covered about 6 square meters. The action level was >1450 gross cpm for the 43-68 and >2900 gross cpm for the 43-37 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was found in SS12 with the 43-68 or greater than 2900 cpm was found with the 43-37.

6.7.2 Fixed point measurements

Eleven randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point measurements in SS12 had results in excess of the adjusted surrogate DCGLw. The table below (Table 8) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 8 – Fixed point results for SS12

Point Number	Gross beta cpm
1	355
2	339
3	421
4	260
5	367
6	426
7	430
8	373
9	356
10	467
11	387
Mean	380
Std Dev	56.0
Min	260
Max	467

6.8 Survey Unit SS24-1

6.8.1 Scan survey

Scan measurements were made on the residual concrete in part of 4 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 and the 43-37 detector with an MDCscan of 7311 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

The area of the survey unit was 249 square meters and about 105 square meters was planned for scanning. This results in approximately 105 square meters actually scanned in the 249 square meter survey unit, or 42 percent which is consistent with coverage requirements for Class 3 survey units. The scans conducted in all 105 square meters did not identify any activity greater than the action level. Flat surfaces were scanned with the 43-37 and constituted about 90 square meters. Scanning of rough or uneven surfaces was performed with the 43-68 and covered about 15 square meters. The action level was >1450 gross cpm for the 43-68 and >2900 gross cpm for the 43-37 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was found in SS24-1 with the 43-68 or greater than 2900 cpm was found with the 43-37.

6.8.2 Fixed point measurements

Eleven randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. None of the design fixed point measurements in SS24-1 had results in excess of the adjusted surrogate DCGLw. The table below (Table 9) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 9 – Fixed point results for SS24-1

Point Number	Gross beta cpm
1	401
2	456
3	417
4	390
5	465
6	412
7	381
8	420
9	454
10	429
11	444
Mean	424
Std Dev	27.9
Min	381
Max	465

6.9 Survey Unit SS24-2

6.9.1 Scan survey

Scan measurements were made on the residual concrete in part of 4 grids using both the 43-68 GFPC detector with an MDCscan of 4634 dpm/100cm^2 (table 3 on page 5 of appendix B). The 75 % administrative limit was 19834 dpm/100cm^2 (table 1 on page 3 of appendix B), and the adjusted surrogate Cs137 DCGLw for

this survey unit was 26445 dpm/100cm^2 (table 1 on page 3 of appendix B). In this case, the MDCscan was below the DCGLw so no fixed point number adjustment was needed.

The area of the survey unit was 321 square meters and about 122 square meters was planned for scanning. This results in approximately 122 square meters actually scanned in the 321 square meter survey unit, or 38 percent, which is consistent with coverage requirements for Class 3 survey units. The scans conducted in all 122 square meters did not identify any activity greater than the action level. All surface scanning in the survey unit was performed with the 43-68 detector due to the unevenness of the concrete surface. The action level was >1450 gross cpm for the 43-68 (table 3 on page 5 of appendix B). No area greater than 1450 gross cpm was found in SS24-2 with the 43-68.

6.9.2 Fixed point measurements

Eighteen randomly selected fixed point measurement locations were defined for the survey unit, based on a conservative relative shift of about 3.0. The minimum required was eleven, but was increased based on engineering judgment to improve coverage in the partially soil covered area. None of the design fixed point measurements in SS24-2 had results in excess of the adjusted surrogate DCGLw. The table below (Table 10) shows the gross beta results for each fixed point measurement, along with the mean, standard deviation and range of the fixed point measurement data.

The standard deviation of the measurements collected from the survey unit was greater than the variability assumed in the survey design. However, since the LBGR used for the design was higher than the typical 50% of the DCGL, a relative shift of three would still result from the observed variability and a slightly less conservative LBGR. Therefore, the assessment of variability, relative shift , and number of fixed point measurements required is consistent between the survey design and the survey results. Based on this, no changes to the survey design or additional measurements are required.

Table 10 – Fixed point results for SS24-2

Point Number	Gross beta cpm
1	548
2	494
3	538
4	521
5	562
6	588
7	502
8	519
9	579
10	486
11	423
12	442
13	534
14	423
15	448
16	458
17	516
18	480
Mean	503
Std Dev	50.8
Min	423
Max	588

6.10 Summary of DSB pad soils

6.10.1 Survey

Eleven soil samples were taken at the DSB pad (PF1, DB1-1, DB1-2, DB5 combined) in response to questions from reviewers. Seven of samples were collected at the edge of the pad, and four through core holes in the pad. Eleven samples were collected because this is the typical number obtained based on the variability observed in OL1 soils. However, due to the presence of the pad, the sample locations were arbitrarily selected to provide information on sub-slab soils without the need for eleven core boring efforts through the slab. The samples from the edge of the pad are expected to be representative of the soils throughout the pad footprint. Attachment 6-40 of Appendix C shows the layout of the soil sample locations relative to the DSB pad.

The soil DCGL is 5.73 pCi/gm and the 75 % administrative limit is 4.3 pCi/g (table 1 on page 3 of Appendix D is used as the soil basis). All of the soil sample results

were well below the DCGL. No statistical tests are required. Table 11 below shows the results of these soil samples. For purposes of the statistics in the table, results less than the MDA are assumed to be present at the MDA. This will overestimate the mean.

Table 11 – DSB pad soil samples

Point	Cs137 pCi/g
DB1-1/1	0.16
DB1-1/2	0.12
DB1-1/3	0.28
DB1-2/1	0.15
DB1-2/2	<0.08
DB1-2/3	0.12
DB5/1	<0.06
DB5/2	0.31
DB5/3	<0.06
PF1/1	0.09
PF1/2	<0.06
Mean	0.14
Std Dev	0.09
Min	0.06
Max	0.31

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

MA8-14 had no alarm points during scan surveys of 100% of the surface. Scan MDCs were adequate. Eleven fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

MA8-15 had no alarm points during scan surveys of 100% of the surface. Scan MDCs were adequate. Eleven fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

PF1 had no alarm points during scan surveys of 100% of the surface. Scan MDCs were adequate. Twelve fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

DB1-1 had no alarm points during scan surveys of 100% of the surface. Scan MDCs were adequate. Thirteen fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

DB1-2 had no alarm points during scan surveys of 100% of the surface. Scan MDCs were adequate. Thirteen fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

DB5 had no alarm points during scan surveys of 100% of the surface. Scan MDCs were adequate. Eleven fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

SS12 had no alarm points during scan surveys of 11% of the surface. Scan MDCs were adequate. Eleven fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

SS24-1 had no alarm points during scan surveys of 42% of the surface. Scan MDCs were adequate. Eleven fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

SS24-2 had no alarm points during scan surveys of 38% of the surface. Scan MDCs were adequate. Eighteen fixed point measurements were all less than the DCGLw. Scan fraction and number of fixed point measurements meets LTP and MARSSIM requirements.

DSB pad soil samples were all less than the DCGL. Eleven samples is typical of the OL1 soil designs and so meets LTP and MARSSIM requirements except that the locations were arbitrarily selected rather than based on a full random grid.

7.3 Survey Variations (Design, survey request, LTP)

7.3.1 Soils under the DSB pad were evaluated by sampling at the edge of the pad and through 4 core bore holes. The locations were arbitrarily selected rather than a random start grid, and no scanning of the sub-slab soils could be performed.

7.3.2 About 5 square meters of the area selected for scanning in SS12 was actually soil and was not GFPC scanned.

7.3.3 The four soil samples collected through the core bore holes in the DSB slab were not collected to the full 1 meter depth due to encountering hard rock in the

hole. Actual sample depths were: DB1-1 #3 0.8 m, DB1-2 #2 0.5m, DB5 #1 0.6m, and PF1 #2 0.55m.

7.3.4 Seven fixed point measurements in SS12 and 2 in SS24-1 were relocated by up to 11 feet due the presence of soil spots in the slabs and unevenness of the edges of the slabs.

7.4 QC comparisons

7.4.1 Scan surveys

Multiple locations throughout the several survey units 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 42m^2 of the survey unit using the 43-68 GFPC, which represents about 18 percent of the area scanned with the 43-68. QC scans were conducted on 32m^2 of the survey unit using the 43-37 GFPC, which represents about 11 percent of the area scanned with the 43-37. These exceed the minimum 5% required.

7.4.2 Fixed Point measurements

One fixed point measurement from each of the nine survey units received QC duplicate GFPC measurements. These duplicates had good agreement as shown in the table below (Table 12) because they support the same conclusion, that the survey units pass. Nine QC splits out of 112 measurements (including the biased point) represents about 8.0% and exceeds the 5% minimum criterion.

Table 12 – QC Fixed point duplicate comparison

Fixed Point	Result (cpm)	QC Result (cpm)
MA8-14 8	365	414
MA8-15 11	393	444
PF1 8	354	323
DB1-1 10	297	338
DB1-2 9	331	330
DB5 5	373	381
SS12 6	426	568
SS24-1 2	456	397
SS24-2 4	521	369

One QC duplicate sample was collected of the DSB pad soils. This duplicate had good agreement as shown in the table below (Table 13) because it supports the

same conclusion, that the survey units pass. One QC split out of 11 samples represents about 9.1% and exceeds the 5% minimum criterion.

Table 13 – DSB pad soil QC Duplicate comparison

Fixed Point	Result (pCi/g)	QC Result (pCi/g)
DB1-1 1	0.16	0.25

8.0 Final Survey Conclusions

The concrete surfaces in OL1 final status survey was performed in accordance with the SNEC 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 on the surfaces is less than the derived surrogate DCGLw in both survey units.

2) All measurements were less than the DCGLw in all of the survey unit areas.

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 Surface Area consisting of nine survey units of surface exposed concrete slab in the OL1 area and designated MA8-14, MA8-15, PF1, DB1-1, DB1-2, DB5, SS12, SS24-1, and SS24-2 are 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
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) # SR233
9.10 SNEC Survey Request (SR) # SR236
9.11 SNEC Survey Request (SR) # SR252

10.0 Appendices

Appendix A - SNEC Calculation E900-05-015 "OL1 Paved and Miscellaneous concrete surfaces MA8, PF1, DB5, DB1 – Survey Design" (11 pages plus numerous attachments)

Appendix B - SNEC Calculation E900-05-015 Rev 1 "OL1 Paved and Miscellaneous concrete surfaces MA8, PF1, DB5, DB1, SS12, SS24 – Survey Design" (13 pages plus numerous attachments)

Appendix C - SNEC Calculation E900-05-015 Rev 2 "OL1 Paved and Miscellaneous concrete surfaces MA8, PF1, DB5, DB1, SS12, SS24 – Survey Design" (14 pages plus numerous attachments)

Appendix D - SNEC Calculation E900-05-014 "SNEC Plant Area Open Land – OL1 - Survey Design" (11 pages plus numerous attachments)