Final Status Survey Report

For

Saxton Nuclear Experimental Corporation
Embedded / Buried Piping

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 embedded / buried piping of the Saxton Nuclear Experimental Corporation (SNEC) facility. This FSS includes surveys of residual piping within the Saxton Steam Generating Station facility and other underground drainage systems and was conducted in two campaigns in October of 2001 and August of 2003.

The FSS was performed in accordance with special measurements provisions of the SNEC License Termination Plan (LTP). The residual piping was divided into twenty eight groups which each included one or more pipes. Data was collected from each pipe in accordance with the specific data collection requirements. The following is a summary of the measurements performed:

1) Two hundred and fifty two in-situ gamma spectroscopy measurements

2) Forty eight scale / sediment samples counted by laboratory gamma spectrometry.

The in-situ gamma spectroscopy measurements were performed by a contractor utilizing a sodium-iodide (NaI) detector and portable multi-channel analyzer. Accessible portions of the piping were measured with this equipment but the detector could not access through sediment clogs or around tight bends.

The collected FSS survey data demonstrate that the embedded / buried piping meets the radiological release criteria for unrestricted use specified in 10CFR20.1402 and the bounding pipe dose condition from the SNEC LTP. 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 embedded and buried piping of the SNEC facility. It provides the information required by 10CFR50.82(a)(11) and the SNEC license termination plan (LTP) to demonstrate that this area meets the radiological criteria for unrestricted use specified in 10CFR20.1402.

This report describes the radiological data collected in twenty eight groups of embedded and buried piping. This report only addresses the FSS performed on this specific area . The format of this report follows the guidance contained in reference 9.2.

2.0 Survey Area Description

The embedded buried piping consists of various pipes throughout the Saxton Steam Generating Station (SSGS) and associated outlying systems (e.g. discharge tunnel) and structures (e.g. warehouse). Individual groups are discussed in the results summary.

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. Other shared systems also introduced SNEC activity into the SSGS and the main SNEC discharge entered the SSGS discharge tunnel. After shutdown in 1972, the SNEC 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. The SSGS was dismantled circa 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

Numerous pipes were removed. Some of the pipes measured and reported here had been removed and were measured after removal. The seal chamber 3 area was remediated after the measurements of the pipes in seal chamber 3.

4.0 Site Release Criteria

The site release criteria applied to the embedded / buried pipe correspond to the radiological dose criteria for unrestricted use per 10CFR20.1402 and the bounding dose limit condition from the SNEC LTP. The 10CFR20 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.

Section 6.2.1 of the SNEC LTP discusses the bounding condition for the embedded / buried pipe and provides an estimate of 0.611 mrem annual dose from the bounded embedded pipe. Appendix B provides the basis for this dose estimate derived from the October 2001 pipe survey campaign.

5.0 Final Status Survey Design and DQO

References 9.7 and 9.8 contain the results of the contractor measurements and provide the details of the design of the survey for the embedded and buried pipe. Twenty eight groups of piping were measured in two campaigns using in-situ gamma spectroscopy and scrape / sediment sampling. A twenty ninth group was measured, but this group was known to be contaminated and was measured as a system test. Therefore, this group is not reported here.

The measurements conducted did not entail a full statistical MARSSIM sampling and scan design because of the unique nature of the piping to be measured and because of the use of in-situ gamma spectroscopy. The SNEC LTP addresses the performance of these unique surveys in section 5.5.3.4.3.

6.0 Final Status Survey Results

The following section provide the survey summary results for each pipe group. Summary data was taken from References 9.6, 9.7, and 9.8 which are filed in the SNEC history files. All surface and volumetric results discussed below are for Cs137 unless otherwise noted. Results for sections 6.1 through 6.16 are from reference 9.8 and results for sections 6.17 through 6.28 are from reference 9.7.

6.1 Removed intake tunnel and crossover piping

This group consisted of ten pipe segments that had already been removed and were staged on the ground for survey. Twenty in-situ gamma spectra were collected. Table 1-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 1-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	269	1.6
Min	<209	<1
Max	<342	<3.3

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 1.6 pCi/g in the highest positive result, with a maximum MDA of <3.3 pCi/g (reference 9.8).

Three samples were obtained of the scale / sediment in the pipes. Table 1-2 below shows the mean and range of the results.

Table 1-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.8
Min	<0.17
Max	<1.3

6.2 Pipes angled into SSGS abutment near seal chamber 3

This group consisted of two pipes, one each on the east and west side of seal chamber 3. Twelve in-situ gamma spectra were collected. Table 2-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 2-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	415	2.0
Min	<316	<1.5
Max	<512	<2.4

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.0 pCi/g in the highest positive result, with a maximum MDA of <2.4 pCi/g (reference 9.8).

There was little to no scale or sediment in these pipes, so no samples were collected.

6.3 Pipes from SSGS boiler pad to SSGS footprint

This group consisted of three pipes, from the SSGS boiler pad to the SSGS basement / footprint area accessed on the south wall. Nine in-situ gamma spectra were collected. Table 3-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 3-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	554	2.6
Min	254	1.2
Max	898	4.2

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 4.2 pCi/g in the highest positive result (reference 9.8).

Three samples were obtained of the scale / sediment in the pipes. Table 3-2 below shows the mean and range of the results.

Table 3-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	3.0
Min	0.16
Max	5.9

6.4 Pipes from SSGS boiler pad to mid section of SSGS

This group consisted of two 10" pipes, from the SSGS boiler pad to the SSGS basement / footprint area accessed on the south wall. Six in-situ gamma spectra were collected. Table 4-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 4-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	268	1.3
Min	<206	<1.0
Max	421	2.0

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.0 pCi/g in the highest positive result (reference 9.8).

No samples of the scale / sediment in the pipes were collected.

6.5 Pipes from SSGS boiler pad to north section of SSGS

This group consisted of two 10" pipes, from the SSGS boiler pad to the SSGS basement / footprint area accessed on the south wall. Five in-situ gamma spectra were collected. Table 5-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 5-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	326	1.5
Min	<229	<1.1
Max	574	2.7

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.7 pCi/g in the highest positive result (reference 9.8).

One scale / sediment sample was collected with a result of 0.1 pCi/g.

6.6 Pipe from SSGS boiler pad to mid section of SSGS

This group consisted of one 4" pipe and one 2' pipe, from the SSGS boiler pad to the SSGS basement / footprint area accessed on the south wall. Five in-situ gamma spectra were collected. Table 6-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 6-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	829	3.9
Min	<451	2.1
Max	1036	4.9

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 4.9 pCi/g in the highest positive result (reference 9.8).

Two samples were obtained of the scale / sediment in the pipes. Table 6-2 below shows the mean and range of the results.

Table 6-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	2.5
Min	<0.13
Max	4.8

6.7 Pipe through north wall into seal chamber 2 of SSGS

This group consisted of one 10" pipe, from the SSGS through the north wall into seal chamber 2. Two in-situ gamma spectra were collected. Table 7-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 7-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	709	3.4
Min	656	3.1
Max	761	3.6

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 3.6 pCi/g in the highest positive result (reference 9.8).

One scale / sediment sample was collected with a maximum result of 6.1 pCi/g.

6.8 Pipe into rubble bed in SSGS

This group consisted of one 8" pipe, in the SSGS footprint that leads from the northeast corner into a concrete rubble bed. Three in-situ gamma spectra were collected. Table 8-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 8-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	423	2.0
Min	<377	<1.8
Max	493	2.3

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.3 pCi/g in the highest positive result (reference 9.8).

No scale / sediment samples were collected.

6.9 Pipes into seal chambers 1 and 2 of SSGS

This group consisted of seven pipes and / or penetrations, extending down through the roof of seal chambers 1 and 2. Ten in-situ gamma spectra were collected. Table 9-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 9-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	429	2.0
Min	<217	<1.0
Max	568	2.7

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.7 pCi/g in the highest positive result (reference 9.8).

No scale / sediment samples were collected.

6.10 Pipes into seal chamber 3 of SSGS

This group consisted of six pipes penetrations and suction tubes extending down through the top of seal chamber 3. The results of these measurements were higher than those obtained in other pipe measurements (section 4.10 of reference 9.8). Investigation indicated that the results were affected by residual contamination on the seal chamber walls and did overestimated the activity on the piping. Additional measurements were made after remediation of the seal chamber 3 concrete and are reported in reference 9.6. It was estimated, based on a gamma spec collect obtained 'in air' in the seal chamber, that about 4000 dpm/100cm2 of background was present from the seal chamber itself.

Twenty in-situ gamma spectra were collected. Table 10-1 below shows the mean and range of the results.

Table 10-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	2625	12
Min	426	2.0
Max	4696	22

Scrape samples obtained after the in-situ gamma spec (reference 9.6) had a maximum result of 1.5 pCi/g.

The data (reference 9.8) show that the measurements taken in the upper portion of each of the pipes is much lower than the remainder of the measurements. This also strongly suggests that the measurements are affected by gammas not associated with this piping.

6.11 Pipe in ceiling of discharge tunnel

This group consisted of one10" pipe, in the ceiling of the SSGS discharge tunnel. Five in-situ gamma spectra were collected. Table 9-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 11-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	561	2.6
Min	<438	<2.1
Max	648	3.0

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 3.0 pCi/g in the highest positive result.

One scale / sediment sample was collected with a result of 0.2 pCi/g.

6.12 Rollup-door in Discharge tunnel of SSGS

This area was extensively resurveyed as SS25-2 and will be reported separately.

6.13 Pipes in discharge tunnel ceiling of SSGS

This group consisted of six pipes, entering through the ceiling of the discharge tunnel. Eighteen in-situ gamma spectra were collected. Table 13-1 below shows

the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 13-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	551	2.6
Min	<354	<1.7
Max	857	4.0

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 4.0 pCi/g in the highest positive result.

Two samples were obtained of the scale / sediment in the pipes. Table 13-2 below shows the mean and range of the results.

Table 13-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	3.0
Min	0.16
Max	5.9

6.14 Floor drains and pipes at the Discharge Tunnel access area

This group consisted of two floor drain pipes in the SSGS tunnel area. The two floor drains were grouted shut but were found to be partially open elsewhere. Two in-situ gamma spectra were collected. Table 14-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 14-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	456	2.2
Min	<424	<2.0
Max	<487	<2.3

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be less than MDA at <2.3 pCi/g at the highest MDA.

No scale / sediment samples were collected.

6.15 Suction tubes and pipes in the SSGS intake tunnel

This group consisted of six large suction tubes, 2 small pipes, and 2 large penetrations in the intake tunnels. Eleven in-situ gamma spectra were collected. Table 15-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 15-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	362	1.4
Min	<151	<0.7
Max	<1131	<2.0

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 1.8 pCi/g in the highest positive result and <2.0 in the highest MDA.

Two samples were obtained of the scale / sediment in the pipes. Table 15-2 below shows the mean and range of the results.

Table 15-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.29
Min	0.20
Max	0.37

6.16 Drain line in SW corner of old warehouse slab

This group consisted of one 4" pipe, in the southwest corner of the old warehouse slab. One in-situ gamma spectra was collected with a result of less than 415 dpm/100 cm^2. Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be less than 1.9 pCi/g in the measurement.

No scale / sediment samples were collected.

6.17 Removed pipes from SSGS boiler pad

This group consisted of seven pipes of 3.75" to 9" diameters that were already removed and staged for survey. Eight in-situ gamma spectra were collected. Table 17-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 17-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	350	1.2
Min	<306	<1.1
Max	<377	<1.3

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be <1.3 in the highest MDA.

Seven samples were obtained of the scale / sediment in the pipes. Table 17-2 below shows the mean and range of the results. The highest positive result was 0.34 pCi/g.

Table 17-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.36
Min	0.07
Max	<1.3

6.18 Cross over line from Intake tunnel to spray pond feed line

This group consisted of nine 24" diameter pipe sections already removed and staged for survey. Four in-situ gamma spectra were collected. Table 18-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 18-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	442	1.6
Min	<393	<1.4
Max	<499	<1.8

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 1.6 pCi/g in the only positive result and less than 1.8 pCi/g at the highest MDA.

Three samples were obtained of the scale / sediment in the pipes. Table 18-2 below shows the mean and range of the results.

Table 18-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	1.7
Min	0.6
Max	2.7

6.19 Small garage drain openings

This group consisted of the pipes and sumps of each of the four sumps of the small garage. Nine in-situ gamma spectra were collected. Table 19-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 19-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	1426	2.5
Min	<664	<2.1
Max	<2134	<3.8

Volumetric contamination of the scale is estimated, using assumptions on scale thickness, to be less than 3.8 pCi/g at the highest MDA.

Four samples were obtained of the sediment in the sumps. Table 19-2 below shows the mean and range of the results. One of the four showed positive Co60 at 0.06 pCi/g along with a positive Cs137 of 1.4 pCi/g. Although the Co60 result is slightly higher than that assumed in appendix B, the total dose remains below the bounding dose of 0.611 because the Cs137 in this sample is only about 20% of that assumed in appendix B.

Table 19-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.6
Min	0.2
Max	1.4

6.20 Center yard drain and 16" drain line behind garage

This group consisted of the center yard drain and attached 16" pipe. Additional measurements were made at the downstream end where the line connects to the shunt line. Eleven in-situ gamma spectra were collected. Table 20-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 20-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	459	1.4
Min	<330	1.0
Max	910	<2.0

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 1.0 pCi/g in the only positive result and less than 2.0 pCi/g at the highest MDA.

Two samples were obtained of the scale / sediment in the pipes. Table 20-2 below shows the mean and range of the results.

Table 20-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.59
Min	<0.07
Max	1.1

6.21 Yard drain near warehouse

This group consisted of the yard drain near the warehouse and the 12" corrugated steel pipe attached. Five in-situ gamma spectra were collected. Table 21-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 21-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	617	1.4
Min	<309	<1.1
Max	<1633	<1.8

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be less than 1.8 pCi/g at the highest MDA.

One sample was obtained of the scale / sediment in the pipes. The result of this sample was 0.7 pCi/g.

6.22 18" Pipe in SSGS area footprint

This group consisted of an 18" pipe, from the SSGS discharge tunnel to the SSGS screen / rake section of the intake tunnel. Eighteen in-situ gamma spectra were collected. Table 22-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 22-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	247	0.9
Min	<174	<0.6
Max	375	1.3

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 1.3 pCi/g in the highest positive result.

Five samples were obtained of the scale / sediment in the pipes. Table 22-2 below shows the mean and range of the results. One of the five showed positive Co60 at 0.1 pCi/g along with a positive Cs137 of 0.66 pCi/g. Although the Co60 result is slightly higher than that assumed in appendix B, the total dose remains below the bounding dose of 0.611 because the Cs137 in this sample is only about 10% of that assumed in appendix B.

Table 22-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	2.2
Min	0.66
Max	4.2

6.23 12" drain line into shunt line

This group consisted of the 12" drainage pipe south of the garage that connects to the shunt line. Twelve in-situ gamma spectra were collected. Table 23-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 23-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	473	1.7
Min	<366	<1.2
Max	<656	<2.3

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be less than 2.3 pCi/g at the highest MDA. One of the twelve showed positive Co60 at 1.1 pCi/g with no Cs137 detected. Although the Co60 result is higher than that assumed in appendix B, the total dose remains below the bounding dose of 0.611 because the Cs137 in this sample, even assuming it is present at the MDA, is only about 30% of that assumed in appendix B.

One sample was obtained of the scale / sediment in the pipes with a result of <0.1 pCi/g.

6.24 12" drainage line east of small garage

This group consisted of the 12" drainage line unearthed behind the northern end of the garage. Eight in-situ gamma spectra were collected. Table 24-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 24-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	489	1.7
Min	<360	<1.3
Max	<565	<2.0

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be less than 2.0 pCi/g at the highest MDA.

One scale / sediment sample was collected with an MDA result of less than 0.1 pCi/g.

6.25 Pipes in NW SSGS above seal chamber 3

This group consisted of three pipes over seal chamber 3. Eighteen in-situ gamma spectra were collected. Table 25-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 25-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	585	2.1
Min	<241	<0.8
Max	1478	5.2

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 5.2 pCi/g in the highest positive result.

Three samples were obtained of the scale / sediment in the pipes. Table 25-2 below shows the mean and range of the results.

Table 25-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	2.7
Min	0.16
Max	5.6

6.26 Pipe in SW SSGS towards screen room

This group consisted of one 8" pipe, from the southwest corner of the SSGS that leads towards the intake tunnel screen rooms. Twelve in-situ gamma spectra were collected. Table 26-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 26-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	456	1.6
Min	<255	<0.9
Max	703	2.5

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.5 pCi/g in the highest positive result.

Two samples were obtained of the scale / sediment in the pipes. Table 26-2 below shows the mean and range of the results. One of the two showed positive Co60 at 0.036 pCi/g along with a positive Cs137 of 0.25 pCi/g. Since the Co60 result is less than that assumed in appendix B, the total dose remains below the bounding dose of 0.611.

Table 26-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.26
Min	0.25
Max	0.27

6.27 Drain line from warehouse to shunt line

This group consisted of an 18" pipe that leads from the warehouse to the shunt line. Twelve in-situ gamma spectra were collected. Table 27-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 27-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	406	1.4
Min	<309	<1.1
Max	<522	<1.8

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be less than 1.8 pCi/g in the highest MDA.

One scale / sediment sample was collected with a result of 0.11 pCi/g.

6.28 Shunt line and yard drain line tie-ins

This group consisted of the 42" shunt line, two 12" connections and one 16" connection. Results for the connecting lines are reported above in sections 6.1.20, 6.1.23, and 6.1.24. Six in-situ gamma spectra were collected. Table 28-1 below shows the mean and range of the results. Values that are less than the MDA are assumed to be positive at the MDA for purposes of calculating the mean.

Table 28-1 – In-situ gamma summary

	Cs137 dpm/100cm^2	Cs137 pCi/g
Mean	535	1.9
Min	<409	<1.4
Max	<694	<2.4

Volumetric contamination of the pipe scale is estimated, using assumptions on scale thickness, to be 2.4 pCi/g in the highest MDA.

Three samples were obtained of the scale / sediment in the pipes. Table 28-2 below shows the mean and range of the results.

Table 28-2 – Scrape / sediment sample summary

	Cs137 pCi/g
Mean	0.22
Min	0.04
Max	0.34

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

The survey results for the seal chamber 3 downcomers was affected by background gammas going through the pipes from the concrete surfaces of the chamber. Appendix A shows that the results are bounding and that the surface contamination results obtained, even with the elevated background source, are acceptable for unrestricted release.

The residual activity in the other 27 groups of pipes do not exceed 2134 dpm/100cm2 (group 19, actually this is a MDA value) and do not exceed 6.1 pCi/g (group 7) in the highest observed results. The residual surface activity is well below the surface residual DCGL and below the residual volumetric value used for the dose assessment (section 5.3.1 in appendix B). Since the results from all of the piping groups are below the basis for the dose calculation in appendix B, and the dose result of 0.611 is used as the piping dose bounding value ('bounding limit 2' in the SNEC LTP section 6.2.1), the results of the piping

are bounded by the derived limit in the SNEC LTP and therefore are acceptable for unrestricted use.

7.3 Survey Variations (Design, survey request, LTP)

No QC splits were performed on the scale / sediment samples from the October 2001 campaign. Since the scale / sediment samples and the volumetric estimates from the in-situ gamma spectroscopy are independent duplicate results, the general agreement between the sample and in-situ results is sufficient as a QC verification process. No result for either analysis exceded the bounding limit basis, and therefore bot sets of data support the conclusion that the piping does not exceed the LTP bounding condition and therefore is suitable for unrestricted release.

7.4 QC comparisons

7.4.1 Gamma spectroscopy

Pipe segments were rescanned as QC duplicates. The QC rescans did not identify any activity above DCGLs and so are in agreement with the primary scans and support the same conclusion that the survey unit passes. QC gamma spectroscopic measurements were conducted on 18 of the pipe segments, which represents about 6.9 percent of the 261 spectra originally obtained. This exceeds the minimum 5% required.

7.4.2 Scale / Sediment samples

No QC split scale / sediment samples were performed during the October 2001 campaign. However, the scale / sediment samples were essentially a QC process on the in-situ measurements and there was generally good agreement between the in-situ measurements and the scale / sediment samples because they both support the conclusion that the pipes are suitable for unrestricted release.

Two QC split samples were collected of the scale / sediment during the August 2003 campaign. There was good agreement between the initial and split sample results as shown in table 7.4-1 below, because they both support the conclusion that the pipes are suitable for unrestricted release. Two QC splits of the 16 samples collected in the August 2003 campaign represents 12 percent of the initial samples. This exceeds the 5% minimum requirement.

Table 7.4-1 QC Scale / sediment sample split comparison

Point	Result (Cs137 pCi/g)	QC Result (Cs137 pCi/g)
8" boiler pad pipe (sec 6.1.3)	0.16	0.12
8" pipe discharge tunnel ceiling (sec 6.1.13)	<0.09	0.10

8.0 Final Survey Conclusions

The embedded / buried piping 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 SNEC LTP bounding limit (0.611 mrem) basis.

2) All measurements were less than the SNEC LTP bounding limit (0.611 mrem) basis except in group 10, which were subsequently shown to be affected by background and to be acceptable fro unrestricted release.

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 embedded / buried piping is suitable for unrestricted release.

9.0 References

9.1 SNEC procedure E900-ADM-4500.60 "Final Status Survey Report"
9.2 SNEC License Termination Plan
9.3 NUREG 1575 "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), revision 1 August 2000
9.4 SNEC procedure E900-IMP-4500.59, "Final Site Survey Planning and DQA"
9.5 SNEC procedure E900-IMP-4520.04, "Survey Methodology to Support SNEC License Termination"
9.6 SNEC Survey Request (SR) # SR098
9.7 "Embedded Pipe Radiation Survey Report", CoPhysics Corp., January, 2002
9.8 "Embedded Pipe Radiation Survey", CoPhysics Corp., April 2004

10.0 Appendices

Appendix A – SNEC Calculation number E900-04-018 "Assessment of Survey Results from Seal Chamber 3 Downcomers" (5 pages plus numerous attachments)

Appendix B – SNEC Calculation number 6900-02-025 "Multiple Source Term Bounding Calculation" (44 pages)