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E910-02-054
December 16, 2002

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

Gentlemen,

Subject: Saxton Nuclear Experimental Corporation (SNEC)
Application for License Termination
Operating License No. DPR-4
Docket No. 50-146

On February 2, 2000, the Saxton Nuclear Experimental Corporation (SNEC) submitted an application for termination of facility license: DPR-4, and included a License Termination Plan (LTP). On September 26, 2002 SNEC submitted Revision 1 to the LTP. The changes in Revision 1 incorporated information previously provided by SNEC to the NRC staff in response to requests for information. This letter submits responses to NRC Discussion Topics as a result of NRC letter dated October 28, 2002 (Attachment 1) and, Revision 2 to the LTP, consisting of a list of effective pages for the LTP and change pages to Revision 1 resulting from the discussion topic responses (Attachment 2). Additionally Calculation No. 6900-02-025 (Attachment 3) is provided to support the resolution of discussion topic 27.

SNEC's February 2, 2000 application requested that the facility license be amended by adding a new section 2.E requiring SNEC to implement the LTP as approved by the NRC and containing criteria limiting SNEC's ability to make changes to the LTP without prior approval. The NRC staff requested that SNEC include several additional criteria further limiting the circumstances in which the LTP may be changed. NRC's letter of October 28, 2002 requested further modification to these criteria. This letter responds to the NRC's request and supplements the February 2, 2000 application to adopt the additional restrictive criteria. The No Significant Hazards Consideration Analysis determination in the February 2,2000 application is unaffected by this change. Accordingly, SNEC requests that section 2.E be worded as follows:

2.E. The licensee shall implement the approved SNEC Facility License Termination Plan as approved in the SER dated _____________. The licensee may make changes to the SNEC Facility License Termination Plan without prior approval provided the proposed changes do not:

(a) involve a change to the Technical Specifications or require NRC approval pursuant to 10 CFR 50.59;

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(b) violate the criteria of 10 CFR 50.82(a)(6);

(c) reduce the coverage requirements for scan measurements;

(d) increase the derived concentration guideline level (DCGL), developed to meet the requirements of 10 CFR 20.1402, and related minimum detectable concentrations for both scan and fixed measurement methods;

(e) use a statistical test other than the Sign test or Wilcoxon Rank Sum test for evaluation of the final status survey;

(f) increase the radioactivity level, relative to the applicable derived concentration guideline level, developed to meet the requirements of 10 CFR 20.1402, at which investigation occurs;

(g) Increase the Type I decision error;

(h) Decrease an area classification (i.e., impacted to non-impacted; Class 1 to Class 2; Class 2 to Class 3; Class 1 to Class 3)

If you have any questions or require additional information regarding this license amendment, please contact Mr. James Byrne at (717) 948-8461.

I swear under penalty of perjury that the foregoing is true and correct.

Executed on 12/16/02

Sincerely,

G. A. Kuehn, Jr.
Director, SNEC Facility

Attachments:

1) Response to NRC Discussion Topics
2) SNEC Facility License Termination Plan, Revision 2 change pages
3) Calculation No. 6900-02-025

cc: Regional Administrator – NRC Region 1
NRC Project Manager, NRR
NRC Project Scientist, Region 1
Chairman, Board of Supervisors, Liberty Township
Chairman, Board of County Commissioners, Bedford County
Director, Bureau of Radiation Protection, PA Department of Environmental Protection

Re Memo # E910-02-054

Attachment 1

Response to NRC Discussion Topics

DISCUSSION ISSUES FOR MEETING BETWEEN THE NRC AND SNEC STAFFS
OCTOBER 31, 2002

HEALTH PHYSICS ISSUES

COVER LETTER:

1. Consider revision of license conditions under Section 2.E as follows:
Revise condition (d) text as "...related minimum detectable concentrations (for both scan and fixed measurement methods);"

Delete condition (e) result in significant environmental impacts not previously reviewed. This condition is already contained in condition (b) violate the criteria of 10 CFR 50.82(a)(6)(iii) [i.e, Result in significant environmental impacts not previously reviewed.].

Response:
Condition (d) has been revised and condition (e) has been deleted. Letter has been revised as follows:

(a) involve a change to the Technical Specifications or require NRC approval pursuant to 10 CFR 50.59;

(b) violate the criteria of 10 CFR 50.82(a)(6);

(c) reduce the coverage requirements for scan measurements;

(d) increase the derived concentration guideline level (DCGL), developed to meet the requirements of 10 CFR 20.1402, and related minimum detectable concentrations for **both** scan and **fixed** measurement **methods**;

(e) use a statistical test other than the Sign test or Wilcoxon Rank Sum test for evaluation of the final status survey;

(f) increase the radioactivity level, relative to the applicable derived concentration guideline level, developed to meet the requirements of 10 CFR 20.1402, at which investigation occurs;

(g) increase the Type I decision error;

(h) decrease an area classification (i.e., impacted to **non-impacted**; Class 1 to Class 2; Class 2 to Class 3; Class 1 to Class 3)

CHAPTER 1.0 GENERAL INFORMATION

2. Section 1.3, Plan Summary, page 1-2:

Revise the approval of proposed changes to be the same as those stated in the Cover Letter.

Response:
LTP section 1.3 has been revised so that approval of proposed changes is the same as those stated in the Cover Letter. This change also required editorial revisions to LTP Sections 5.2.4.4, 5.6.4.3 and Appendix 5.2 to correct for License Condition References.

CHAPTER 2.0 SITE CHARACTERIZATION

3. Section 2.2.4.1.7.1, Intake Tunnel Characterization Results, page 1-1:

The first paragraph states "Approximately 1 square foot of surface area was surveyed." It is unclear whether the 1 square foot total was scanned or 1 square foot every 10 feet of tunnel length was scanned. This statement needs to be clarified.

Response:
Section 2.2.4.1.7.1, page 2-16 revised as follows:

Surface Scans Using an E-140N with a HP-210/260 Probe: **Locations of survey scan measurements were obtained for each 10 feet of tunnel length. Approximately 1 square foot of surface area was surveyed at each location.** All Surface Scan survey results were <100 NCPM.

4. Section 2.2.4.1.8.5, Conclusions, page 2-19:

Consider revising the following sentence in the third paragraph follows: "Robotics was employed for the majority of this work as the small diameter pipes, **as the** confined spaces, and presence of water made manned entry difficult."

Response:
".. as the" has been deleted. Sentence revised as follows:

Robotics was employed for the majority of this work as the small diameter pipes, confined spaces and presence of water made manned entry difficult.

5. Section 2.6, CONCLUSIONS, pages 2-33 to 2-34:

Consider revision of "No positive results were detected >10' below the surface." to "No positive results above background were detected >10' below the surface."

Response:
Bottom of page 2-33 to top of 2-34 - Sentence has been revised as follows:

No positive results **above background** were detected >10' below the surface.

6. Section 2.7, REFERENCES, page 2-36:

Neither the text, tables, nor figures in Chapter 2 referred to Reference 2-21, TLG Services, Inc. report, "The Saxton Facility Reactor Vessel, internals, Ex-Vessel Lead, Structural Steel and Reactor Compartment Concrete Shield Wall Radionuclide Inventory", December, 1995 (TLG Document No. G01-1192-003). Delete this reference or cite it in Chapter 2.

Response:
REFERENCE 2-21, page 2-36, has been deleted.

7. Table 2-1, Radionuclide Inventory for the SNEC Facility (2002), page 2-39:
This table was revised to include two new columns, i.e., "Remaining Fraction" and "Total CV Activity Estimate (mCi)." Clarify the determination and use of the factor "0.26" throughout the Remaining Fraction column.

Response:
Table 2-1, page 2-39, has been revised to footnote the explanation for the "0.26" factor and correct unit term (mCi to Ci) in 'Total CV Activity column.

Table 2-1

Radionuclide Inventory for the SNEC Facility (2002)

Radionuclide	Total Activity Estimate (Ci)	Remaining Fraction (1)	Total CV Activity Estimate (Ci)	% of Total
Am-241	**1.12E-02**	**0.26**	**0.0029**	**1.29%**
C-14	**5.89E-03**	**0.26**	**0.0015**	0 68%
Cm-243/Cm-244	**1.73E-04**	**0.26**	**0.0000**	0 02%
Co-60	**7.68E-02**	**0.26**	**0.0199**	**8.85%**
Cs-134	**1.99E-04**	**0.26**	**0.0001**	0.02%
Cs-137	**4.24E-01**	**0.26**	**0.1100**	**48.86%**
Eu-152	**1.49E-03**	**0.26**	**0.0004**	0.17%
Eu-154	**5.98E-04**	**0.26**	**0.0002**	0 07%
Eu-155	**1.62E-04**	**0.26**	**0.0000**	0.02%
Fe-55	**1.01E-03**	**0.26**	**0.0003**	0 12%
H-3	**1.09E-01**	**0.26**	**0.0283**	**12.56%**
Nb-94	**2.50E-04**	**0.26**	**0.0001**	0 03%
Ni-59	**5.08E-03**	**0.26**	**0.0013**	0.59%
Ni-63	**1.60E-01**	**0.26**	**0.0415**	**18.44%**
Pu-238	**1.54E-03**	**0.26**	**0.0004**	0 18%
Pu-239/Pu-240	**3.67E-03**	**0.26**	**0.0010**	0.42%
Pu-241	**5.36E-02**	**0.26**	**0.0139**	**6.18%**
Pu-242	**7.71E-06**	**0.26**	**0.0000**	0 00%
Sb-125	**5.54E-04**	**0.26**	**0.0001**	0.06%
Sr-90	**1.17E-02**	**0.26**	**0.0030**	**1.35%**
Tc-99	**7.83E-04**	**0.26**	**0.0002**	0 09%
U-234	**6.79E-06**	**0.26**	**0.0000**	0.00%
U-235	**6.79E-06**	**0.26**	**0.0000**	0.00%
U-238	**6.79E-06**	**0.26**	**0.0000**	0 00%
	0.87		**0.23**	100.00%

Note. % values in **Bold** are those nuclides greater than one percent (1%) of the mix

Footnote: (1) Fraction of concrete remaining as of September 2002.

8. Tables 2-3a, 2-3b, 2-3c and 2.6a, pages 2-40, 2-42, 2-43, and 2-51:

During the public meeting on health physics issues (May 22, 2002), SNEC agreed to revise Tables 2.3a, 2.3b, and 2.6a to clarify sample type descriptions (e.g., scrap samples - paint, concrete, etc.) and corresponding footnotes added as appropriate. Please revise Tables 2-3a and 2-3b to resolve this issue. Also, Table 2-3c needs to be revised to indicate scrap sample type. Regarding Table 2-6a, the sample data for the DSF Roof, Debris from Inside Air Conditioner Housing - SXOT951 needs to be revised (as agreed to at the public meeting) to indicate the radionuclide analyzed.

Response:
Tables 2-3a, 2-3b and 2-3c have been revised to clarify scraping descriptions. In addition Cs-137 has been added to Table 2-6a as the radionuclide of reference.

9. Table 2-28, Site Access Roads, page 2-86:

The number of standard deviations is not stated for the data in this table. Please address.

Response:
Uncertainty values reported in Table 2-28 are one standard deviation. A note has been added to bottom of table to clarify.

10. Table 2-29, Listing of all "Hard to Detect Nuclides"/Transuranic Analysis, pages 2-87 to 2-95:

During the public meeting on health physics issues (May 22, 2002), SNEC agreed to revise Table 2-29 to include clarifying footnotes (i.e., state the analytical techniques used, other radionuclides analyzed but not listed, and that blanks indicate no sample analysis done). Please revise Table 2-29 to include this information.

Response:
Analytical techniques are specified in LTP Section 2.4, pg 2-32. The eleven radionuclides listed in the table are deemed the most significant for the site. The selection process for these radionuclides is documented in SNEC Calculation E900-01-030 and noted as Reference 6-13 in Chapter 6 of the LTP. A note has been added to the beginning of Table 2-29 to denote 'blank spaces indicate no sample analyses performed.'

11. Table 2-30 (Cont'd), CV Backfill & Subsurface Sample Results (see Figures 2-31 and 2-32):

Entries numbered 123 and 124 refer to subsurface sample data located at Grout Curtain Hole # 37. There is no such location identified on Figure 2-32, SNEC CV Grout and Well Installation Plan. Please revise the LTP to rectify this matter.

Response:
The correct sample entries are 122 and 123 located on G.C. Hole # 37. Although grout hole # 37 was not completed to depth and therefore never incorporated into Figure 2-32, these samples were taken out of the first 10 feet. Figure 2-32 has been revised to denote G.C. Hole # 37.

12. Figure 2-18, SNEC FACILITY - SSGS DISCHARGE TUNNEL, page 2-137:

During the public meeting on health physics issues (May 22, 2002), SNEC agreed to revise Figure 2-18 to indicate sampling locations. Please revise Figure 2-18 to include this information.

Response:
Tables 2-3e and 2-3f provide a comprehensive list of samples and respective location distances on Figure 2-18. It was agreed that placing all sample locations into Figure 2-18 would congest the data making it hard to comprehend. Figure 2-18 has been expanded to make it more readable.

13. Figure 2-29, Soil Remediation Near SNEC CV, page 2-148:

Regarding the "area of current excavation," the figure provides no reference distances for the excavation boundaries. Thus, the extent of remediation is not clear. Please provide a frame of reference with distances or delete this figure.

Response:
Figure 2-29, "SOIL REMEDIATION NEAR SNEC CV" is included simply for illustrative purposes to aid the readers understanding of the area involving soil remediation. Figure 2-32 has been revised and Figures 2-34 and 2-35 added to provide the reference distances in the impacted and non-impacted areas. These drawings are to scale.

14. Figure 2-30, SNEC Facility CV, page 2-149:

This figure is a sketch that shows the approximate depth of remediation efforts to date around the CV structure. Since this figure does not provide geophysical boundaries regarding the non-impacted region below the CV, it cannot be used to depict this region. During the public meeting on health physics issues (June 21, 2002), the NRC staff explained that the LTP needs to include a figure(s) that clearly indicate the boundary of the non-impacted region under the CV. Figures/text specifying the non-impacted region boundaries were not included in LTP Rev. 1. A separate figure with text that clearly depicts the geophysical boundaries of the non-impacted region needs to be provided.

Response:
Figure 2-30, "SNEC FACILITY CV" is included simply for illustrative purposes to aid the reader's understanding of the extent of remediation in the impacted and non-impacted regions. Figure 2-32 has been revised and Figures 2-34 and 2-35 added to more clearly indicate the boundary of the non-impacted region under the CV and the geophysical boundaries. These drawings are to scale. Section 2.2.4.2 has been updated to include these revised or new figures.

CHAPTER 5.0 SNEC FACILITY FINAL STATUS SURVEY PLAN

15. Section 5.1.1, Purpose, page 5-1:

Reference 5-5, NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," should also be cited as a document cited and reviewed in the process of preparing the final status survey plan.

Response:
Reference 5-5 has been cited in Section 5.1.1 as follows:

10 CFR 50.82(a)(9)(ii)(D) (Reference 5-1), Regulatory Guide 1.179 (Reference 5-2) and **NUREG-1575 (Reference 5-5)** have been used as guides in the preparation of this plan.

16. Section 5.2.4.2.2, Class 2 Area, page 5-10:

Consider revising the first sentence to read: "Class 2 areas are those that have or have had prior to remediation, a potential for radioactive contamination or known contamination, but are not expected to contain material greater than the $DCGL_W$."

Response:
First sentence in 5.2.4.2.2, page 5-10, has been revised as follows:

Class 2 areas are those that have or have had **prior to remediation**, a potential for radioactive contamination **or known contamination**, but are not expected to contain radioactive material greater than the $DCGL_W$.

17. Table 5-2, Initial Classifications of Site Areas, pages 5-10:

Consider changing the Column 1 title "Survey Unit Number" to "Survey Area Number." Interior Vertical Wall of CV Shell: Although the Description column specifies that this area is a wall, the Survey Unit Area column designates it as a ceiling. Please address. Type of DCGL Used: Confirm that volumetric DCGLs will not be used to assess contamination in the SSGS.

Response:
SNEC feels current Column 1 header in Table 5-2 is appropriate, i.e. "Survey Unit Number." Final status survey designs are currently planned to use a survey unit number code. It was agreed to leave current Column header as is.

Table 5-2, page 5-11 has been corrected as noted in the shaded area below. Value (392) has been placed in correct column (i.e. wall).

CONTAINMENT VESSEL (CV) - INTERIOR & EXTERIOR STEEL SHELL									
Interior Vertical Wall of CV Shell < ~804 5' El	X				392			4	1 (c)
Internal Support Ring Areas	X				65			22 (d)	1 (c)
Interior Curved Bottom of CV Shell	X						255	3	1 (c)
Exterior Wall – 802 6' El up to Cut-off	X				16 (g)			1	1 (c)
Exterior Wall 1 Meter Below Class 1 Area (Down to 797 6' El)		X			10			1	1 (c)
External Rock Anchor Support Ring Assembly Area	X				66			1 (d)	1 (c)

The following footnote has been added to the SSGS section in Table 5-2, page 5-13, to denote the use of the appropriate DCGL

(c) NRC Default Surface DCGLs = 1, Site Specific Volumetric DCGLs = 2: SNEC plans to use surface area DCGLs as noted in SSGS section. However, if geometry of surface is not appropriate for a surface area measurement then guidance in LTP Chapter 6, Section 6 2.1 may need to be implemented

18. <u>Section 5.2.5.1, Survey Design Overview, page 5-16</u>:

The third paragraph of this section states, "When necessary, a two-stage sampling process may be used IAW Reference 5-20. This sampling approach allows a second set of samples to be taken to meet the requirements of the statistical design of the survey. When used, this process will be incorporated as an option in the original survey design for the area." Per the Saxton Public Meeting Minutes, June 21, 2002, regarding the use of "Two Stage or Double Sampling" in final status surveys, the NRC staff stated that the LTP needs to indicate those survey units where this method may be used to show release criteria compliance. Section 5.2.5.1 does not indicate the criteria to be applied when making the determination that Two Stage or Double Sampling will be applied to a survey unit. In addition, use of Two Stage or Double Sampling increases the Type I decision error. Consequently, to use this process without identifying the applicable survey units in the LTP would require additional license amendments after the LTP is approved.

Response:
All sections of the LTP referring to "Two Stage or Double Sampling have been deleted from the LTP. Reference 5-20 has been deleted.

19. <u>Section 5.2.10, Schedule, page 5-24</u>:

This section states "Final survey activities are planned and will be discussed with the NRC in advance to allow scheduling of the required public meeting on the License Termination Plan." Per 10 CFR 50.82(a)(9)(iii), "The NRC shall also schedule a public meeting in the vicinity of the licensee's facility of upon receipt of the of the license termination plan." The required public meeting was held on May 25, 2000, after LTP Revision 0 (dated February 2000) was submitted by the licensee. There is no regulatory requirement to hold additional meetings. The sentence above needs to be explained or deleted from the LTP.

Response:
Last sentence in Section 5.2.10, page 5-23 has been deleted. Section now reads as follows:

Final status surveys are planned, scheduled, and tracked as a part of the overall decommissioning planning process. The schedule is dependent upon the progress and completion of several decommissioning activities and review and approval of the License Termination Plan. Presently, survey data collection is expected to begin in the fourth quarter of 2002.

20. <u>Section 5.4, SURVEY DESIGN, page 5-26</u>:

Item 1 - Use of "Two Stage or Double Sampling" needs to be addressed in the design package. Consider revising the text to read "A brief overview describing the final status survey design, and a description of the use of "Two Stage or Double Sampling" when applicable."

Item 2 - Each survey design package needs to include a clear description of the boundaries for each survey area or unit. Consider revising the text to read "A description and map or drawing of impacted areas of the site, area, or building classified by residual radioactivity levels (Class 1, Class 2, or Class 3) and divided into survey units, with an explanation of the basis for division into survey units and the boundaries for each survey unit or area indicated. Maps should have compass headings indicated."

Response:

Item 1. SNEC will not be using the Two Stage or Double Sampling approach and therefore this technique will not be added under this item.

Item 2. Reworded as follows: A description and map or drawing of impacted areas of the site, area, or building classified by residual radioactivity levels (Class 1, Class 2, or Class 3) and divided into survey units, with an explanation of the basis for division into survey units **and the boundaries for each survey unit or area indicated**. Maps should have compass headings indicated;

21. Section 5.4.4.5, Resurvey, page 5-38:

The second paragraph of this section states "In the case where a new survey unit is separated out from an existing survey unit or an existing survey unit is subdivided, Class 3 survey units need only additional randomly located measurements to complete the survey data set." When elevated contamination is identified in a Class 3 area and the area is subsequently subdivided into different classifications, the survey for the remaining Class 3 area needs to be repeated. In other words, taking of additional samples from the revised Class 3 area to supplement those now contained in the new subdivided area(s) classified as Class 1 or Class 2 is not permitted. Consider revising this paragraph to state "In the case where a new survey unit is separated out from an existing survey unit or an existing survey unit is subdivided, Class 3 survey units need to have the survey repeated to obtain a new survey data set."

Response:

Paragraph 5.4.4.5, page 5-38, has been revised as follows:

In the case where a new survey unit is separated out from an existing survey unit, or an existing survey unit is subdivided, Class 3 survey units need **to have the survey repeated to obtain a new survey data set**. Class 1 and Class 2 survey units require a new survey design based on random-start systematic measurement locations.

22. Section 5.5.2.4.4, Static MDC for Structural Surfaces, page 5-46:

Item 5 states "Other correction factors may be applied to the above equation as deemed appropriate." This statement is vague; clarification of the term "other correction factors" needs to be provided.

Response:

Page 5-46, Item 5 has been deleted.

23. Section 5.5.3.4.7, Subsurface Soil Contamination Survey, page 5-51:

The text at the end of the first paragraph states "Additionally, *in-situ* measurements may be considered when any layer exhibits results approaching 50% of the release criteria." The purpose of these measurements needs to be explained.

Response:

Section 5.5.3.4.7, page 5-51 - Text has been revised to clarify meaning as follows:

Additionally, *in-situ* measurements may be considered when any layer exhibits results approaching 50% of the release criteria **to verify and determine extent of contamination.**

24. Section 5.5.3.5, Investigation Measurements, page 5-54:
In Section 2.2.4.2, "Soil," the third paragraph on page 2-20 states "Gamma bore logging will not be used as a stand alone technique for characterization or Final Status Survey but rather as a compliment to sampling." In order that the term "compliment to sampling" is consistently used throughout the LTP, consider revising the final sentence in Section 5.5.3.5, "Investigation Measurements," to state "Therefore, GPU Nuclear, Inc. will consider using gamma-logging as a compliment to sampling in areas where..."

Response:
Last paragraph, final sentence in Section 5.5.3.5, page 5-54 has been revised as follows:

Therefore, GPU Nuclear, Inc. will consider using gamma-logging **as a compliment** to sampling in areas where volumetrically contaminated materials approach the release criteria or when contamination is thought to be present in piping systems within a survey area.

25. Section 5.5.5.1, Other Scan Measurements, pages 5-54 to 5-55:
Regarding 100 percent scanning of an area with high detection efficiency instrumentation, this section states "Therefore, the need to measure a finite number of randomly selected survey points are reduced or eliminated. Consequently, some scan survey measurement efforts performed for initial phase and/or investigative purposes, may be accepted as final survey data provided the following conditions are met..." In contrast to this statement on the use of such instrumentation, Section 5.4.3, "Static Measurements," states - "However, GPU Nuclear, Inc. has agreed that soil samples will still be collected in open land areas additional to these semi-automated scan survey or *in-situ* gamma spectrometry special measurement techniques." In the latter case, SNEC has told the NRC staff (at public meetings) that the number of sampling points for the final status survey will be determined by the MARSSIM process. Consequently, once determined, the number of sample points cannot be reduced or eliminated. This inconsistency between the two sections needs to be rectified. Furthermore, Section 5.5.5.1 needs to specify the survey unit types or characteristics (e.g., embedded pipes) for which scan measurements may be accepted as final status survey data.

Response:
First paragraph, second sentence in Section 5.5.5.1, page 5-54 has been deleted. Revised paragraph currently reads:

When 100% of any area is scanned at a high detection efficiency, capable of discerning low levels of residual activity (well below established $DCGL_W$ levels), collected results have a greater assurance that survey areas meet the site release criteria. Consequently, some scan survey measurement efforts performed for initial phase and/or investigative purposes, may be accepted as final survey data provided the following conditions are met:

26. <u>Section 5.8, DEFINITIONS, page 5-66</u>:

The definition for *scoping survey* states "Surveys such as investigative surveys used to provide a quick look at conditions before or during FSS work. These surveys are not necessarily documented." This definition needs to be revised since scoping survey activities are performed for a preliminary risk assessment or to provide input for additional characterization and are not conducted during the final status survey. Consider replacing this definition with that which is in NUREG-1575, Rev. 1.. i.e., "A type of *survey* that is conducted to identify: 1) radionuclide contaminants, 2) relative radionuclide ratios, and 3) general levels and extent of contamination."

Response:
Section 5.8, page 5-66 - Definition has been revised as follows:

Scoping Surveys – A type of survey that is conducted to identify: 1) radionuclide contaminants, 2) relative radionuclide ratios, and 3) general levels and extent of contamination.

DOSE MODELING

27. Consider referencing in the LTP the specific MicroShield analysis used in support of Equation 6-1. In referencing these calculations, consider stating that any future analysis using MicroShield in support of Equation 6-1 will use the same conceptual model and input parameters (with possibly the exception of the concentration) as those used in the referenced analysis.

Response:
Copies of SNEC Calculation 6900-02-025 have been provided to NRC as part of this answer submittal. This document has been included in the reference section of LTP Chapter 6. Section 6.2.1, page 6-3, has been revised to include NRC's comment that only the concentration or activity will be updated in Equation 6-1 and the appropriate bounding constant(s) are notated for use in Equation 6-1. In addition, application of Equation 6-1 will used over the entire respective survey unit. Revisions to Section 6.2.1 have resulted in page changes to pages 6-4 through 6-9. The following is the revision to Section 6.2.1.

Exposure pathway (d) listed above applies to areas where there is penetrating radiation from embedded sources of radioactivity, such as embedded piping or activated metal. To the extent practical embedded pipe sources will be filled with grout or concrete. For modeling these scenarios a bounding calculation has been performed (Reference 6-19) using the sum of the fractions method. This method combines applicable surface and volumetric DCGLs along with the Microshield shielding code to calculate the respective dose from residual activity remaining on structural surfaces, within residual piping, walls and floors or within activated metal (e.g. CV steel liner). Two scenarios have been evaluated in the calculation. They are:

- Bounding Limit 1 – Dose from an activated region of the SNEC CV steel shell is combined with the dose from surface contamination. The annual direct gamma dose calculated by MicroShield for the activated region is 7.2 mrem.
- Bounding Limit 2 – Dose from post remediation surface contamination and volumetric contamination of concrete surfaces within the SSGS Discharge Tunnel are combined with several hypothetical direct exposures from pipe sections. The annual direct gamma dose calculated by MicroShield for the SSGS pipe sections is 0.611 mrem.

As a result of the Reference 6-19 calculation the direct gamma dose will remain fixed and bounding based on the applicable scenario. Only the surface contamination or volume concentration parameters are allowed to vary in Equation 6-1. Use of Equation 6-1 will ensure the combined exposure is bounded for the applicable source terms over the entire survey unit and result in less than the 25 mrem/yr limit.

Equation 6-1

$$\sum_{i=1}^{n}\left(\frac{C_{si}}{DCGL_{si}}+\frac{C_{vi}}{DCGL_{vi}}\right)+\left[\frac{Direct\ \gamma\ Dose}{25}\right]\leq 1$$

Where: C_{si} = Surface contamination of radionuclide i (dpm/100 cm^2).

C_{vi} = Specific volume concentration of radionuclide i (pCi/g).

$DCGL_{si}$ = Surface contamination DCGL of radionuclide i from Table 6-2.

$DCGL_{vi}$ = Volumetric DCGL (25 mrem/yr) of radionuclide i from Table 6-2.

Direct γ Dose = MicroShield shielding code calculation (mrem/yr).

For the following bounding cases Equation 6-1 reduces to:

Activated CV Steel - $\sum (C_{si} / DCGL_{si}) + 0.288 \leq 1$

SSGS - $\sum (C_{si} / DCGL_{si} + C_{vi} / DCGL_{vi}) + 0.024 \leq 1$

FINANCIAL

28. Please list outstanding decommissioning work and the basis for the statement that it will cost $13.0 million to complete this work.

Response:
Chapter 7 has been revised to include the basis of the cost to complete the work as follows:

7.0 UPDATE OF THE SITE-SPECIFIC DECOMMISSIONING COSTS

NRC's request for additional information dated November 8, 2000 requested additional information with respect to the site specific decommissioning cost information provided in Revision 0 of the SNEC License Termination Plan. GPU Nuclear's response to this request was reviewed and accepted by the NRC in conjunction with their review of the merger between FirstEnergy Corp. and GPU, Inc. The adequacy of decommissioning funding assurance for the SNEC Facility was documented by the Nuclear Regulatory Commission in the "Order Approving Application Regarding Proposed Merger of GPU, Inc. and FirstEnergy Corp. – Saxton Nuclear Experimental Facility (TAC NO. MB0215)" dated March 7, 2001.

Since that time the cost and schedule associated with the current Containment Vessel (CV) concrete removal project has exceeded what was assumed in this response. This has resulted in an overall $7 million increase in the remaining project cost beyond the $19.8 million estimate provided in GPU Nuclear letter E910-01-002 dated February 14, 2001, "Partial Response to Request for Additional Information, RE: License Termination Plan, (TAC NO. MA8076) dated November 8, 2000). Thus the current overall project cost estimate is approximately $63 million. As of July 31, 2002 approximately **$51** Million has been spent on the SNEC Decommissioning Project. Thus the remaining cost to complete the project is approximately **$12** Million. Table 7-1 Provides a breakdown of the remaining costs.

GPU Nuclear Letter E910-01-004, dated February 19, 2001, "Parent Guarantee for Decommissioning Funding" committed the SNEC Owners to carry out the required activities or setup a trust fund in favor of the NRC in the event GPU Nuclear failed to perform the required decommissioning activities. The amount of this guarantee is $20 million, which exceeds the remaining cost estimate of **$12** million. Thus adequate funding exists to complete the project.

Table 7-1 Outstanding Decommissioning Work

Cost Element	2002 Budget (8/1-12/31)	2003 Budget	Total
Project Management	189,000	179,000	368,000
Engineering	197,000	140,000	337,000
Radiological Controls	315,000	0	315,000
QA-Licensing	480,000	170,000	650,000
Miscellaneous	326,000	197,000	523,000
Radioactive Waste	3,527,000	148,000	3,675,000
Material & Supplies	143,000	150,000	293,000
Site Restoration	100,000	743,000	843,000
Final Status Survey	759,000	931,000	1,690,000
Communications	46,000	47,000	93,000
Decon & Dismantlement	1,892,000	0	1,892,000
Overheads	319,000	935,000	1,254,000
Total	8,293,000	3,640,000	11,933,000

GROUND WATER

29. Please incorporate your responses to the RAIs, the radiological analytical results from the groundwater sampling events, and other appropriate hydrogeological data into the revised LTP. This should include updating all text, tables, figures, and calculations in the LTP for the aforementioned items where these items have been replaced by more current analysis and data.

Please discuss as a minimum the following items in the LTP Groundwater Section:

a. Description of the overburden and bedrock water-bearing units at this site. (Note that the revised LTP has an adequate description of these units and this topic is included here only for purposes of having a complete list.)

Response:
No response required.

b. Discussion of the groundwater monitoring program at this site. This should include a discussion on the different phases in their monitoring program (i.e., what wells were installed, when, why). A map delineating the location of the overburden and bedrock wells. (Revised LTP is adequate except several monitoring wells installed during the fall/winter of 2000 are not discussed. Some of these are very important wells, for example, the nested background wells OW-3 and OW-3R and others – OW-4, OW-4R, OW-5, OW-5R, and OW-6.)

Response:
Last paragraph in Section 2.2.4.5, page 2-25 and Reference Section page 2-37, have been revised to add the references to the GPU Response letter to RAI3 dated March 19, 2001 (Reference 2-35) and the Haley & Aldrich Report dated March 14, 2001 (Reference 2-36), where this information is contained.

Remediation activities have resulted in several monitoring wells being removed from service. **In December 2000 additional wells were installed to characterize the upgradient and downgradient regions onsite. References 2-35 and 2-36 provide information on these installations. In addition**, at the request of the NRC a deep angle well was installed in March 2002 adjacent to and hydraulically downgradient of the CV. This well is intended to monitor for potential ground water and subsurface contamination originating from the CV or from migration of contaminants down through the backfill adjacent to the CV. The location of all wells, both in-service and abandoned is shown on Figures 2-17 and 2-32.

c. Recent groundwater-level configuration maps representing the overburden and bedrock units. Also, discuss any changes in the groundwater-level configuration maps under drought and extremely wet conditions. The groundwater flow directions or patterns should be discussed and shown on the maps. The groundwater flow in the bedrock should also be discussed based upon observed water levels and the fractures and structural features in the bedrock units. (This information was not included in the LTP, but it was included in the items listed above.) The licensee should also provide a table that lists the groundwater levels over time at this site for the different monitoring wells. The licensee staff or consultants provided the NRC staff with a table with this information during the April 2002 groundwater sampling event. This table provides information on the variations in the groundwater levels during seasonal and wet and dry climatic periods.

Response:
Table 2-34 listing the most recent groundwater levels has been provided. In addition, Section 2.2.4.5.1, page 2-26, has been revised as follows to describe groundwater flows through the various geological units.

Reference 2-32, submitted to the NRC on January 24, 2002 contains information on the SNEC site hydrogeology, monitoring well placement and sampling results.

Of particular note, as described in Reference 2-32, in 2000 and 2001, slug tests were conducted on several observation wells. Slug tests (falling head tests) were conducted on seven wells to assess the ability of water to move through the subsurface. Tests were conducted on three overburden (OW-3, OW-5, and OW-6) and four bedrock wells (OW-3R, OW-4R, OW-5R, OW-7R). The test was conducted by adding water to the well and frequently measuring and recording decreasing water levels. The water levels were recorded with a hand held water level probe. The Bouwer-Rice and the Hvorslov methods were used to analyze the slug test data and estimate hydraulic conductivity.

The range of hydraulic conductivity for three wells at the overburden/bedrock interface is 15.59 m/year to 35.62 m/year. The range of hydraulic conductivity for the four bedrock wells is 15.59 m/year to 909.53 m/year. Travel time estimates based on these hydraulic conductivities indicate that if tritium was released from the facility it has likely reached the Raystown Branch of the Juniata River.

Additionally water levels have been collected monthly or bimonthly basis since January 2001 to evaluate the potential for seasonal groundwater flow directions changes. A spreadsheet with level data is attached as Table 2-34. As discussed in Reference 2-32 Haley & Aldrich, Inc. evaluated the individual sets of water level information for Saxton through November 2001. This evaluation included wells installed at the overburden/bedrock interface and bedrock.

Groundwater elevations fluctuate throughout the year, however the groundwater flow pattern remains consistent. Groundwater elevations were reviewed and groundwater elevation contours were generated for the 2001 monitoring events. This includes the high water period in April 2001 and during the low water period in November 2001. Contouring indicates that the flow pattern is consistent and similar to past groundwater contours. For example, at the upgradient OW-3 series wells the water level elevations have fluctuated 8.30 and 7.00 feet in OW-3 and OW-3R, respectively. Similarly, the groundwater elevations have fluctuated 4.75 and 4.90 feet at the OW-5 series wells situated downgradient of the site and near the river.

A comparison of groundwater and surface water level trends indicates they behave similarly. When higher and lower groundwater elevations occur at the site, they also occur in the surface water (the Raystown Branch of the Juniata River).

d. Groundwater flow rates in the two water-bearing units should be discussed. Account for ranges in the hydraulic conductivity of the different rock materials; impact, if any, of climatic conditions on hydraulic heads and flow rate; and the impact of bedrock structure (fractures and bedding planes) on the flow rate in the bedrock unit. (This information was not included in the revised LTP.)

Response:
See response to item c above.

e. The groundwater flow rates should be used with potential plant-generated radionuclides to calculate travel times from the industrial area to the surface water discharge in the Raytown Branch of the Juniata River. Where appropriate, the Kd's of the different radionuclides need to be used. Discuss the potential ranges in these travel times within both water-bearing units for the different potential radionuclides. (This information was not included in the revised LTP.)

Response:
Chemical form and K_ds are discussed in LTP Section 6.2.2.7. For purposes of flow transport through soil or aqueous media tritium is normally the radionuclide of reference to predict maximum transport through the various geological units found at Saxton. Note the answer to item c in the hydraulic conductivity section and the reference to tritium transport.

f. Discuss the analytical results of the radionuclides present in the groundwater. This discussion should include all potential plant-generated radionuclides, including the hard-to-detect. (The licensee's discussion is adequate. However, the licensee's conclusion on page 2-26 that results from Table 2-32 confirms that there are no radionuclides related to plant operations present in the monitored groundwater is not correct. Table 2-32 does not include all the monitoring wells that were sampled during the April 2002 sampling event. This table contains only results from the wells that NRC collected a split sample. Also, NRC analyzed their groundwater samples for H-3, Cs-137, Cs-134, Co-60, and the hard-to-detect radionuclides while the licensee apparently analyzed their groundwater samples for H-3, Cs-137, Cs-134, and Co-60.)

Response:

LTP Revision 1 Table 2-17b (New Monitoring Well TRU/HTD Analysis Results) has been renumbered as 2-17c. A new table, which includes all the monitoring wells that were sampled in April 2002, has been inserted and numbered as 2-17b. Section 2.2.4.5.1, paragraph 8, page 2-26, has been revised as follows:

The ORISE results are reported in Reference 2-34. SNEC analyzed the split samples for Cs-137, Cs-134, Co-60, and tritium. **SNEC results are reported in Table 2-32 for wells where split samples were taken. Table 2-17b provides data for the remainder of the wells sampled that day.** Review of **these** sets of analysis confirms the conclusion that no radionuclides related to plant operations are present in the monitored groundwater.

Errata and Miscellaneous Corrections

1. Table of Contents, pages iv, v, and vii: Updated to reflect new and/or revised tables and figures.
2. Page 2-18, Section 2.2.4.1.8.3, last sentence: Fixed grammar. Changed "..may have be.." to "..may have been.."
3. Page 2-19, Last sentence bottom of page: Added reference to CoPhysics report.
4. Page 2-20: Added a paragraph to section 2.2.4.2 to describe scan surveys performed by Shonka Research Associates and corresponding reference.
5. Page 2-21, 1st paragraph: Clarified that the section of the CV Tunnel supporting the MHB will be removed.
6. Page 2-23, Section 2.2.4.4.1, last paragraph, Typo error: "C1-1" changed to "C1-6"
7. Page 2-34, paragraph 8: Revised to denote only the Weir discharge point impacts the Juniata River. Paragraph 9 was deleted to avoid confusion with paragraph 8.
8. Page 2-36: Reference 2-14 updated.
9. Page 2-37: Added four (4) new references.
10. Pages 2-41 through 2-47: Changed font style in Tables 2-3a through 2-3l to Arial and added corrected rows to Tables 2-3b, 2-3e and 2-3f to denote correct units.
11. Page 2-49, Table 2-5b: Added Cs-137 to table headers.
12. Page 2-71: Table 2-17b renamed to Table 2-17c. Corrected Table 2-17c units from pCi/g to pCi/l.
13. Page 2-147, Figure 2-28: Removed Note reference to microRem/hr readings.
14. Page 5-13, Table 5-2: Increased number of survey units from 2 to 3 for SSGS Intake Tunnel floor and ceiling sections. This revision was required due to dimension complexities determined from recent inspections of the tunnels. Changed description of "Top of Seal Chambers" to "Floor Above Seal Chambers".
15. Page 5-24, Section 5.2.11, 2nd bullet item: Changed "Saxton" to "SNEC".
16. Page 5-63, Section 5.7.2, Item 5, 2nd bullet, Typo error: "Class 5" changed to "Class 3."
17. Page 5-68, Reference 5-5: Updated with latest revision.
18. Page 5-72, Table 5-15A, Sr-90 area factor for 9 m^2 : Corrected value from 1.5 to 3.9. The correct value (3.9) is documented in SNEC Calculation E900-01-005 (LTP Reference 6-10). Copy of this calculation was submitted to the NRC in their April 8, 2002 meeting with SNEC staff.

Re Memo # E910-02-054

Attachment 2

SNEC Facility License Termination Plan, Revision 2 Change Pages

List of Effective Pages

Page No.	Rev.·No.	Page No.	Rev No.
TOC			
i	1	ii	1
iii	1	iv	2
v	2	vi	1
vii	2		
CHAPTERS			
1-1	1	1-2	2
1-3	1	1-4	1
2-1	1	2-2	1
2-3	1	2-4	1
2-5	1	2-6	1
2-7	1	2-8	1
2-9	1	2-10	1
2-11	1	2-12	1
2-13	1	2-14	1
2-15	1	2-16	2
2-17	1	2-18	2
2-19	2	2-20	2
2-21	2	2-22	1
2-23	2	2-24	1
2-25	2	2-26	2
2-26a	2		
2-27	1	2-28	1
2-29	1	2-30	1
2-31	1	2-32	1
2-33	2	2-34	2
2-35	1	2-36	2
2-37	2	2-38	1
2-39	2	2-40	2
2-41	2	2-42	2
2-43	2	2-44	2
2-45	2	2-46	2
2-47	2	2-48	1
2-49	2	2-50	1
2-51	2	2-52	1
2-53	1	2-54	1
2-55	1	2-56	1
2-57	1	2-58	1
2-59	1	2-60	1
2-61	1	2-62	1
2-63	1	2-64	1
2-65	1	2-66	1
2-67	1	2-68	1
2-69	1	2-70	1
2-71	2	2-72	1
2-73	1	2-74	1
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Page No.	Rev. No.	Page No.	Rev. No.
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2-83	1	2-84	1
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2-87	2	2-88	1
2-89	1	2-90	1
2-91	1	2-92	1
2-93	1	2-94	1
2-95	1	2-96	1
2-97	1	2-98	1
2-99	1	2-100	1
2-101	1	2-102	1
2-103	1	2-104	1
2-105	1	2-106	1
2-107	1	2-108	1
2-109	1	2-110	1
2-111	1	2-112	1
2-113	1	2-114	1
2-115	1	2-116	1
2-117	1	2-118	1
2-119a-119i	2		
2-119	1	2-120 (Fig. 2-1)	1
2-121 (Fig. 2-2)	1	2-122 (Fig. 2-3)	1
2-123 (Fig. 2-4)	1	2-124 (Fig. 2-5)	1
2-125 (Fig. 2-6)	1	2-126 (Fig. 2-7)	1
2-127 (Fig. 2-8)	1	2-128 (Fig. 2-9)	1
2-129 (Fig. 2-10)	1	2-130 (Fig. 2-11)	1
2-131 (Fig. 2-12)	1	2-132 (Fig. 2-13)	1
2-133 (Fig. 2-14)	1	2-134 (Fig. 2-15)	1
2-135 (Fig. 2-16)	1	2-136 (Fig. 2-17)	1
2-137 (Fig. 2-18)	1	2-138 (Fig. 2-19)	0
2-139 (Fig. 2-20)	0	2-140 (Fig. 2-21)	0
2-141 (Fig. 2-22)	0	2-142 (Fig. 2-23)	1
2-143 (Fig. 2-24)	1	2-144 (Fig. 2-25)	0
2-145 (Fig. 2-26)	0	2-146 (Fig. 2-27)	0
2-147 (Fig. 2-28)	2	2-148 (Fig. 2-29)	1
2-149 (Fig. 2-30)	1	2-150 (Fig. 2-31)	0
2-151 (Fig. 2-32)	0	2-152 (Fig. 2-33)	1
2-153 (Fig. 2-34)	2	2-154 (Fig. 2-35)	2
3-1	1	3-2	1
3-3	1	3-4	1
3-5	1		
4-1	1	4-2	1
4-3	1	4-4	1
5-1	2	5-2	1
5-3	1	5-4	1
5-5	1	5-6	1
5-7	1	5-8	1

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5-9	1	5-10	2
5-11	2	5-12	1
5-13	2	5-14	1
5-15	1	5-16	2
5-17	1	5-18	1
5-19	1	5-20	1
5-21	1	5-22	1
5-23	2	5-24	2
5-25	1	5-26	2
5-27	1	5-28	1
5-29	1	5-30	1
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5-33	1	5-34	1
5-35	1	5-36	1
5-37	1	5-38	2
5-39	1	5-40	1
5-41	1	5-42	1
5-43	1	5-44	1
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5-47	1	5-48	1
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5-51	2	5-52	1
5-53	1	5-54	2
5-55	2	5-56	1
5-57	1	5-58	1
5-59	1	5-60	1
5-61	2	5-62	1
5-63	2	5-64	1
5-65	1	5-66	2
5-67	1	5-68	2
5-69	2	5-70	1
5-71	1	5-72	2
5-73	1	5-74	1
5-75	2	5-76	1
5-77	1	5-78	1
5-79	1	5-80	1
5-81	1	5-82	1
Figure 5-1	1	Figure 5-4	0
Figure 5-5	0		
6-1	1	6-2	1
6-3	2	6-4	2
6-5	2	6-6	2
6-7	2	6-8	2
6-9	2	6-10	1
6-11	1	6-12	1
6-13	1	6-14	1

List Of Effective Pages

[a] Appendix 6.1 contains information on DandD DCGL Calculations for Building Occupancy Surface Area Model executed on 9/28/99 for Am-241 (3 pages), C-14 (2 pages), Co-60 (2 pages), Cs-137 (2 pages), Eu-152 (2 pages), H-3 (2 pages), Ni-63 (2 pages), Pu-238 (3 pages), Pu-239 (3 pages), Pu-241 (3 pages) and Sr-90 (2 pages)

LIST OF TABLES

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1.0 GENERAL INFORMATION

1.1 PURPOSE

The Saxton Nuclear Experimental Corporation (SNEC) Facility License Termination Plan (LTP) has been prepared in accordance with the requirements of 10 CFR 50.82, "Termination of License" (Reference 1-1) and the guidance provided in Regulatory Guide 1.179, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors" (Reference 1-2). The SNEC Facility License Termination Plan is maintained as a supplement to the SNEC Facility Updated Final Safety Analysis Report (USAR) (Reference 1-3) in accordance with 10 CFR 50.82(a)(9)(i).

This plan demonstrates that the remainder of the decommissioning activities at the SNEC Facility site will be performed in accordance with the regulations in 10 CFR 50.82. These activities will not be inimical to the health and safety, common defense and security of the public and will not have a significant effect on the quality of the environment.

1.2 HISTORICAL BACKGROUND

The Saxton Nuclear Experimental Corporation (SNEC) facility, is a deactivated pressurized water reactor (PWR), which was licensed to operate at 23.5-megawatt thermal (23.5 MWTh). It is owned by the Saxton Nuclear Experimental Corporation (SNEC) and is supported by GPU Nuclear Inc. The SNEC Facility is maintained under a Title 10 Part 50 License and associated Technical Specifications. In 1972, the license was amended to possess but not operate the SNEC reactor.

The facility was built from 1960 to 1962 and operated from 1962 to 1972 primarily as a research and training reactor. After shutdown in 1972, the facility was placed in a condition equivalent to a status later defined by the NRC as SAFSTOR. Since then, it has been maintained in a monitored condition. The fuel was removed from the Containment Vessel (CV) in 1972 and shipped to the Atomic Energy Commission (AEC) (now Department of Energy) facility at Savannah River, SC., who remains as owner of the fuel. As a result, neither SNEC nor GPU Nuclear Inc. has any responsibility relative to the spent fuel from the SNEC Facility. In addition, the control rod blades and the superheated steam test loop assemblies were shipped off-site. Following fuel removal, equipment, tanks, and piping located outside the CV were removed. The buildings and structures that supported reactor operations were partially decontaminated from 1972 through 1974.

Additional information on the SNEC Facility history is provided in Chapter 2 of this plan.

1.3 PLAN SUMMARY

This SNEC Facility License Termination Plan describes the process by which decommissioning will be completed and the SNEC Facility site released for unrestricted use. The plant activities described in the SNEC Facility License Termination Plan are consistent with the activities that already may be conducted under the approved SNEC Facility Technical Specifications. As specified in the accompanying License Amendment application GPU Nuclear Inc. may make changes or revisions to this plan without U.S. NRC approval provided the proposed changes or revisions do not:

a) Involve a change to the Technical Specifications or require NRC approval pursuant to 10 CFR 50.59;

b) Violate the criteria of 10 CFR 50.82(a)(6);

c) Reduce the coverage requirements for scan measurements;

d) Increase the derived concentration guideline level (DCGL)' developed to meet the requirements of 10 CFR 20.1402, and related minimum detectable concentrations for both scan and fixed measurement methods;

e) Use a statistical test other than the Sign test or Wilcoxon Rank Sum test for evaluation of the final status survey;

f) Increase the radioactivity level, relative to the applicable derived concentration guideline level, developed to meet the requirements of 10 CFR 20.1402, at which investigation occurs;

g) Increase the Type I decision error;

h) Decrease an area classification (i.e., impacted to non-impacted; Class 1 to Class 2; Class 2 to Class 3; Class 1 to Class 3)

The following subsections provide a brief summary of the chapters presented in the License Termination Plan.

1.3.1 Summary of Chapter 1 - General Information

This chapter provides the purpose of and regulatory basis for the SNEC Facility License Termination Plan, as well as a brief overview of each chapter contained in the plan.

1.3.2 Summary of Chapter 2 - Site Characterization

In accordance with 10 CFR 50.82(a)(9)(ii)(A), this chapter provides a description of the radiological conditions at the SNEC Facility site. The SNEC Facility site characterization incorporates the results of scoping and characterization surveys conducted to quantify the extent and nature of contamination at the SNEC Facility. The results of the scoping and characterization surveys have been and continue to be used to identify areas of the site that will require remediation, as well as to plan remediation methodologies and costs. Characterization data has been used to classify areas as to the magnitude of radiological impact for Final Status Survey and to guide remediation efforts. General findings are presented and explanation as to the impact on remediation is given.

Reference 2-30, submitted to the NRC on September 4, 2001 contains additional information on the characterization of the SSGS.

2.2.4.1.6 SSGS Discharge Tunnel Surrounding Environs

Investigations of soils at several locations in the vicinity of the SSGS Discharge and Intake Tunnels and the SSGS area are reported in Table 2-3i. There is no evidence of elevated contamination in these results above that which results from natural background radiation. Soils removed in the vicinity of the SSGS Discharge Tunnel during soil type investigations contained only background levels of radionuclides normally associated with plant operation.

2.2.4.1.7 SSGS Intake Tunnel

During operation of the SSGS, water was drawn from the Raystown Branch of the Juniata River. A dam was utilized to impound the river in the area of the intake structure, which included the Intake tunnel. The intake water system only provided intake of river water to the SSGS and no discharges to the river were made via this pathway. During freezing weather, warm water from the SSGS Discharge Tunnel was diverted and allowed to flow into the SSGS Intake Tunnel via a pathway that utilized the Spray Pond supply piping. This configuration was established in order to prevent ice formation on the intake tunnel screen wash and filtration system components. This flow path, by use of discharge tunnel water, would have provided a mechanism for low level radioactivity to enter the SSGS intake tunnel. Figures 2-25, 2-26 and 2-28 show the SSGS Intake Tunnel in detail.

2.2.4.1.7.1 Intake Tunnel characterization Results

Table 2-26 lists the Intake Tunnel characterization results. Figure 2-28 shows the SSGS Intake Tunnel distances related to sampling point locations. Sample locations from Table 2-26 are also plotted on Figures 2-26 and 2-28. Table 2-29 provides TRU/HTDN analysis results from this area.

Sediment Sampling: A total of 174 sediment samples were taken throughout the Intake Tunnel. Of these, 142 samples showed positive Cs-137 above MDC. The average Cs-137 value is 0.46 pCi/g and the highest is 1.8 pCi/g (SSGS North Intake Tunnel North Wall / MID-SECTION at 85'). All sediment samples were <MDC for Co-60 activity.

Concrete Core Bore Sampling: Fourteen (14) concrete core bore samples were obtained throughout the tunnel. All core samples were found to be <MDC.

Concrete Samples – Material debris: Sample number SX-CF-2245 core disk crumbled when sliced and was counted as Concrete Debris. Results were <0.27 pCi/g Cs-137 and <0.4 pCi/g Co-60. No other debris samples were collected.

Water Sampling: Five (5) water samples were obtained throughout the intake tunnel. Sample results were <MDC for Cs-137, Co-60, and Tritium.

Loose Surface Contamination (Smear Surveys): At least 1 smear was obtained for every 100 square feet of concrete tunnel surface area. A total of 335 smears were obtained throughout the tunnel. All smears were <1000 dpm/100cm^2 beta-gamma and <MDC alpha.

Surface Scans Using an E-140N with a HP-210/260 Probe: Locations of survey scan measurements were obtained for each 10 feet of tunnel length. Approximately 1 square foot of surface area was surveyed at each location. All Surface Scan survey results were <100 NCPM.

Static Measurements Using a Bicron Micro-Rem: Dose rates were obtained throughout the tunnel approximately every 10 feet at 3 feet from the floor. Dose rates were 2-4 uR/hr throughout the intake tunnel.

Reference 2-31, submitted to the NRC on January 11, 2002 contains additional information on the characterization of the SSGS intake tunnel.

The intake tunnel from the river intake to the second clean-out (~440') is classified as non-impacted. The balance of the intake tunnel floors and walls are classified as a class 2 area while the ceiling is a class 3. The trash rack and intake screen areas are classified as non-impacted. Chapter 5.0 and Table 5-2 provide more information on the intake tunnel classification.

2.2.4.1.8 Systems

Only those systems that will remain following remediation and fall under the Final Status Survey program were characterized. This precluded characterization of such systems as the CV ventilation system, piping that penetrates the CV into the service tunnel, and temporary systems installed to support decommissioning such as compressed air, electrical power, rigging fixtures, etc. All of these systems will be removed prior to the Final Status Survey and are not included in its scope.

One system that was characterized, as it will remain and be included in the Final Status Survey, is the complex site storm drain system. This system collects surface water and building drains from structures in the Penelec property and directs it to the Raystown Branch of the Juniata River.

The Saxton Steam Generating Station (SSGS) was demolished along with segments of its supporting yard drainage systems over twenty five (25) years ago. However, several sections of underground drainage piping still exist in the South and West sides of the SSGS in-ground structure. These piping systems continue to channel rain water and site run-off away from the site.

Drainage systems surrounding the SNEC CV area have largely been removed as a result of the excavation of contaminated soils in the vicinity of the SNEC CV, including the Weir system piping to the Juniata River in its entirety. In addition, a septic system drain field has been excavated on the South side of the Penelec Warehouse.

2.2.4.1.8.1 Yard Drains - Initial Inspection Results

An inspection and sampling of remaining segments of SSGS Yard System Drainage piping has been performed in two (2) phases. The initial phase involved an effort to investigate and understand the various interconnections that exist between piping segments within the larger 100 acre Penelec site area and the enclosed ~10 acre inner area that surrounds the former coal fired SSGS footprint and existing SNEC Facility structures.

Robotics and video camera equipment was used to probe and examine existing piping segments and establish their interconnections. The investigation phase also located access points and established existing water flow patterns from these systems. Because water flows away from the site (toward the Juniata River), it was decided that a thorough investigation and sampling of remaining underground piping systems should be performed to rule out the possibility elevated levels of radionuclide contamination having been introduced into the environs through these systems.

The Shoup Run Shunt Line is a 600 foot long 42 inch diameter line that was originally used to channel water from Shoup Run to below the SSGS dam on the Juniata River thus bypassing the SSGS Intake Tunnel. All of the remaining SSGS area drainage lines on the south and west sides of the SSGS area connect at different points along the Shoup Run Shunt Line.

At the South edge of the SSGS Boiler Pad, a pipe section was discovered and unearthed that appears to have been a storm drain line originating at the old SSGS Facility. This line continues South toward the Penelec Warehouse where it connects with the grated yard drain opening by this structure. This pipe section then continues further South past the Warehouse into the open field beyond the ~10 acre fenced in Penelec property. It continues South toward Shoup Run and passes into and out of two (2) access openings. At this point the line is approximately 6 to 8 feet below the surface (grade level). At the second of the two access openings, the drain line turns toward the Southwest and terminates into the Shunt Line.

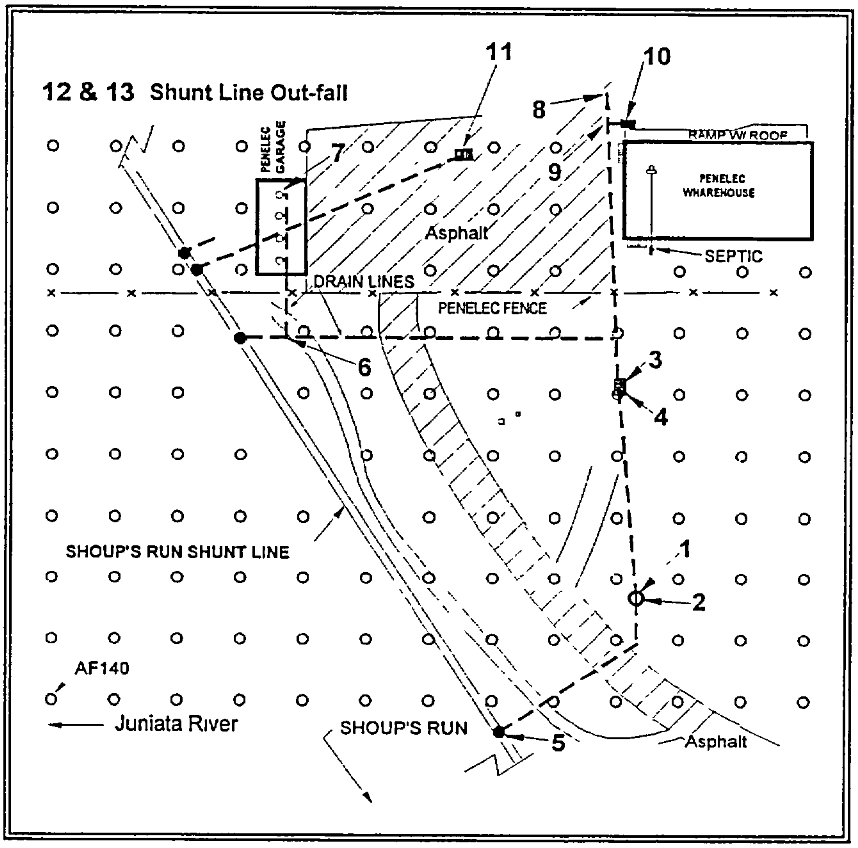
The small four (4) bay Penelec Garage has four (4) sumps (1 per bay). Each of these sumps connect to a common header that passes below the garage floor toward the South and then connects to a ~12" diameter line that ties directly into the Shunt Line. This 12" line runs parallel with the South fence that surrounds the ~10 acre Penelec property, and is assumed to connect at some point with the line running by the Penelec Warehouse.

About in the middle of the asphalt covered parking area between the Small Garage and the Warehouse, is a second grated drainage collection point that connects with the Shunt Line through a subsurface pipe traveling West toward and past the Penelec Garage. From robotics inspection efforts it appears to travel very close to or beneath the Penelec Garage on its way to the Shunt Line.

Another connection with the Shunt Line (about 10 feet further northwest and beyond the previous connection) was discovered during a robotic inspection of the interior of the Shunt Line. This pipe serviced an unknown portion of the SSGS area but it is assumed to have been another yard drainage system tie-in that was destroyed during the initial SSGS demolition effort. All the Yard Drain piping sections are depicted in **Figure 2A-1**.

Figure 2A-1

SNEC Site Grid Map Segment Yard Drain Lines



2.2.4.1.8.2 Initial Sampling Results (Phase 1)

First phase sampling of Yard Drain piping access points was performed at the time of the initial exploration and mapping of these systems. These samples were grab samples of materials that had collected in these drainage system pipe sections since plant shutdown. GPU Nuclear personnel have assayed these materials and these analysis results are reported in tables 2-5 and 2-5a.

2.2.4.1.8.3 Discussion of Initial Sampling and Inspection Results

First phase sampling results did not detect any significant or elevated levels of Cs-137 or Co-60 in any of the Yard Drain system piping that was accessed during this work effort. However, a sample taken from within sump number four (4) of the Penelec Garage did show a Cs-137 concentration of 6 pCi/g. This elevated level of Cs-137 may have been the result of radiological work performed in the Penelec Garage during previous site remediation efforts.

2.2.4.1.8.4 Phase 2 Sampling and Measurement Effort

After reviewing the results from the phase one investigation effort, it was decided that a more rigorous investigation of the yard drain piping systems would be appropriate. The reasons for this are as follows:

- Grab samples from within an operational drainage system continually collect sediment and washout materials, i.e., materials that have washed into the systems since the time of facility demolition. Potentially contaminated materials from the time of site operation have most likely been lost by washing through the system and are no longer available for sampling.
- Grab samples alone, without internal measurements can easily miss encrusted or fixed contamination within a piping system.
- Some sections of drainage piping were not accessed during phase one activities.
- A more rigorous survey approach would be needed to meet Final Status Survey release criteria.

To satisfy these concerns, a second phase sampling and measurement effort was conducted. Measurements were made over accessible lengths of pipe and samples were taken from each piping system. The results were compared with previous sampling results. No further actions are planned for Final Status Survey since there were no significant findings in these systems. Characterization results from this phase are summarized in table 2-5b.

2.2.4.1.8.5 Conclusions

During October 2001, in-situ gamma spectroscopy measurements and scale/sediment sampling was performed as part of a study of radioactive contamination in embedded piping found at the SNEC site. One hundred and twenty seven (127) spectra were collected in approximately 10 pipes and drainage areas. Additionally, 39 QA/QC spectra were collected, and 29 scale/sediment samples were collected and analyzed in the on-site GPU Nuclear laboratory. The results show that radioactivity levels are well within site release limits (DCGLs), even using conservative assumptions regarding calculations of in situ radionuclide concentrations. Sampling data compare favorably with measurement results.

Phase 2 measurements confirm that the Yard Drain piping system is below the DCGL's for releasing the site. In addition, measurements of significant sections of this system suggest that no major source of contamination was released to this system during past site operations. As such, this piping will not need to be resurveyed as part of the Final Site Survey. This piping is located under open land areas already classified as impacted Class 2 or 3 and these areas are documented in Figure 5-1 of the SNEC LTP.

Because of the history of the site as evidenced by the HSA (Reference 2-14), and the soil contamination on-site, this system was felt to be "impacted" and was surveyed and sampled. Robotics was employed for the majority of this work as the small diameter pipes, the confined spaces and presence of water made manned entry difficult. Figures 2A-1, 2-11 and 2-12 show the location of these drains. Tables 2-5, 2-5a and 2-5b list the sample results. Chapter 5.0 provides the survey classifications that result from the characterization data.

References 2-31 and 2-38 contain information regarding characterization of embedded and yard drain piping.

2.2.4.2 Soil

In addition to the CV, contaminated soil in and around the SNEC Facility site will require remediation. As described in Section 2.2.1, the SNEC Soil Remediation Project, completed in 1994, removed contaminated soil from the site in an effort to reduce Cs-137 levels to <1pCi/g average. While this project achieved its goal, contaminated soil near the CV and the surrounding support tunnel could not be removed until these structures were removed. Additionally, soil conditions and pervasive ground water near the surface prevented an assessment of soil contamination below about three feet deep in these areas.

Shonka Research Associates, Inc. performed a radiological scan survey in late November and early December 2001 at the Saxton site (Reference 2-37). This survey constituted the first phase of a two-phase effort to perform a Final Status Survey (FSS) for SNEC. The survey was performed using sodium iodide NaI(Tl) scintillation spectrometers. Approximately 7 hectares (15 acres) of open land area was surveyed with 100% coverage The average concentration site-wide of ^{137}Cs was 0.3 +/- 0.15 pCi/g (1 standard deviation).

In order to survey the areas not covered by the 1994 soil project and to investigate potentially impacted areas identified by the HSA (Reference 2-14) a major surface and subsurface soil sampling program was completed in 1999. In addition to random points, biased sample locations were selected based on the HSA and previous survey results. Cs-137 was the only nuclide attributed to licensed operations, which was detected. The surface sample results are reported in Table 2-14, while the sample locations are shown on Figures 2-13 and 2-14. The information has been used in concert with historical information to classify the survey units as described in Chapter 5.0. The data has resulted in some areas off the SNEC Facility site but within the surrounding Penelec property being classified as impacted.

In addition to the 55 surface sample locations, 42 subsurface sample locations were sampled. These were generally biased samples located in areas where below grade tanks, piping, ducts, spills, and or structures were once present. The results of subsurface sampling are presented in Table 2-15. Subsurface sample locations are shown on Figures 2-15 and 2-16. As a compliment to the subsurface sampling, gamma bore logging was performed at these same locations. The use of two different techniques allows for the differentiation of possible soil contamination at a location from the presence of buried radioactive components. The results of the gamma bore logging are presented in Table 2-16. Subsurface gamma bore logging locations are shown on Figures 2-15 and 2-16. Results of the subsurface sampling and gamma logging indicate the need to remediate soil to a depth at least ten (10) feet deep on the north side of the CV. This has been completed. The gamma bore logging results show that some radioactive components were present at this depth in this location (holes #10, 11 & 13), these have been removed. Gamma bore logging will not be used as a stand alone technique for characterization or Final Status Survey but rather as a compliment to sampling.

The CV Pipe Tunnel concrete structure has largely been removed, allowing characterization of the soil beneath it. The top of the tunnel started at grade elevation (~811'-6") and ended approximately ten (10) feet below grade. The walls, ceiling and floor of the CV Pipe Tunnel were 8 to 14 inches thick in most areas.

The interior tunnel surface was contaminated from leaks in piping within the tunnel area during facility operation. Additionally, there are a number of contaminated pipe penetrations that extend through the CV steel shell wall and entered into the CV Pipe Tunnel. Many of these penetrations, which were initially cut and capped, leaked over the years since plant shutdown. These leaks resulted in contaminated water penetrating the seam between the CV Tunnel floor and wall sections, and at other structural defect areas within the CV Tunnel, which caused contamination in soils at select locations below and adjacent to the CV Tunnel floor.

Based on the difficulty of surveying this contaminated and water filled structure, it was determined that removal of the CV Tunnel would be necessary. As a result of this decision, the majority of the CV Tunnel has now been removed. Only a small section of the CV Tunnel remains which supports the floor of the Material Handling Bay (MHB) portion of the DSF. The MHB is still in use and will be removed at a later time. The section of the CV Tunnel supporting the MHB floor will be surveyed and removed prior to backfill operations. Soil volumes below the remaining section of the CV Pipe Tunnel floor (below the MHB) have been sampled by drilling through the floor to allow access to this area.

Figures 2-29, 2-30 and 2-32 show the approximate location of the CV Tunnel and the currently excavated area surrounding the CV. The depth of the current excavation ranges from grade (~811' El.) down to approximately the 795' elevation and covers an area of about 1300 square meters that includes the CV. Characterization information is provided in Tables 2-27, 2-29, 2-30 and 2-31.

Some soil, particularly that surrounding the CV will require remediation. Some subsurface samples and surveys indicate that remediation of soil north of the CV may be required to a depth of ten (10) feet below the dominant grade. In an effort to justify the classification of the backfill surrounding the CV below the 797.6' elevation and under the CV as non-impacted, an extensive characterization and sampling project was conducted in this area. Approximately 857 samples were obtained and analyzed from 112 locations around the CV. Depths of these samples ranged from the surface to 150' deep. Sample media included soil, soil like materials, bedrock, groundwater and concrete from the exterior CV saddle. Of the 857 samples analyzed, 35 of those detected positive activity. Of those 35 positive results, only five (5) indicated Cs-137 above background. These five ranged from 0.6 pCi/gm to a high of 0.9 pCi/gm, all well below the applicable DCGL. No positive results were detected >10' below the surface being sampled. A complete listing of the analysis results is given in Table 2-30. Due to the volume of data with no positive activity, a separate table, 2-31 provides a listing of all positive results. Figures 2-32, 2-34 and 2-35 illustrate the sampling of this area in detail.

Transuranic (TRU) radionuclides and strontium-90 were positively identified by off-site analysis in several samples from the CV excavation area. SNEC sample number SX5SD99202 was taken at a depth of 4-6 feet within the CV North yard area. This sample contained Am-241 at a concentration of 0.012 pCi/g. Another North yard area sample that was collected from soil bag number 34L (packaged for disposal), contained a combined TRU concentration of approximately 0.2 pCi/g and exhibited a strontium-90 concentration of 0.27 pCi/g. Finally a sample of sediment from within the CV Pipe Tunnel (before remediation), contained strontium-90 at a concentration of about 9.7 pCi/g. The latter two sample materials both contained measurable amounts of Cs-137 and Co-60 as well. Selected samples from on-site areas are routinely sent for a more complete analysis supporting SNEC remediation efforts.

The surface areas and subsurface to one meter deep below the current excavation surrounding the CV are classified as class 1 survey areas. Chapter 5.0 provides the survey classifications that result from the characterization data, see Table 5-2.

2.2.4.3 Pavement

Paved and unpaved roads are indicated on Figures 2-11 and 2-12. The pavement area south of the DSF has had subsurface sampling and gamma logging performed (sample location #14 and 15 in tables 2-15 and 2-16, shown on Figure 2-16). Results of sampling and gamma logging in these two locations showed no activity related to licensed operations. Site access roads (paved and unpaved) extend over the SNEC Facility property as well as Penelec area properties. Scan surveys of these surfaces were performed using 2" diameter by 2" long sodium iodide (NaI) detectors. Because of the variability of natural occurring site radionuclides, background values were determined by re-evaluation on a location by location basis, supported by sample collection and analysis of the major gamma emitters, Cs-137 and Co-60.

The main access roadway to the site enters the Penelec property from Power Plant Road from Pennsylvania Route 913. The entrance road extends approximately 1/8 mile onto the site before terminating at a trailer complex. Various side roads branch from this main site access road into other areas of the site. An old access roadway to the Saxton Steam Generating Station (SSGS) west of the nuclear station also was included in the survey coverage. Much of this old roadway was required to be uncovered due to overburden soils and fly-ash that were deposited during previous SSGS demolition efforts. There are two main paved areas at the site. One area lies between the Penelec warehouse and Penelec garage areas (South and Southwest of the site). The second is a paved area by the Decommissioning Support Facility. Figures 2-11, 2-12 and 5-1 show these features in detail.

Current and abandoned site access roads, including paved and unpaved surfaces and sub-pavement soils have been characterized and the results summarized in Table-2-28. A comparison of these results indicates the site paved and unpaved surfaces and sub-pavement soil radioactivity levels are consistent with similar materials offsite (non-impacted). The radiological characterization results of these areas indicate they should be non-impacted. However, the survey classification of these areas as impacted is based on Historical Site Assessment information as to the use and history of these areas and a very conservative application of such classification from MARSSIM guidance.

Chapter 5.0 provides the preliminary survey classifications that result from the characterization data, see Table 5-2.

2.2.4.4 Environment (REMP)

GPU Nuclear conducts a comprehensive radiological environmental monitoring program (REMP) at SNEC to measure levels of radiation and radioactive materials in the environment. The information obtained from the REMP is then used to determine the effect of SNEC operations, if any, on the environment and the public.

The NRC has established regulatory guides that contain acceptable monitoring practices. The SNEC REMP was designed on the basis of these regulatory guides along with the guidance provided by the NRC Radiological Assessment Branch Technical Position for an acceptable radiological environmental monitoring program (Reference 2-26).

The important objectives of the REMP are:

- To assess dose impacts to the public from the SNEC Facility.
- To verify decommissioning controls for the containment of radioactive materials.
- To determine buildup of long-lived radionuclides in the environment and changes in background radiation levels.
- To provide reassurance to the public that the program is capable of adequately assessing impacts and identifying noteworthy changes in the radiological status of the environment.

- To fulfill the requirements of the SNEC Facility License and associated Technical Specifications.

In addition to its role in determining the effect of operations, the REMP data provides valuable current and historic information on the radiological conditions of the environment surrounding the site. This information will be used to compliment the characterization survey data to assess the classification of off-site areas and the possible need for any remediation.

2.2.4.4.1 Sampling

The program consists of thermoluminescent dosimeter measurements and collection of samples from the environment, analyzing them for radioactivity content, and then interpreting the results. These samples include, but are not limited to, air, water, sediment, soil, vegetation and groundwater. Thermoluminescent dosimeters (TLDs) are placed in the environment to measure gamma radiation levels. The SNEC Offsite Dose Calculation Manual (ODCM), (Reference 2-13) defines the sample types to be collected and the analyses to be performed.

Sampling locations are established by considering topography, meteorology, population distribution, hydrology, and areas of public interest. The sampling locations are divided into two classes, indicator and control. Indicator locations are those which are expected to show effects from SNEC activities, if any exist. These locations were selected primarily on the basis of where the highest predicted environmental concentrations would occur. The indicator locations are typically within the site boundary, along the perimeter fence or a few miles from the SNEC Facility.

Control stations are located generally at distances greater than 10 miles from SNEC. The samples collected at these sites are expected to be unaffected by SNEC operations. Data from control locations provide a basis for evaluating indicator data relative to natural background radioactivity and fallout from prior nuclear weapon tests. Figure 2-24 shows the current sampling locations around the facility. The most recent REMP aquatic sediment sampling results for 2001 are presented in Table 2-19. Sample locations A1-1 and C1-6 are in impacted class 1 surface soil areas. TLD results are provided in Table 2-20.

2.2.4.4.2 Analysis

In addition to specifying the media to be collected and the number of sampling locations, the ODCM also specifies the frequency of sample collection and the types and frequency of analyses to be performed. Also specified are analytical sensitivities (detection limits) and reporting levels.

Measurement of low radionuclide concentrations in environmental media requires special analysis techniques. Analytical laboratories use state-of-the-art laboratory equipment designed to detect all three types of radiation emitted (alpha, beta, and gamma). This equipment must meet the analytical sensitivities required by the ODCM. Examples of the specialized laboratory equipment used are germanium detectors with multichannel analyzers for determining specific gamma-emitting radionuclides, liquid scintillation counters for detecting tritium (H-3), low level proportional counters for detecting gross alpha and beta radioactivity and alpha spectroscopy for determining specific transuranic isotopes.

Calibrations of the counting equipment are performed using standards traceable to the National Institute of Standards and Technology (NIST). Computer hardware and software used in conjunction with the counting equipment performs calculations and provides data management.

2.2.4.5 Groundwater

Groundwater monitoring is conducted to check for water leakage, if any, from the SNEC Containment Vessel and residual radioactivity from previously demolished structures. In addition, due to the site history of spills, soil contamination and previously demolished structures, monitoring of ground water is an important element in site characterization. An investigation was performed to define the depth of the bedrock surface and the orientation of the bedrock groundwater flow pathways (Reference 2-15). The site is immediately underlain by a fill-layer composed of flyash, cinders and/or silt and sand-size sediment. A layer of boulders in a silty clay matrix underlies this fill-layer. The surface of the bedrock lies beneath this boulder layer at a depth between approximately 7.5 to 18 feet.

The results of this investigation indicate that the overburden groundwater occurs at a depth ranging from approximately 4 to 16 feet. Groundwater elevation contour maps indicate that the groundwater within the overburden soil flows west toward the Raystown Branch of the Juniata River. Groundwater movement within the bedrock beneath the site is predominately controlled by fractures in the bedrock. There are two major fracture patterns; one trends northeast to southwest, and dips moderately toward the northwest. The second fracture pattern trends northwest to southeast, and dips steeply toward the southwest (Reference 2-16). Groundwater also moves within the spaces (bedding planes) between the individual layers of the siltstone bedrock at Saxton.

In 1994, eight overburden groundwater wells were installed. Four of the wells were located hydraulically downgradient of the containment vessel (GEO-3, GEO-6, GEO-7, and GEO-8). The other four wells (GEO-1, GEO-2, GEO-4, and GEO-5), were located hydraulically upgradient of the containment vessel. GEO-9 is not sampled as it is used for level monitoring by means of a piezometer.

Two bedrock wells (MW-1 and MW-2) were also monitored. As part of the analysis performed by the contracted hydrogeologic consultants (GEO Engineering), it was determined that bedrock monitoring wells should be installed at an angle in order to maximize the interception of fractures and bedding planes. The boreholes were drilled into bedrock at an angle of approximately 25 degrees from vertical to accomplish this. Filling the annular space with a sand filter pack, a bentonite pellet seal and cement grout allows these wells to monitor only the significant fractures and bedding planes of the bedrock ground water.

In May of 1998, three additional monitoring wells were drilled. Two bedrock wells (MW-3 and MW-4) were installed to determine if there was subsurface contamination in the vicinity of the former Radwaste Disposal Facility Building. This area was monitored by well GEO-5, which in the past was the only well to show positive tritium levels, the only nuclide associated with licensed operations ever detected in the ground water. An additional overburden well (GEO-10) was installed to supplement the existing monitoring wells to monitor for the possible migration of trace amounts of tritium or other contaminants.

In addition, two off-site (potable water) samples are collected. One site monitors the well water from the Penelec Line Shack located adjacent to the SNEC Facility site. The other sample is collected from a resident in the borough of Saxton. All Saxton borough residents get their water from one of two sources. Putts Hollow reservoir is the primary source, but during low water levels, the township switches to the Seton Plant water supply, which draws from the Juniata River upstream of the SNEC Facility. Neither of these samples have ever detected any radioactive contaminates.

Remediation activities have resulted in several monitoring wells being removed from service. In December 2000 additional wells were installed to characterize the upgradient and downgradient regions onsite. References 2-35 and 2-36 provide information on these new installations. In addition, at the request of the NRC a deep angle well was installed in March 2002 adjacent to and hydraulically downgradient of the CV. This well is intended to monitor for potential ground water and subsurface contamination originating from the CV or from migration of contaminants down through the backfill adjacent to the CV. The location of all wells, both in-service and abandoned is shown on Figures 2-17 and 2-32.

2.2.4.5.1 Groundwater Results

Locations of the onsite groundwater stations sampled are shown in Figures 2-17 and 2-32. Historically the results from the analyses performed on these samples indicated no radioactive contamination from plant-related radionuclides, other than tritium. Of the 57 groundwater samples collected in 2001, none showed positive tritium. The results are well below the USEPA's Primary Drinking Water Standard of 20,000 pCi/L (Reference 2-18). Tritium analysis requires a minimum sensitivity of 2000 pCi/L. Required sensitivities for Co-60, Cs-134, and Cs-137 (gamma emitting radionuclides) are 15 pCi/L. Year 2001 groundwater monitoring results are given in Table 2-17a. Year 2002 data requested by the NRC is provided in Table 2-17b.

As stated earlier, GEO-5 originally was the only well to show positive tritium levels. The first sample obtained from GEO-5 was collected and analyzed July of 1994. A "Less Than" result for tritium was reported. Gamma analysis performed on this sample yielded "Less Than" activities. The October 1994 sample reported 560 pCi/L tritium. A special collection was performed two weeks later to confirm the positive tritium and a result of 310 pCi/L was obtained. Gamma analysis continued to show no reportable activity.

Quarterly and special collections from GEO-5 yielded some positive and some "Less Than" tritium activities. The highest activity of tritium (760 pCi/L) was observed October 1995. Since that time, no concentrations above 200 pCi/L were observed. Table 2-18 is a list of all tritium results that have been performed since the start of GEO-5 monitoring.

Upon review of these results, it appears that the activity in the GEO-5 area can be attributed to pockets of tritiated water trapped in fractures leading to the overburden groundwater. In order to assess the possibility of other contaminates in this area, GPU Nuclear contracted Haley & Aldrich, Inc. (formally GEO Engineering) to add supplemental monitoring wells in this location (Reference 2-17). These new wells showed infrequent tritium activity slightly above the MDA. The new monitoring wells, like the former wells, yielded "Less Than" activities for gamma analysis. Table 2-17a lists the tritium results from all the monitoring wells sampled in the year 2001. The results indicate that no other contaminants are present in the groundwater.

Based on the ground water monitoring program results, no contamination of ground water, with the exception of tritium well below the USEPA's Primary Drinking Water Standard of 20,000 pCi/L, has been observed over the monitoring period. The transit times for contaminant movement would indicate that no such contamination will occur as it would have been observed with or shortly following the positive tritium results.

Recent groundwater testing results (last 12 months) indicate tritium is not present above levels of measurable detection. In May 2001, additional monitor wells (OW-7 and OW-7R) were installed closer to the Site to increase confidence that tritium was not present in the groundwater. In addition, monitor wells were installed in the backfill of the discharge tunnel (OP-3 and OP-4). Tables 2-17a, 2-17b and 2-17c provide sample results for the new monitoring wells. Figure 2-17 is updated to show all prior and current monitoring well locations.

In 2001, the NRC requested SNEC analyze groundwater samples for hard to detect nuclides and transuranics (HTDN/TRU). Nine wells were sampled and analyzed by an off-site laboratory for HTDN/TRU. Except for naturally occurring uranium, all results were less than the minimum detectable activity (<MDA). The results are reported in Table 2-17c.

Special monitoring of ground water was requested by the NRC in early 2002 in order to validate reported data and the conclusions related to potential ground water contamination. In April 2002, ten (10) groundwater monitoring wells were sampled under NRC observation. The samples were split with the NRC who had the analyzed by Oak Ridge Institute for Science and Education (ORISE). ORISE analyzed the samples for I-129, Co-60, Cs-137, Am-241, Pu-238, Pu-239, Pu-241, U-234, U-235, U238, total uranium, Sr-90, C-14 and tritium. The ORISE results are reported in Reference 2-34. SNEC analyzed the split samples for Cs-137, Cs-134, Co-60, and tritium. SNEC results are reported in Table 2-32 for wells where split samples were taken. Table 2-17b provides data for the remainder of the wells sampled that day. Review of these sets of analysis confirms the conclusion that no radionuclides related to plant operations are present in the monitored groundwater.

Reference 2-32, submitted to the NRC on January 24, 2002 contains information on the SNEC site hydrogeology, monitoring well placement and sampling results.

Of particular note, as described in Reference 2-32, in 2000 and 2001, slug tests were conducted on several observation wells. Slug tests (falling head tests) were conducted on seven wells to assess the ability of water to move through the subsurface. Tests were conducted on three overburden (OW-3, OW-5, and OW-6) and four bedrock wells (OW-3R, OW-4R, OW-5R, OW-7R). The test was conducted by adding water to the well and frequently measuring and recording decreasing water levels. The water levels were recorded with a hand held water level probe. The Bouwer-Rice and the Hvorslov methods were used to analyze the slug test data and estimate hydraulic conductivity.

The range of hydraulic conductivity for three wells at the <u>overburden/bedrock</u> interface is 15.59 m/year to 35.62 m/year. The range of hydraulic conductivity for the four <u>bedrock</u> wells is 15.59 m/year to 909.53 m/year. Travel time estimates based on these hydraulic conductivities indicate that if tritium was released from the facility it has likely reached the Raystown Branch of the Juniata River.

Additionally water levels have been collected monthly or bimonthly basis since January 2001 to evaluate the potential for seasonal groundwater flow directions changes. A spreadsheet with level data is attached as Table 2-34. As discussed in Reference 2-32 Haley & Aldrich, Inc. evaluated the individual sets of water level information for Saxton through November 2001. This evaluation included wells installed at the overburden/bedrock interface and bedrock.

Groundwater elevations fluctuate throughout the year, however the groundwater flow pattern remains consistent. Groundwater elevations were reviewed and groundwater elevation contours were generated for the 2001 monitoring events. This includes the high water period in

April 2001 and during the low water period in November 2001. Contouring indicates that the flow pattern is consistent and similar to past groundwater contours. For example, at the upgradient OW-3 series wells the water level elevations have fluctuated 8.30 and 7.00 feet in OW-3 and OW-3R, respectively. Similarly, the groundwater elevations have fluctuated 4.75 and 4.90 feet at the OW-5 series wells situated downgradient of the site and near the river.

A comparison of groundwater and surface water level trends indicates they behave similarly. When higher and lower groundwater elevations occur at the site, they also occur in the surface water (the Raystown Branch of the Juniata River).

2.2.4.6 Surface Water

The Juniata River surface water is monitored for radionuclides of potential SNEC Facility origin. Two grab samples, one control and one indicator, are collected on a quarterly basis and analyzed for gamma emitting radionuclides and tritium. The indicator sample was collected at the discharge bulkhead leading into the river, while the control sample was collected upstream of the discharge. No tritium or other radionuclides attributed to SNEC operations were detected above the minimum detectable concentration (MDC).

2.2.4.7 River Sediment Characterization

The Raystown Branch of the Juniata River meanders from its headwaters near Deeters Gap in Somerset County through rural Bedford County. From Deeters Gap, the river runs an easterly course through the Town of Bedford, Pennsylvania. After Bedford, the river takes a northeasterly course to Saxton, Pennsylvania where the river begins to form Raystown Lake. The river upstream of Raystown Lake is characterized by slow pools and interrupted by fast shallow riffles.

The Saxton Steam Generating Station (SSGS) Dam, located adjacent to the SSGS, was constructed to impound water for the SSGS. Although this dam was breached after shutdown of the SSGS in 1974, it was in place during the operational period of the Saxton Nuclear Experimental Corporation (SNEC) Facility. The SSGS Dam was a 780 feet long concrete gravity dam on the Raystown Branch, about 700 feet downstream from the mouth of Shoup Run. Backwater from the SSGS Dam extended 1.5 miles upstream according to one historical report. However, based on a crest elevation of approximately of 794.00, it is possible that the

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6. To provide accurate and timely information about site conditions to stakeholders during the decommissioning process (the public, regulators, licensee management, etc.)

The principal study questions for all SNEC Facility site characterization work have been:

1. Are contaminants present at the site as a result of licensed activities? if present;

2. Are contaminant concentrations above background levels and to what degree do they approach postulated DCGL values?

The SNEC Facility Decommissioning Quality Assurance Plan (Reference 2-25) ensures that all survey activities are performed in a manner that assures the results are accurate and that uncertainties have been adequately considered. All sampling, analysis and surveys have been performed under written procedures, which are reviewed and approved in a rigorous fashion. Trained and qualified individuals carry out these activities. Radiological survey instrumentation and laboratory equipment is operated in accordance with SNEC procedure 6575-QAP-4220.01, "Quality Assurance Program for Radiological Instruments", (Reference 2-24). Characterization data, as well as calibration and source check records are maintained in accordance with approved procedures that comply with NRC and industry requirements. All characterization activities have been and continue to be conducted under the auspices of a comprehensive quality assurance program, specifically 1000-PLN-3000.05, "SNEC Facility Decommissioning Quality Assurance Plan" (Reference 2-25).

2.6 CONCLUSIONS

The SNEC Facility site has been comprehensively characterized. The results support decisions related to remediation required and the classification of land areas, systems and structures as to non impacted or impacted status. The data also supports the classification of areas if impacted, and the establishment of initial DCGLs.

In general, the characterization results support the continued remediation of the Containment Vessel (CV) and the pipe tunnel surrounding the CV. The CV interior concrete is contaminated on surfaces and in areas where cracks and defects have allowed contaminants to reach subsurface areas. Areas of CV concrete in the reactor storage well that are above the operating water level, are activated from neutron flux. Due to the nature and extent of CV concrete contamination, all of the interior CV concrete will be removed. The CV steel liner (shell) is activated and, following interior concrete removal, will require the remediation of loose surface contamination. The CV pipe tunnel is scheduled to be completely removed prior to the Final Status Survey. Following removal, the soil beneath the CV pipe tunnel will need to be more fully characterized as it is currently inaccessible.

Soil, particularly that surrounding the CV will require remediation. Some subsurface samples and surveys indicate that remediation of soil north of the CV may be required to a depth of ten (10) feet. In an effort to justify the classification of the backfill surrounding the CV below the 797.6' elevation and under the CV as non-impacted, an extensive characterization and sampling project was conducted in this area. Approximately 857 samples were obtained and analyzed from 112 locations around the CV. Depths of these samples ranged from the surface to 150' deep. Sample media included soil, soil like materials, bedrock, groundwater and concrete from the exterior CV saddle. Of the 857 samples analyzed, 35 of those detected positive activity. Of those 35 positive results, five (5) indicated Cs-137 above background. These ranged from 0.6 pCi/gm to a high of 0.9 pCi/gm, all well below the applicable DCGL. No positive results above background were detected >10' below the surface. A complete listing of the analysis results is given in Table 2-30. Due to the volume of data with no positive activity, a separate table, 2-31 provides a listing of all positive results. These characterization results justify the classification of these areas as listed in Chapter 5.0. See Figures 2-32, 2-34 and 2-35.

Some soil sample results offsite but on surrounding Penelec property indicate the area has been impacted by SNEC Facility operations. These areas will be classified as "impacted" and included in the Final Status Survey. Initial characterization data indicates that remediation of these areas may not be required.

The Saxton Steam Generating Station (SSGS) discharge tunnel is contaminated as a result of routine radioactive liquid effluent discharges from the SNEC Facility. Characterization of this structure indicates that extensive remediation will not be needed to meet final release criteria. However, several piping sections required removal as they were significantly above the applicable DCGL.

The SSGS intake tunnel has been characterized and is minimally impacted by SNEC Facility operations. Remediation is not required to meet the proposed DCGLs however the SSGS intake tunnel will be included in the Final Status Survey.

The SSGS footprint including the turbine room, firing aisle and boiler pads has been characterized and these areas are impacted by SNEC Facility operations. These areas will be included in the Final Status Survey.

The Decommissioning Support Facility (DSF) is in use at this time to support decommissioning and contains radioactive material that precludes characterization sufficient to determine if remediation will be required to meet final release criteria. In addition, the final disposition of this building has not been determined; i.e. will the building be removed prior to the Final Status Survey. If the structure remains it will be included in the Final Status Survey.

Other buildings, structures and systems offsite but on the surrounding Penelec property (excepting the SSGS discharge tunnel described above) will likely not require remediation to meet final release criteria. However, they have been impacted by the operation of the SNEC Facility and will be included in the Final Status Survey process. This includes the Penelec garage (Figure 2-19), the Penelec warehouse (Figure 2-20) and the Penelec "line shack" (Figure 2-21). The Penelec garage and warehouse are scheduled to be demolished prior to performance of the Final Status Survey. If they remain they will be included in the survey.

The REMP data and characterization of offsite environmental areas indicate that remediation of offsite areas including effluent release pathways will not be required. The liquid effluent discharge point (Weir) to the Raystown Branch of the Juniata River has been impacted by SNEC Facility operations and will be included in the Final Status Survey.

Due to the use of mixed oxide (MOX) fuel at the SNEC Facility and the history of failed fuel, special emphasis has been placed on the detection of so called hard to detect nuclides and transuranic isotopes (HTDN/TRU) during characterization. Over 200 samples were analyzed for

HTDN and or TRU. These results are used to determine the appropriate nuclide ratios/mix for the appropriate surrogate DCGL and to plan remediation activities. The extensive analysis performed for HTDN/TRU has enabled SNEC to focus on those nuclides present as a result of licensed operations as discussed in section 6.2.2.3. Table 2-29 provides the results of HTDN/TRU analysis performed to date and is provided as requested by the NRC.

Supplemental characterization information has been submitted to the NRC under separate cover in References 2-30, 2-31 and 2-32.

2.7 REFERENCES

2-1 Code of Federal Regulations, Title 10 Part 50.82, "Application for Termination of License"

2-2 USNRC Regulatory Guide 1.179, "Standard Format and Content of License Termination Plans for nuclear Power Reactors," January 1999

2-3 GPU Nuclear, "1994 Saxton Soil Remediation Project Report"

2-4 SNEC procedure No. 6575-PLN-5420.06, "SNEC Site Characterization Plan"

2-5 Station Work Instructions:

2-5.1 SWI-94-001, "Remove Core Bore Samples from Saxton Containment Vessel Bldg. Structures", Rev 2

2-5.2 SWI-94-002, "Bulk Sample Collection from SNEC Site Facilities in Preparation for Offsite Analysis"

2-5.3 SWI-94-003, "System Sampling at SNEC Facilities"

2-5.4 SWI-99-065, "Collecting Samples of Scabbled Concrete in the SNEC CV

2-5.5 SWI-99-068, "Characterization of the Remaining On-Site Structures"

2-5.6 SWI-99-069, "Saxton Coal Fired Steam Plant Discharge Tunnel Area"

2-5.7 SWI-99-070, "SNEC Site Sub-surface Soil Gamma Logging and Sampling"

2-5.8 SWI-99-071, "Saxton Out-falls and Other Remote Areas"

2-6 "SNEC Facility Site Characterization Report", May 1996

2-7 NUREG-1575, "Multi-Agency Radiation Survey and Site investigation Manual (MARSSIM)," Revision 1 August 2001

2-8 SNEC Report, "Decommissioned Status of the SNEC Reactor Facility", February 20, 1975

2-9 NUREG/CR-2082, "Monitoring for Compliance with Decommissioning Termination Survey Criteria"

2-10 "Saxton Nuclear Power Plant Final Release Survey of Reactor Support Buildings", GPU Nuclear Corporation report, Revision 3, March 1992

2-11 "Confirmatory Radiological Survey for Portions of the Saxton Nuclear Experimental Facility, Saxton, Pa.", June 1991, Oak Ridge Associated Universities

2-12 USNRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear reactors," June 1974

2-13 "SNEC Facility Offsite Dose Calculation Manual", "E900-PLN-4542.08"

2-14 GPU Nuclear Report, "SNEC Facility Historical Site Assessment", March 2000

2-15 GEO Engineering "Phase I Report of Findings – Groundwater Investigation." November 18, 1992

2-16 GEO Engineering "Summary of Field Work." June 7, 1994

2-17 Haley and Aldrich "Summary of Field Work." July 24, 1998

2-18 United States Environmental Protection Agency, Primary Drinking Water Standard, 40CFR141.

2-19 CoPhysics Corp. report, "Review of the Final Release Survey of the Reactor Support Buildings at the Saxton Nuclear Experimental Facility", 12/14/99

2-20 Minutes of the February 2, 1987 SNEC briefing to NRC Region 1

2-21 Deleted

2-22 RESRAD, Version 5.82, United States Department of Energy and Argonne National Laboratory, April 1998

2-23 NUREG/CR-5849, "Manual for Conducting Radiological Surveys in support of License Termination", draft of June 1992

2-24 SNEC procedure E900-QAP-4220.01, "Quality Assurance Program for Radiological Instruments"

2-25 GPU Nuclear Plan, 1000-PLN-3000.05, "SNEC Facility Decommissioning Quality Assurance Plan"

2-26 United States Nuclear Regulatory Commission Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979

2-27 June 1988 "*In-situ* Survey General Public Utilities Facility and Surrounding Area", conducted by EG&G Energy Measurements for the DOE/NRC, report number DOE/ONS-8806 dated September 1990

2-28 July 1989 "Aerial Radiological Survey of the Saxton Nuclear Experimental Corporation Facility" conducted by EG&E Energy Measurements for the DOE/NRC, report number EGG-10617-1132 dated October 1991

2-29 "Saxton Nuclear Experimental Corporation Facility Decommissioning Environmental Report," Revision 2, GPU Nuclear, September 2002

2-30 GPU letter to the Nuclear Regulatory Commission E910-01-016 dated September 4, 2001: Phase 2 Characterization of the Saxton Steam Generating Station (SSGS), SSGS Discharge Tunnel and Surrounding Environs

2-31 GPU letter to the Nuclear Regulatory Commission E910-02-002, dated January 11, 2002: Phase 2 & 3 Characterization Data

2-32 GPU letter to the Nuclear Regulatory Commission E910-02-003, dated January 24, 2002: Supplemental Response to RAI #3 Questions

2-33 "Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Amendment No. 11 to Amended Facility License No. DPR-4 Saxton Nuclear Experimental Corporation Docket No. 50-146" May 28, 1992

2-34 ORISE letter dated June 27, 2002 to Mr. Jon Peckenpaugh, U.S. Nuclear Regulatory Commission reporting the analytical results for water samples collected April 1 and 2, 2002 from Saxton Nuclear Experimental Corporation. ADAMS ascension number ML022460476

2-35 GPU Letter to the Nuclear Regulatory Commission E910-01-007, dated March 19, 2001: SNEC License Termination Plan (LTP), Response to NRC Request for Additional Information. (RAI3)

2-36 Haley & Aldrich Report, "Report of Field Investigation, Saxton Nuclear Experimental Station, Saxton, Pennsylvania," March 14, 2001.

2-37 Shonka Research Associates, Inc. Final Report, "Phase 1 of the Large Area Open Land Survey for FSS," September 2002.

2-38 CoPhysics Corporation Report, "Embedded Pipe Radiation Survey Report, GPU Nuclear Corp., Saxton Experimental Nuclear Co., Saxton, Pa.," January 2002.

Sample Table notes:

Sample type codes are as follows:

AP – Air Particulate
AS – Asbestos
AT – Asphalt
CC – Concrete Ceiling
CD – Concrete Debris
CF – Concrete Floor
CW – Concrete Wall
DW – Discharge Water
GW – Ground Water
IW – Intake Water
LQ – Liquid
OT – Other
PC – Paint Chips
RS – Resin
SD – Sediment
SL – Soil
SM – Smears
SP – Steel Platform
ST – Steel
SW – Surface Water
VG – Vegetation
WA – Water (unspecified)
WW – Well Water

Unless otherwise noted, activity units are as follows:

pCi/g for solids
pCi/l for liquids
pCi for smears

NOTE: Less than values (<) indicate the analysis was less than the reported minimum detectable activity (<MDA), minimum detectable concentration (MDC) or lower limit of detection (LLD).

Table 2-1

Radionuclide Inventory for the SNEC Facility (2002)

Radionuclide	Total Activity Estimate (Ci)	Remaining Fraction (1)	Total CV Activity Estimate (Ci)	% of Total
Am-241	1.12E-02	0.26	0.0029	**1.29%**
C-14	5.89E-03	0.26	0.0015	0 68%
Cm-243/Cm-244	1.73E-04	0.26	0.0000	0.02%
Co-60	7.68E-02	0.26	0.0199	**8.85%**
Cs-134	1.99E-04	0.26	0.0001	0 02%
Cs-137	4.24E-01	0.26	0.1100	**48.86%**
Eu-152	1.49E-03	0.26	0.0004	0.17%
Eu-154	5.98E-04	0.26	0.0002	0.07%
Eu-155	1.62E-04	0.26	0.0000	0 02%
Fe-55	1.01E-03	0.26	0.0003	0.12%
H-3	1.09E-01	0.26	0.0283	**12.56%**
Nb-94	2.50E-04	0.26	0.0001	0.03%
Ni-59	5.08E-03	0.26	0.0013	0.59%
Ni-63	1.60E-01	0.26	0.0415	**18.44%**
Pu-238	1.54E-03	0.26	0.0004	0.18%
Pu-239/Pu-240	3.67E-03	0.26	0.0010	0.42%
Pu-241	5.36E-02	0.26	0.0139	**6.18%**
Pu-242	7.71E-06	0.26	0.0000	0.00%
Sb-125	5.54E-04	0.26	0.0001	0.06%
Sr-90	1.17E-02	0.26	0.0030	**1.35%**
Tc-99	7.83E-04	0.26	0.0002	0.09%
U-234	6.79E-06	0.26	0.0000	0.00%
U-235	6.79E-06	0.26	0.0000	0.00%
U-238	6.79E-06	0.26	0.0000	0.00%
	0.87		0.23	100.00%

Note: % values in **Bold** are those nuclides greater than one percent (1%) of the mix.

Footnote: (1) Fraction of concrete remaining as of September 2002.

Table 2-2
Radionuclide Concentrations - CV Pipe Tunnel Water and Sediment

Sample Number	Cs-137	Co-60
SX856950167-SD (Liquid)	3.44E-7 uCi/ml	1 16E-7 uCi/ml
SX856950167-SD (Solids)	2.94E-4 uCi/g	6.39E-6 uCi/g

Table 2-3
Radionuclide Concentrations - SSGS Discharge Tunnel - Water and Sediment

Sample Number	H-3	Cs-137	Co-60	Ni-63	TRU
SX10SD99002 2	2.1E-4 uCi/g	2.1E-5 uCi/g	< 3E-6 uCi/g	< 3E-5 uCi/g	< 7.2E-5 uCi/g
SX10SD99003 1	NR	1.2E-4 uCi/g	8.4E-7 uCi/g	NR	NR
SX10SD99003 3	NR	4.8E-3 uCi/g	3.0E-5 uCi/g	5.5E-5 uCi/g	9 6E-6 uCi/g
SX10SD99003 4	NR	6 2E-5 uCi/g	< 9E-uCi/g	NR	< 2.4E-7 uCi/g
SX5DW99017 7 (Liquid)	2.0E-7 uCi/ml	2.0E-8 uCi/ml	NR	NR	NR

NR = Not Reported

Table 2-3a
Sample Results From SR-0006, SSGS West ~790' to 811' Elevation

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX10CF01813	Hole 1	Core Bore 3"D x 6"L	< 0 16	< 0 15
SX10CF01814	Hole 2	Core Bore 3"D x 6"L	< 0 14	< 0 11
SX10CF01815	Hole 3	Core Bore 3"D x 6"L	0.32	< 0 16
SX10CF01816	Hole 4	Core Bore 3"D x 6"L	0.3	< 0.15
SX10CF01817	Hole 5	Core Bore 3"D x 6"L	< 0 15	< 0 13
SX10CF01818	Hole 6	Core Bore 3"D x 6"L	0.14	< 0 19
SX10CF01819	Hole 7	Core Bore 3"D x 6"L	0.35	< 0 19
SX10CF01897	Southeast Sump Hole 1	Core Bore 3"D x 6"L	< 0 16	< 0 15
SX10CF01898	Southeast Sump Hole 2	Core Bore 3"D x 6"L	< 0 14	< 0 15
SX10CF01899	North Central Hole 1	Core Bore 3"D x 6"L	< 0 4	< 0 28
SX10CF01900	North Central Hole 2	Core Bore 3"D x 6"L	< 0 3	< 0 2
SX10CF01834	Central Area – Drain Trough South	1 liter of Concrete Rubble	19 6	< 0 09
SX10SD01917	North Manway	Scrape (rust)	0.1	< 0 1
SX10SD01918	South Manway	Scrape (asbestos fibers, sediment)	0.58	< 0 1
SX10SD01927	18" Line in Northwest Corner	Scrape (pipe fragments, rust)	0.9	< 0 09
SX10SD01756	North Sump 4" Tie Line	Sediment	6.1	0.41
SX10SD01757	North Sump 2' Line	Sediment	13.2	< 0.29

Table 2-3a
Sample Results From SR-0006, SSGS West ~790' to 811' Elevation, Cont'd

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX10SD01762	Seal Chamber #1 – 8" Penetration	Sediment	**31**	< 0 1
SX10SD01761	Seal Chamber #3 – Upper 8" Penetration	Sediment	**0.2**	< 0 09
SX10SD01763	Seal Chamber #3 – Lower 8" Penetration	Sediment	**3.2**	< 0.1
SX10SD01774	South Sump 4" Tie Line	Sediment	**3.6**	< 0.13
SX10SD01775	South Wall ~806' El, 8" Upper Drain Pipe	Sediment	**7.8**	< 0 07
SX10SD01776	South Wall ~803' El, 8" Middle Drain Pipe	Sediment	**0.06**	< 0 1
SX10SD01777	South Wall ~803' El, 8" Lower Drain Pipe	Sediment	**3.4**	< 0.15
SX10SD01839	790' El South Sump	Sediment	**1.3**	< 0.09
SX10SD01964	Mezzanine† – East Wall Penetration	Sediment	**0.59**	< 0.4
SX10SD01965	Mezzanine† – Manway Northeast Corner	Sediment	**0.15**	< 0.12
SX10SD01966	Mezzanine† – Northeast Central Manway	Sediment	**6.7**	< 0.14
SX10SD01967	Mezzanine† – Northeast Central Small Pipe	Sediment	**1.4**	< 0 2
SX10SD01968	Mezzanine† – West Wall Penetration	Sediment	< 0.17	< 0 17

Direct frisk of the West section of the SSGS area floor and other selected locations indicated < 100 ncpm using a standard frisker probe with the exception of the a lower section of the Northwest wall between 0" and 6" above the floor, which ranged from about 200 to 400 ncpm General area micro REM measurements ranged from about 3 to 5 micro REM per hour throughout (taken at ~1 meter above the floor). All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma) Bold type face reports a > MDA value. †Area above Seal Chambers

Table 2-3b
Sample Results From SR-0004, SSGS East ~790' to 811' Elevation

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/L)	H-3 (pCi/L)
SX10WA01724	Northeast Sump	Water	**35**	< 255
SX10WA01726	Southeast Sump	Water	**12.8**	< 255
SX10WA011191	Southwest Sump	Water	< 16	< 318
Sample No.	**General Location Information**	**Sample Type**	**Cs-137 (pCi/g)**	**Co-60 (pCi/g)**
SX10SD01725	Northeast Sump	Sediment	**25.5**	**0.15**
SX10SD01727	Southeast Sump	Sediment	**88.1**	**0.53**
SX10SD01743	West Wall 8" Pipe Penetration	Sediment	**4.43**	< 0 08
SX10SD01744	Mezzanine† – 2" Pipe	Sediment	**84**	**3.8**
SX10SD01745	790' El Condenser Pump Pad Southwest	Sediment	**0.9**	< 0 06
SX10SD011192	Northwest Sump	Sediment	**10.9**	**0.15**
SX10CF01825	Hole # 1	Core Bore 3"D x 6"L	**3.1**	< 0.19
SX10CF01826	Hole # 2	Core Bore 3"D x 6"L	**3.7**	< 0.17
SX10CF01827	Hole # 3	Core Bore 3"D x 6"L	**109**	< 0.2
SX10CF01828	Hole # 4	Core Bore 3"D x 6"L	**464**	**1.4**
SX10CF01892	Hole # 5	Core Bore 3"D x 6"L	**0.91**	< 0.18
SX10CF01893	Hole # 6	Core Bore 3"D x 6"L	**4.68**	< 0.15
SX10CF01894	Hole # 7	Core Bore 3"D x 6"L	**0.9**	< 0.18
SX10CF01895	Hole # 8	Core Bore 3"D x 6"L	**1.0**	< 0.22
SX10CF01896	Hole # 9	Core Bore 3"D x 6"L	**57.3**	< 0 24
SX10CF01888	Northwest Sump Hole # 1	Core Bore 3"D x 6"L	< 0.17	< 0.14
SX10CF01889	Northwest Sump Hole # 2	Core Bore 3"D x 6"L	**0.31**	< 0.13
SX10CF01890	Southwest Sump Hole # 1	Core Bore 3"D x 6"L	**20.3**	< 0 24
SX10CF01891	Southwest Sump Hole # 2	Core Bore 3"D x 6"L	**10.6**	< 0 22
SX10CF011207	QA Sample	Core Bore 3"D x 6"L	**13.8**	< 0.13
SX10SD01915	Northwest Manway	Scrape (boiler clinkers, rust, sediment)	**0.56**	< 0 24
SX10SD01916	Southwest Manway	Scrape (rust)	**0.76**	< 0.16

Direct frisk of the East section of the SSGS area floor and other selected locations indicated a range of values from < 100 ncpm to as much as 1200 ncpm, using a standard frisker probe. The majority of elevated count rates were detected on the floor area Walls were for the most part < 100 ncpm. General area micro REM measurements ranged from about 2 to 5 micro REM per hour throughout (taken at ~1 meter above the floor) All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma). Bold type face reports a > MDA value.
†Area above Seal Chambers

Table 2-3c
Sample Results From SR-0011, SSGS Center Section ~790' to 811' Elevation

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX10SD011215	Floor Trough & Drain - Center Section	Sediment	**4.6**	< 0 08
SX10OT011248	South Wall Penetration @ ~810' El	Scrape (sediment, rust)	**1.2**	< 0 16
SX10OT011249	South Wall Penetration @ ~808' El	Scrape (rust)	**0.96**	< 0 16
SX10SD011250	South Wall Penetration @ ~807' El	Sediment	**0.12**	< 0.12
SX10OT011265	Floor Trough & Drain - Center Section	Sediment	**14.9**	< 0.1
SX10CF011208	QA Core Bore	Core Bore 3"D x 6"L	**0.12**	< 0 12
SX10CF011209	Core Bore # 1	Core Bore 3"D x 6"L	**0.13**	< 0.18
SX10CF011210	Core Bore # 2	Core Bore 3"D x 6"L	**0.3**	**0.16**
SX10CF011211	Core Bore # 3	Core Bore 3"D x 6"L	**0.42**	< 0 14
SX10CF011212	Core Bore # 4	Core Bore 3"D x 6"L	**6.0**	< 0 08
SX10CF011213	Core Bore # 5	Core Bore 3"D x 6"L	**0.19**	< 0.16

Direct frisk of the Center section of the SSGS area floor and other selected locations indicated a range of from < 100 ncpm to 300 ncpm (in one small area), using a standard frisker probe The elevated count rate was detected on the base of the south wall. However, walls were for the most part < 100 ncpm. General area micro REM measurements ranged from about 4 to 5 micro REM per hour throughout (taken at ~1 meter above the floor). All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma) Bold type face reports a > MDA value

Table 2-3d
Sample Results From SR-0012, SSGS Firing Isle, 806' Elevation

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX10CF010990	Hole # 1	Core Bore 3"D x 6"L	< 0 18	< 0.17
SX10CF010991	Hole # 2	Core Bore 3"D x 6"L	**0.33**	< 0 1
SX10CF010992	Hole # 3	Core Bore 3"D x 6"L	< 0.12	< 0.11
SX10CF010993	Hole # 4	Core Bore 3"D x 6"L	< 0.12	< 0.1
SX10CF010994	Hole # 5	Core Bore 3"D x 6"L	**0.13**	< 0 11
SX10CF010995	QC Hole # 1	Core Bore 3"D x 6"L	< 0.16	< 0.15
SX10SD010768	Drain # 1	Sediment	**2.8**	< 0.1
SX10SD010769	Drain # 2	Sediment	**1.6**	< 0.1
SX10SD010770	Drain # 3	Sediment	**2.4**	< 0.08
SX10SD010771	Drain # 4	Sediment	**9.3**	**0.3**
SX10SD010772	Drain # 5	Sediment	**0.62**	< 0.08
SX10SD010779	Drain # 6	Sediment	**7.2**	< 0.09
SX10SD010781	Drain # 7	Sediment	**5.77**	**0.22**
SX10SD010778	6" Drains	Sediment	**1.3**	< 0.13
SX10SD011000	Sump Pit	Sediment	**0.9**	< 0 05

Direct frisk of the Firing Aisle of the SSGS area indicated < 100 ncpm using a standard frisker probe General area micro REM measurements ranged from about 3 to 5 micro REM per hour throughout (~1 meter above the floor) All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma) Bold type face reports a > MDA value.

Table 2-3e
Sample Results From SWI-99-069, SSGS Discharge Tunnel

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/L)	H-3 (pCi/L)
SX5DW99176	Seal Chamber # 1	Water	< 8	220
SX5DW99175	Seal Chamber # 2	Water	< 5	150
SX5DW99177	Seal Chamber # 3	Water	20	200
SX5DW99178	~10' Position	Water	< 5	< 140
SX5DW99179	~170' Position	Water	< 5	< 140
SX5DW99180	~290' Position	Water	< 4	< 140
Sample No.	**General Location Information**	**Sample Type**	**Cs-137 (pCi/g)**	**Co-60 (pCi/g)**
SX13CF01739	Floor @ ~10' Position	Core Bore 3"D x 6"L	0.5	< 0 2
SX13CW01740	Wall @ ~13' Position	Core Bore 3"D x 6"L	1.3	< 0 2
SXCF998	Floor @ ~38' Position	Core Bore 3"D x 6"L	< 0 26	< 0 2
SX13CF01737	Floor @ ~60' Position	Core Bore 3"D x 6"L	< 0 23	< 0 17
SX13CF01738	Floor @ ~60' Position	Core Bore 3"D x 6"L	0.25	< 0 43
SX13CF01734	Floor @ ~110' Position	Core Bore 3"D x 6"L	< 0 18	< 0 19
SX13CW01736	Wall @ ~111' Position	Core Bore 3"D x 6"L	18.4	< 0 19
SX13CW01735	Wall @ ~115' Position	Core Bore 3"D x 6"L	31.5	< 0 14
SX13CW01733	Wall @ ~147' Position	Core Bore 3"D x 6"L	< 0.17	< 0 18
SX13CF01732	Floor @ ~150' Position	Core Bore 3"D x 6"L	< 0 2	< 0.18
SX13CW01731	Wall @ ~189' Position	Core Bore 3"D x 6"L	< 0 17	< 0.14
SX13CF01730	Floor @ ~200' Position	Core Bore 3"D x 6"L	0.17	< 0.24
SX13CF01729	Floor @ ~270' Position	Core Bore 3"D x 6"L	< 0 43	< 0 39
SX13CF01728	Floor @ ~340' Position	Core Bore 3"D x 6"L	< 0.2	< 0 22
SX13CW01702	Wall (Not Designated)	Concrete Rubble	0.41	< 0 06
SX13CW000649	Wall @ ~65' Position	Concrete Rubble	0.26	< 0 09
SX5CC000675	Ceiling @ ~105' Position	Concrete Rubble	1.4	< 0 08
SX5CW00661	Wall @ ~195' Position	Concrete Rubble	< 0.1	< 0.05
SX5CF000673	Floor @ ~195' Position	Concrete Rubble	0.55	< 0.13
SX13CF01709	Sump Hole @ ~350' Position	Concrete Rubble	< 0.1	< 0 08
SX10SD990033*	Seal Chamber # 1, 6" Discharge Pipe	Sediment	4800	30
SX5SD99257*	Seal Chamber # 2 Floor	Sediment	1.9	< 0 6
SX5SD99254	Seal Chamber # 2, 6" Pipe Internals	Sediment	< 0 6	< 0 4
SX5SD99258*	Seal Chamber # 3 Floor	Sediment	43	< 0 3
SX5SD99256*	~170' Position, 8" Pipe Internals	Sediment	2.2	< 0.15
SX5SD99255*	~170' Position, 15" Pipe Internals	Sediment	2.2	< 0 3
SX5SD99252*	~140' Position, 18" Pipe Internals	Sediment	3.8	< 0 5
SX13SD00365	~140' Position, 50' Down 18" Pipe	Sediment	3.1	< 0 12
SX10SD990031	Wall Scraping	Sediment	120	0.84
SX10SD990022	Floor @ ~0' Position Below Entrance	Sediment	21.2	< 3
SX5SD99263	Floor @ ~20' Position	Sediment	2.1	< 0 3
SX5SD99259*	Floor @ ~30' Position	Sediment	27	< 0 9
SX5SD99261*	Floor @ ~100' Position	Sediment	4.3	< 0 4
SX5SD99260	Floor @ ~160' Position	Sediment	1.1	< 0 3
SX5SD99253	Floor @ ~220' Position	Sediment	1.4	< 0 3
SX5SD99262*	Floor @ ~330' Position	Sediment	7.0	< 0 3
SX5SD99265	Floor @ ~390' Position	Sediment	2.0	< 0.14

Table 2-3e Contd.
Sample Results From SWI-99-069, SSGS Discharge Tunnel

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX5SD99267	Floor @ ~550' Position	Sediment	**2**	< 0 16
SX5SD99268	Floor @ ~490' Position	Sediment	**2.2**	< 0.2
SX5SD99264	Floor @ ~670' Position	Sediment	**1.6**	< 0 2

Direct frisk of the Discharge Tunnel area (floors, Walls & Ceiling) indicated a range of from < 100 ncpm up to a maximum of 500 ncpm using a standard frisker probe. The vast majority of elevated readings were near seal chamber # 3 on wall surfaces or were on piping that has now been removed The majority of other Discharge Tunnel concrete surfaces were < 100 ncpm General area micro REM measurements ranged from about 2 to 6 micro REM per hour throughout (~1 meter above the floor) All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma). Bold type face reports a > MDA value Sample numbers with an "*" also contained positively identified TRU radionuclides

Table 2-3f
Sample Results From SR-0008, Northeast End of SSGS Discharge Tunnel

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/L)	H-3 (pCi/L)
SX10DW01784	~460' Position	Water	**25**	< 253
SX10DW01783	~530' Position	Water	**540**	< 253
SX10DW01785	~580' Position	Water	**16**	< 253
SXDW1009	QA ~620' Position	Water	< 17	< 325
SX10DW01786	~690' Position	Water	< 14	< 253
Sample No.	**General Location Information**	**Sample Type**	**Cs-137 (pCi/g)**	**Co-60 (pCi/g)**
SX10CF01807	Floor @ ~350' Position	Core Bore 3"D x 6"L	**0.14**	< 0.13
SXCF999	QA Floor @ ~370' Position	Core Bore 3"D x 6"L	< 0 2	< 0.12
SX10CF01808	Floor @ ~420' Position	Core Bore 3"D x 6"L	**0.3**	< 0.17
SX10CF01809	Floor @ ~490' Position	Core Bore 3"D x 6"L	< 0.23	< 0 2
SX10CF01810	Floor @ ~560' Position	Core Bore 3"D x 6"L	**0.27**	< 0 2
SX10CF01811	Floor @ ~630' Position	Core Bore 3"D x 6"L	< 0 49	< 0 4
SX10CF01812	Floor @ ~690' Position	Core Bore 3"D x 6"L	< 0 18	< 0 2
SX10SD01923	Floor @ ~700' Position	Rubble	**0.14**	< 0 04
SX10SD01924	Floor @ ~700' Position	Rubble	**0.06**	< 0.06
SX10SD01787	Floor @ ~350' Position	Sediment	**2.4**	< 0 08
SX10SD01788	Floor @ ~380' Position	Sediment	**2.8**	< 0.1
SX10SD01789	Floor @ ~410' Position	Sediment	**2.2**	< 0 1
SX10SD01792	Floor @ ~440' Position	Sediment	**2.8**	< 0 09
SX10SD01793	Floor @ ~470' Position	Sediment	**2.6**	< 0.11
SX10SD01794	Floor @ ~500' Position	Sediment	**2.2**	< 0 1
SX10SD01795	Floor @ ~530' Position	Sediment	**1.8**	< 0 1
SX10SD01796	Floor @ ~560' Position	Sediment	**1.9**	< 0 1
SX10SD01797	Floor @ ~590' Position	Sediment	**1.8**	< 0 1
SX10SD01798	Floor @ ~620' Position	Sediment	**1.6**	< 0 1
SXSD1008	QA Floor @ ~620' Position	Sediment	**1.8**	< 0 06
SX10SD01799	Floor @ ~650' Position	Sediment	**1.8**	< 0 1
SX10SD01800	Floor @ ~680' Position	Sediment	**1.9**	< 0 09

Direct frisk of the Discharge Tunnel area indicated < 100 ncpm using a standard frisker probe General area micro REM measurements ranged from about 3 to 5 micro REM per hour throughout (~1 meter above the floor) All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma) Bold type face reports a > MDA value

Table 2-3g
Sample Results From SR-0014, SSGS Spray Pump Pit

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/L)	H-3 (pCi/L)
SX10DW01902	SPP General Area	Water	< 16.8	**253**
Sample No.	**General Location Information**	**Sample Type**	**Cs-137 (pCi/g)**	**Co-60 (pCi/g)**
SX10CF01820	Hole # 1	Core Bore 3"D x 6"L	**0.09**	< 0.16
SX10CF01821	Hole # 2	Core Bore 3"D x 6"L	**0.15**	< 0.12
SX10CF01832	Hole # 3	Core Bore 3"D x 6"L	**0.16**	< 0 13
SX10CF01988	West QC Hole # 1	Core Bore 3"D x 6"L	**0.18**	< 0.11
SX10SD01904	SPP General Area	Sediment	**0.37**	< 0 05
SX10SD01905	SPP General Area	Sediment	**0.58**	< 0 08
SX10SD011301	Inside Spray Pond Pipe	Sediment	< 0 06	< 0 06
SX10SD011351	Inside Spray Pond Pipe QC	Sediment	**0.03**	< 0 05

Direct frisk of the Firing Aisle of the SSGS area indicated < 100 ncpm using a standard frisker probe General area micro REM measurements ranged from about 3 to 4 micro REM per hour throughout (~1 meter above the floor) All smears taken in this area indicated < 1000 dpm per 100 centimeter square area (beta/gamma) Bold type face reports a > MDA value

Table 2-3h
Sample Results From SR-0015, SSGS Discharge Tunnel 18" Line

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX10SD01938	18" Line ~37' from NW corner of SSGS area toward Screen Room of Intake Tunnel	Sediment	**3.2**	< 0 15
SX10SD01939	18" Line ~42' from NW corner of SSGS area toward Screen Room of Intake Tunnel	Sediment	**4.2**	< 0 1
SXSD953	18" Line ~60' from NW corner of SSGS area toward Screen Room of Intake Tunnel	Sediment	**1.8**	< 0 11

Table 2-3i
Sample Results From SR-0007, Open Land Area near SSGS Tunnels

Sample No.	General Location Information	Sample Type	Cs-137 (pCi/g)	Co-60 (pCi/g)
SX11SL01836	OW7 Test Pit in BG-133 (Surface Sample)	Soil	**0.7**	< 0 1
SX11SL01835	OW7 Test Pit in BG-133 (0' – 3' Below Grade)	Soil	< 0.13	< 14
SX11SL01837	OW7 Test Pit in BG-133 (3' – 6' Below Grade)	Soil	**0.2**	< 0.11
SX11SL01838	OW7 Test Pit in BG-133 (6' – 9' Below Grade)	Soil	< 0 09	< 0 11
SX11SL01849	OP3 Test Pit in BK-135 (Surface Sample)	Soil	**0.13**	< 0.12
SX11SL01850	OP3 Test Pit in BK-135 (3' Below Grade)	Soil	< 0 1	< 0 1
SX11SL01851	OP3 Test Pit in BK-135 (6' Below Grade)	Soil	< 0.07	< 0.07
SX11SL01852	OP3 Test Pit in BK-135 (9' Below Grade)	Soil	< 0 08	< 0.09
SX11SL01853	OP3 Test Pit in BK-135 (12' Below Grade)	Soil	< 0 06	< 0.14
SX11SL01854	OP3 Test Pit in BK-135 (15' Below Grade)	Soil	< 0 06	< 0 07
SX11SL01855	OW7R in BG-133 (Surface Sample)	Soil	**0.19**	< 0 08
SX11SL01856	OW7R in BG-133 (0' – 3' Below Grade)	Soil	**0.09**	< 0 07
SX11SL01857	OW7R in BG-133 (3' – 6' Below Grade)	Soil	**0.11**	< 0.06
SX11SL01858	OW7R in BG-133 (6' – 9' Below Grade)	Soil	< 0.1	< 0 12
SX11SL01859	OW7R in BG-133 (9' – 13' Below Grade)	Soil	< 0.05	< 0 06
SX11SL01860	OW7 in BG-133 (Surface Sample)	Soil	**0.14**	< 0 07
SX11SL01861	OW7 in BG-133 (0' – 3' Below Grade)	Soil	**0.17**	< 0.05
SX11SL01862	OW7 in BG-133 (3' – 6' Below Grade)	Soil	< 0.07	< 0 08
SX11SL01863	OW7 in BG-133 (6' – 8' Below Grade)	Soil	< 0.06	< 0 06
SX11SL01864	OW7R in BG-133 (15' – 18' Below Grade)	Soil	< 0.08	< 0 08
SX11SL01865	OW7R in BG-133 (18' – 21' Below Grade)	Soil	< 0.07	< 0 08
SX11SL01866	OW7R in BG-133 (21' – 24' Below Grade)	Soil	< 0.07	< 0 08
SX11SL01867	OW7R in BG-133 (24' – 27' Below Grade)	Soil	< 0.07	< 0 08
SX11SL01868	OW7R in BG-133 (27' – 30' Below Grade)	Soil	< 0.07	< 0 08
SX11SL01869	OW7R in BG-133 (30' – 33' Below Grade)	Soil	< 0.07	< 0 08
SX11SL01870	OW7R in BG-133 (33' – 36' Below Grade)	Soil	< 0 06	< 0 08
SX11SL01871	OW7R in BG-133 (36' – 39' Below Grade)	Soil	< 0 05	< 0.06
SX11SL01872	OW7R in BG-133 (39' – 42' Below Grade)	Soil	< 0 06	< 0.06
SX11SL01873	OW7R in BG-133 (42' – 45' Below Grade)	Soil	< 0 07	< 0.08
SX11SL01874	OW7R in BG-133 (45' – 48' Below Grade)	Soil	< 0 07	< 0 08
SX11SL01875	OW7R in BG-133 (48' – 50' Below Grade)	Soil	< 0 07	< 0.08
SX11SL01876	OP4 in BI-135 (Surface Sample)	Soil	< 0.06	< 0 07
SX11SL01877	OP4 in BI-135 (0' – 3' Below Grade)	Soil	**0.73**	< 0.06
SX11SL01878	OP4 in BI-135 (3' – 6' Below Grade)	Soil	< 0.05	< 0 06
SX11SL01879	OP4 in BI-135 (6' – 9' Below Grade)	Soil	< 0.04	< 0 04
SX11SL01880	OP4 in BI-135 (9' – 12' Below Grade)	Soil	**0.037**	< 0 06
SX11SL01881	OP4 in BI-135 (12' – 15' Below Grade)	Soil	< 0 07	< 0 07
SX11SL01883	OP4 in BI-135 (15' – 19' Below Grade)	Soil	< 0 04	< 0 04
SX11SL01884	OP4 in BI-135 (15' – 21' Below Grade)	Soil	< 0 07	< 0.08

Table 2-4
Radionuclide Concentrations - CV Paint on Inside Dome Surface

Sample Number	Cs-137	Co-60	TRU (total)
SX4PC990093	3.2E-5 uCi/g	< 2E-6 uCi/g	3.5E-8 uCi/g
SX4PC990098	5.7E-4 uCi/g	3.8E-5 uCi/g	NR
SX4PC990104	3.0E-3 uCi/g	4.0E-4 uCi/g	1E-5 uCi/g

NR = Not Reported

Table 2-5
Radionuclide Concentrations – Yard Drains

Sample Number	Cs-137	Co-60
SX10SD990024	1.6E-7 uCi/g	< 6E-8 uCi/g
SX8SD990027	4.7E-7 uCi/g	< 1.4E-7 uCi/g
SX10SD990032	3.5E-6 uCi/g	< 2E-7 uCi/g

Table 2-5a
Phase 1 SNEC Site Yard Drain Characterization Sampling Results Summary (pCi/g)

Sampling Point (see figure 2A-1)	Sample No.	Description	Cs-137	Co-60	Combined TRU
1	SX11SD990131	Man-Hole Access With Ladder 1	< 0.19	< 0.04	No Analysis
2	SX11SD990132	Man-Hole Access With Ladder 2	**0.23**	< 0.08	No Analysis
3	SX11SD990130	First Man Hole Sample Outside Fence 1	< 0.17	< 0.18	No Analysis
4	SX11SD990129	First Man Hole Sample Outside Fence 2	**0.48**	< 0.04	No Analysis
5	SX11SD990133	Shunt Line Man-Hole Access	< 0.04	< 0.04	No Analysis
6	SX11SD990135	Garage - South of Fence - 12" Line	**0.072**	< 0.05	No Analysis
7	SX10SD99223	Garage Bay #4 - Floor Drain Rim	**6.4**	< 0.3	< MDA
8	SX10SD990137	Warehouse Storm Drain 12" Feed Pipe	**0.52**	< 0.04	No Analysis
9	SX10SD990024	Warehouse Storm Drain Line	0.16	< 0.06	No Analysis
10	SX10SD990136	Warehouse Storm Main	**0.26**	< 0.06	No Analysis
11	SX11SD990134	South - Old Parking Lot Storm Drain	**0.21**	< 0.03	No Analysis
12	SX12SD99287	Shoup Run Shunt Line Outfall 1	< 0.12	< 0.11	No Analysis
13	SX12SD99279	Shoup Run Shunt Line Outfall 2	< 0.06	< 0.07	No Analysis

NOTE. Positive results are in bold typeface.

Table 2-5b
Phase 2 Summary SNEC Site Yard Drain Characterization

Location	Measurement Results (range) dpm/100 cm^2 (Cs-137)	Measurement Results (range) pCi/g (Cs-137)	Sample Results (range) pCi/g (Cs-137)
Small Garage Sumps	< 664 to < 2134	< 2.1 to < 3.8	0.2 to 1.4
Central Grated Cover Yard Drain & Line to Shunt	< 330 to 910	< 1.0 to < 2	< 0.07 to 1.1
Grated Cover Yard Drain Near Warehouse	< 309 to < 1633	< 1.1 to < 1.8	0.7 (one sample)
12" Line South of Small Garage Outside Fence	< 336 to < 656	< 1.2 to < 2.3	< 0.1 (one sample)
Unknown 12" Drainage Line West of Small Garage	< 360 to < 565	< 1.3 to < 2	< 0.1 (one sample)
Drain Line from Warehouse South to Shunt Line	< 309 to < 522	< 1.1 to < 1.8	0.11 (one sample)
Shunt Line Access Points	< 409 to < 694	< 1.4 to < 2.4	0.04 to 0.34

Table 2-6

Summary Results of Characterization for Near Site Structures

		Exposure rate survey data	Direct Frisk Data	Beta Gamma Smear Data	Alpha Smear Data
Structure	**Location**	**GA urem/hr**	**Net cpm Direct Frisk**	**dpm/100 cm^2**	**dpm/100 cm^2**
Penelec Garage (Fig. 2-19)	Interior	6.3	70	< 227	< 8.6
Penelec Garage (Fig. 2-19)	Roof	5.1	60	< 227	< 8.6
Penelec Line Shack (Fig. 2-21)	Interior	4.8	20	< 231	< 10.9
Penelec Line Shack (Fig. 2-21)	Roof	5.3	20	< 231	< 10.9
Penelec Switch Yard Bldg. (Fig. 2-22)	Interior	4	10	< 231	< 10.9
Penelec Switch Yard Bldg. (Fig. 2-22)	Roof	Not Done	0	< 231	< 10.9
Penelec Warehouse (Fig. 2-20)	Interior	8	40	< 231	< 9.9
Penelec Warehouse (Fig. 2-20)	Roof	5.3	50	< 231	< 9.9
MHB (DSF)	Interior	18	20	< 236	< 11.6
DSB (DSF)	Interior	28	60	< 236	< 11.6
PAF (DSF)	Interior	6	10	< 227	< 9.9
SSGS Discharge Tunnel (Fig. 2-18)	Interior	4	30	< 229	< 12.3

Note: These are the average results of the characterization surveys performed.

Table 2-6a
DSF Facility General Area Measurement Results

(Note: ± Values Represent 1 Standard Deviation Estimates)

DECOMMISSIONING SUPPORT BUILDING GENERAL AREA RESULTS	
Type of Material and/or Location	**Average**
Decommissioning Support Building (DSB) – urem/h	26.5 ± 51.4 urem/h
DSB Floor Frisk Results – ncpm	40.7 ± 30.3 ncpm
DSB Wall Frisk Results – ncpm	17 ± 17.5 ncpm
DSB Overhead – ncpm	24 ± 15.8 ncpm
DSB Floor Smear Results – dpm (beta/gamma)	< 236 dpm
DSB Wall Smear Results – dpm (beta/gamma)	< 236 dpm
DSB Overhead Smear Results – dpm (beta/gamma)	< 236 dpm
PERSONNEL ACCESS FACILITY GENERAL AREA RESULTS	
Type of Material and/or Location	**Average**
Personnel Access Facility (PAF) – urem/h	6.9 ± 2.6 urem/h
PAF Floor Frisk Results – ncpm	3.3 ± 11.5 ncpm
PAF Wall Frisk Results – ncpm	10 ± 15.1 ncpm
PAF Overhead – ncpm	7.5 ± 10.4 ncpm
PAF Floor Smear Results – dpm (beta/gamma)	< 237 dpm
PAF Wall Smear Results – dpm (beta/gamma)	< 237 dpm
PAF Overhead Smear Results – dpm (beta/gamma)	< 237 dpm
MATERIALS HANDLING BAY GENERAL AREA RESULTS	
Type of Material and/or Location	**Average**
Materials Handling Bay (MHB) – urem/h	18 ± 5.9 urem/h
MHB Floor Frisk Results – ncpm	100 ± 82 ncpm
MHB Wall Frisk Results – ncpm	16 ± 18.4 ncpm
MHB Overhead – ncpm	23.3 ± 19.7 ncpm
MHB Floor Smear Results – dpm (beta/gamma)	< 237 dpm
MHB Wall Smear Results – dpm (beta/gamma)	< 237 dpm
MHB Overhead Smear Results – dpm (beta/gamma)	< 237 dpm
MHB Floor Sample Above CV Pipe Tunnel – SX8SD99273 (Cs-137)	1.3 ± 0.2 pCi/g
DECOMMISSIONING SUPPORT FACILITY ROOF GENERAL AREA RESULTS	
Type of Material and/or Location	**Average**
DSF Roof, A/C Air Filter Material – SX9SD01908 (Cs-137)	109 ± 11 pCi/g
DSF Roof, A/C Air Filter Material – SX9SD01908 (Co-60)	2.8 ± 0.43 pCi/g
DSF Roof, Debris From Inside Air Conditioner Housing – SXOT951 (Cs-137)	23 ± 4.7 pCi/g
Decommissioning Support Facility (DSF) Roof – urem/h	4.8 ± 0.6 urem/h
DSF Roof Smear Results – dpm	< 100 dpm

Note 1: All smear results are per 100-centimeter square area
Note 2. ncpm = net counts per minute using standard frisker probe (probe area ~15 cm^2 - probe held stationary at ~1/2 inch from surface for each determination)
Note 3: < values indicate Minimum Detectable Activities

Table 2-7

SNEC Facility Surface Contamination Analysis Results

Composited Smears of January 1995

NUCLIDES	AREA 1 (uCi's)	% OF TOTAL	AREA 2 (uCi's)	% OF TOTAL	AREA 3 & 4[1] (uCi's)	% OF TOTAL
C-14	3.0E-5*	0.0081	2.0E-5*	0.0242	2.0E-5*	0.2319
Ni-59	3.0E-4*	0.0814	3.0E-4*	0.3628	3.0E-4*	3.4781
Sr-90	**6.8E-4**	**0.1845**	**1.0E-3**	**1.2094**	**3.0E-5**	**0.3478**
Fe-55	5.0E-4*	0.1356	4 0E-4*	0.4838	3.0E-4*	3.4781
Tc-99	4.0E-5*	0.0109	3.0E-5*	0.0363	4.0E-5*	0.4637
I-129	5.0E-5*	0.0136	4.0E-5*	0.0484	7.0E-5*	0.8116
Co-60	**2.87E-3**	**0.7786**	**8.31E-4**	**1.0050**	**2.59E-4**	**3.0028**
Zn-65	3.0E-4*	0.0814	8.0E-5*	0.0968	1.0E-5*	0.1159
Ru-106	3.0E-3*	0.8139	1.0E-3*	1 2094	9.0E-5*	1.0434
Cs-134	2.0E-4*	0.0543	4.0E-5*	0.0484	6.0E-6*	0.0696
Cs-137	**3.56E-1**	**96.5780**	**7.66E-2**	**92.6432**	**6.26E-3**	**72.5768**
Ce-144	2.0E-3*	0.5426	5.0E-4*	0.6047	4.0E-5*	0.4637
H-3	5.0E-4*	0.1356	5.0E-4*	0.6047	8.0E-4*	9.2750
Ni-63	**1.2E-3**	**0.3255**	**5.4E-4**	**0.6531**	**8.9E-5**	**1.0318**
Pu-238	**4.6E-5**	**0.0125**	**3.1E-5**	**0.0375**	**4.0E-6**	**0.0464**
U-234	1.1E-6*	0.0003	1.0E-6*	0.0012	1.1E-6*	0.0128
U-235	1.1E-6*	0.0003	1.0E-6*	0.0012	1.1E-6*	0.0128
U-238	1.1E-6*	0.0003	1.0E-6*	0.0012	1.1E-6*	0.0128
Am-241	**1.8E-4**	**0.0488**	**1.3E-4**	**0.1572**	**1.2E-5**	**0.1391**
Cm-242	1.3E-6*	0.0004	**2.6E-6**	**0.0031**	1.3E-6*	0.0151
Cm-244	2.2E-6*	0.0006	1.0E-6*	0.0012	9.5E-7*	0.0110
Pu-239	**1.0E-4**	**0.0271**	**8.3E-5**	**0.1004**	**8.6E-6**	**0.0997**
Pu-241	**6.1E-4**	**0.1655**	**5.5E-4**	**0.6652**	2.8E-4*	3.2462
Pu-242	9.9E-7*	0.0003	1.2E-6*	0.0015	1 2E-6*	0.0139
TOTALS	**3.69E-1**	**100%**	**8.27E-2**	**100%**	**8.63E-3**	**100%**

*** Reported as "Less Than" values (values in bold were positively identified)**

Note: Because of similar nuclide compositions, smear results from AREA 3 and 4 (Table 2-8) were combined prior to analysis.

Nuclides with half-lives of < 100 days or naturally occurring isotopes e.g. K-40, Ra-226 and Th-228, were not included in the percent of total columns. These nuclides are not present in sufficient quantity to be significant. "Less than" values are assumed valid for calculations related to curie evaluations.

Table 2-17b
2002 SNEC Well REMP Data

LOCATION CODE	2002 SECOND QUARTER REMP				
	TRITIUM (pCi/L)	Cs-137 (pCi/L)	Cs-134 (pCi/L)	Co-60 (pCi/L)	Sampling Date
MDA	<2000	18	15	15	
wells					
GEO-1	<342	<8.3	<9.2	<9 2	4/11/02 0810
GEO-3	NO SAMPLE- WELL DRY				4/11/02 1055
GEO-4	<326	<9 8	<10 4	<9.7	4/11/02 1105
GEO-5	<308	<14 0	<13.5	<13.2	4/2/02 1454
GEO-8	<308	<13.3	<12.3	<12.3	4/1/02 1620
GEO-10	NO SAMPLE - WELL DRY				4/9/02 1340
MW-2	<342	<15.5	<14.2	<14.4	4/11/02 0845
MW-3	<342	<11.5	<9.7	<11.1	4/9/02 1350
MW-4	<308	<8.0	<9.3	<8 3	4/2/02 1450
OW-3	<342	<8 3	<9.6	<9 3	4/2/02 1400
OW-3R	<308	<10 9	<10 9	<9.4	4/2/02 1120
OW-4	NO SAMPLE - WELL DRY				4/9/02 1230
OW-4R	<308	<12.2	<12.2	<11.2	4/1/02 1700
OW-5	<342	<5.0	<5 5	<5.6	4/9/02 1240
OW-5R	<310	<8 7	<9.5	<9.6	4/1/021500
OW-6	<308	<12.4	<10 9	<12.0	4/2/02 0953
OW-7	NO SAMPLE - WELL DRY				4/11/02 1045
OW-7R	<308	<13 4	<13.0	<12 4	4/1/02 1230
OP-3	NO SAMPLE - WELL DRY				4/10/02 0820
OP-4	<342	<12.4	<14 4	<12.4	4/10/02 0800
NRC ANGLE WELL	<308	<7.9	<8 6	<8 6	4/2/02 0807

Table 2-17c

NEW MONITORING WELL TRU/HTDN ANALYSIS RESULTS
All Results are <MDA in pCi/l except for uranium

Well ID	OW-3	OW-3R	OW-4R	OW-5	OW-5R	OW-6	OP-3	OP-4	OW-7R
Sample Date	4/12/01 @1446	4/12/01 @1455	4/12/01 @1505	4/12/01 @1545	4/12/01 @1535	4/12/01 @1620	7/5/01 @1630	7/3/01 @1545	7/2/01 @1330
Carbon-14	<43.69	<45.32	<44.34	<44.01	<43.79	<46.14	<53.31	<52.08	<53.23
Nickel-63	<12.13	<12.77	<13.7	<11.56	<11.11	<9.9	<154.9	<73.55	<68.53
Sr-90	<0.8	<1.06	<0.65	<1.23	<1.3	<0.82	<1.46	<0.75	<0.77
Tc-99	<11.79	<12.1	<12.94	<11.89	<12.51	<12.26	<24.3	<11.57	<14.48
I-129	<109	<216	<189	<190	<229	<373	<518.05	<183.57	<149.14
Pu-242	<0.22	<0.23	<0.38	<0.25	<0.25	<0.24	<0.39	<0.18	<0.96
Pu-239/240	<0.22	<0.23	<0.36	<0.25	<0.37	<0.2	<0 39	<0.18	<1.07
Pu-238	<0.24	<0.58	<0 63	<0.25	<0 34	<0.49	<0.39	<0.59	<1.79
Pu-241	<55.43	<63.24	<56 48	<67.78	<40.03	<54.53	<120.67	<60 88	<317.69
Am-241	<0.23	<0.52	<0.2	<0.19	<0.32	<0.29	<0.71	<0.82	<0.59
U-234	**0.49**	**0.94**	**1.19**	<0.55	**2.38**	**0.52**	<0.82	**0.41**	**0.81**
U-235	<0.24	<0.23	<0.28	<0 37	<0.23	<0.23	<0.55	<0.21	<0.21
U-238	<0.24	**44**	**0.84**	<0.32	**2.1**	<0.26	<0.49	**0.33**	**0.85**

Table 2-18
Historical Groundwater Monitoring Results for well GEO-5

TRITIUM RESULTS

Activity ± 2σ

Date	Result (pCi/L)
7/13/94	MDA (<170)
10/06/94	560 ± 130
10/27/94	310 ± 120
1/12/95	MDA (<190)
4/05/95	MDA (<180)
5/30/95	270 ± 120
6/13/95	370 ± 130
7/13/95	370 ± 110
8/17/95	390 ± 130
9/15/95	410 ± 130
10/18/95	760 ± 140
11/17/95	MDA (<200)
1/25/96	MDA (<190)
4/03/96	MDA (<150)
7/10/96	MDA (<140)
10/03/96	MDA (<140)
1/08/97	MDA (<140)
4/16/97	MDA (<150)
7/09/97	MDA (<150)
10/01/97	180 ± 100
1/08/98	MDA (<150)
4/15/98	140 ± 80
7/09/98	MDA (<120)
10/08/98	MDA (<130)
1/19/99	200 ± 90
4/15/99	MDA (<160)
7/22/99	200 ± 90
10/14/99	MDA (<130)
1/06/00	MDA (<130)
4/06/00	MDA (<120)
7/13/00	190 ± 80
10/11/00	MDA (<644)
1/24/01	MDA (<105)
4/04/01	MDA (<92)
7/03/01	MDA (<332)
10/02/01	MDA (<266)
1/7/02	MDA (<298)
4/1/02	MDA (<308)
7/11/02	MDA (<336)

Table 2-27

SNEC Containment Vessel (CV) & CV Pipe Tunnel Area Sub-Surface Soil Sample Results (pCi/g)

Table Includes Data from Work Packages SMPRQ - SOIL001, SR-0010 & SR-0016

Sample Number	Estimated Depth (Grade @ ~811' El.)	Cs-137	Co-60
SX-5-SL-01-933	802' El	2 16	< MDA
SX-5-SL-01-934	802' El	9 58	< MDA
SX-5-SL-01-935	802' El	61	< MDA
SX-SL-959	800' El	9.1	< MDA
SX-SL-960	797' El.	2.8	< MDA
SX-SL-961	795' El.	3	< MDA
SX-SL-982	798' El	3 21	< MDA
SX-SL-983	800' El	1.8	< MDA
SX-SL-984	802' El	7.12	< MDA
SX-SL-985	802' El	0 54	< MDA
SX-5-SL-01-790	802' El	0 12	< MDA
SX-5-SL-01-801	802' El	1.04	< MDA
SX-5-SL-01-829	802' El	32.97	< MDA
SX-5-SL-01-830	802' El	105 2	< MDA
SX-5-SL-01-831	802' El	34 3	< MDA
SX-5-SL-01-833	802' El.	80 5	< MDA
SX-5-SL-01-841	802' El.	5 3	< MDA
SX-5-SL-01-842	802' El.	13	< MDA
SX-5-SL-01-802	802' El	4 94	< MDA
SX-SL-942	802' El	0 06	< MDA
SX-SL-943	802' El	1.8	< MDA
SX-SL-944	802' El	0 046	< MDA
SX-SL-945	802' El	27	< MDA
SX-SL-946	802' El.	29.3	< MDA
SX-SL-947	802' El.	46.5	< MDA
SX-SL-948	802' El	38 06	< MDA
SX-SL-949	802' El	53 2	< MDA
SX-SL-972	802' El	0 71	< MDA
SX-SL-973	802' El	0 64	< MDA
SX-SL-974	802' El	0 55	< MDA
SX-SL-975	802' El	0 18	< MDA
SX-SL-976	802' El	23 5	< MDA
SX-9-SL-00-364*	CV Yard 807' El	2 24	< MDA
SX-9-SL-00-343*	CV Yard 809' El.	225 6	0.2
SX-9-SL-00-339*	CV Yard 809' El.	40.8	< MDA
SX-9-SL-00-340*	CV Yard 809' El.	3	< MDA
SX-9-SL-00-341*	CV Yard 809' El	1.2	< MDA
SX-9-SL-00-342*	CV Yard 809' El	4.75	< MDA
SX-9-SL-00-347*	CV Yard 807' El	241	< MDA
SX-9-SL-00-363*	CV Yard 807' El	596 5	< MDA
SX-SL-977*	Under Septic Tank Pad	0 17	< MDA
SX-SL-978*	Under Septic Tank Pad	0 045	< MDA
SX-SL-979*	Under Septic Tank Pad	0 032	< MDA
SX-SL-980*	Under Septic Tank Pad	0 26	< MDA
Average		**39.0**	**0.2**
Standard Deviation		**99.1**	**----**

*** These Samples were not from under CV Tunnel Floor Slab but were taken from CV yard.**

Table 2-28, Site Access Roads

2" by 2" Sodium Iodide (NaI) Scanning Results

Type of Material and/or Location	Average NaI cpm
Macadam Parking Lot Area Between Penelec Warehouse & Garage	8400 ± 2700
Access Areas Between Penelec Warehouse & 1.1 Acre Site	9700 ± 2500
10 Acre Penelec Site Perimeter Dirt Road	10300 ± 2900
Dirt Access Roads to Dump Area & Rifle Range	13400 ± 1800
Main Access Road to Site & Penelec Line Shack	12400 ± 2500
Old Coal Fired Plant Macadam Access Road	12700 ± 2700

Typical Sample results in pCi/g (Cs-137)

Type of Material and/or Location - Sample No.	pCi/g
Access Areas Between Penelec Warehouse & 1.1 Acre Site – SX10SL01758 & 759	0.6 ± 0.25
10 Acre Penelec Site Perimeter Dirt Road – SX11SL01755 & 760	0.31 ± 0.29
Dirt Access Roads to Dump Area & Rifle Range – SX11SL01748, 750 & 754	0.1 ± 0.03
Main Access Road to Site & Penelec Line Shack – SX11SL01749, 751 & 752	0.2 ± 0.28
Old Coal Fired Plant Macadam Access Road – SX11AT01765	< 0.13

2" by 2" Sodium Iodide (NaI) Scanning Results – Near Site Background Samples

Type of Material and/or Location	Average NaI cpm
Near-Site Background Macadam	7200 ± 1000
Near-Site Background Gravel	12900 ± 1000
Near-Site Background Soil	13400 ± 2100

Typical Sample results in pCi/g (Cs-137)

Type of Material and/or Location - Sample No.	pCi/g
Near-Site Background Macadam – SX12AT00371	< 0.27
Near-Site Background Gravel – SX12GR00372	< 0.09
Near-Site Background Soil – SX12SL00370	< 0.15

Note: Positive values are reported with an uncertainty of one standard deviation.

Table 2-29
Listing of all "Hard to Detect Nuclide"/Transuranic Analysis
(Blank spaces indicate no analysis performed)

(Blankple No.	Analysis Date	Location/Description	Sample location See Table 5-2	H-3	Sr-90	Co-60	Cs-137	Am-241	Pu-238	Pu-239	Pu-241	C-14	Ni-63	Eu-152
None Assigned	10/13/94	Soil	OL-1			0.228	11.9					< 3		
SXSGL84S	11/5/94	1994 Soil Remediation Report Results	OL-1		< 0 4	< 0.03	0.45		< 0.04	< 0 08	< 8	< 3	< 1	
SXSGF81S(5)	11/9/94	1994 Soil Remediation Report Results (Recount 1999)	OL-1			1.1	38 6					< 0.4		
SXSGG72S	11/9/94	1994 Soil Remediation Report Results	OL-1		< 0 5	< 0 04	3.58		< 0 03	< 0.03	< 7	< 3	< 1	
SXSGF81S	11/9/94	1994 Soil Remediation Report Results	OL-1		< 0.5	0.968	33.1		< 0 01	< 0 01	< 6	< 2	< 1	
SXSGG761	11/19/94	1994 Soil Remediation Report Results	OL-1		< 0 4	2.35	319		< 0 02	< 0 04	< 4	< 4	< 1	
SXGWG16	1/19/98	Ground Water	OL-1 (3)	< 140										
SXGWG16	4/7/98	CV Pipe Tunnel Water Sample (April 7, 1998)	CV-4/CV-5	160		< 4	5 8							
SXGWG16	6/29/98	CV Pipe Tunnel Water Sample (June 29, 1998)	CV-4/CV-5	< 120		< 1.5	7.4							
SX861990236CO	4/15/99	Scabble Dust of CV Cavity 779' El. - Floor	CV-3			22	31400					< 7		
SX822990235CO	4/15/99	Scabble Dust of CV Cavity 779' El. - Wall	CV-3			22 9	66500					96		
None Assigned	6/2/99	Scabble Dust from SNEC SW	CV-3			< 5	29900					< 5		
None Assigned	6/2/99	Scabble Dust from SNEC Sump	CV-3			< 0.4	2170					< 2		
SXSOBKG2	7/14/99	Composite Soil Background	(4)			< 0.02	0.134	0.6	< 0.3	0.67	< 50	< 8	< 20	< 0 06
DA-SXSOBKG1	7/14/99	Composite BKGND Soil	(4)			< 0 02	0.51	< 0 6	< 0 05	< 0 05				
SXSOBKG1	7/14/99	Composite BKGND Soil	(4)			< 0.02	0.55	< 2	< 0.05	< 0 05				
SXSOBKG1	7/14/99	Composite Soil Background	(4)			< 0.03	0.467	0.43	0.91	0.73	< 70	< 20	< 20	< 0 09
SXSOBKG2	7/14/99	Composite BKGND Soil	(4)			< 0 02	0.15	< 0 6	< 0.05	< 0.04				
SXSO3KG1A	7/14/99	Background Soil Composite (10 miles off-site)	(4)					< 0 02	< 0 04	< 0 03	< 4			
SXSO3KG2A	7/14/99	Background Soil Composite (10 miles off-site)	(4)					< 0.03	< 0 01	< 0 01	< 2			
SX10SD990136	7/15/99	South Garage Storm Main	OL-4			< 0 06	0 26							
SX11SD990134	7/15/99	South - Old Parking Lot Storm Drain	OL-4			< 0 03	0 21							

Table 2-29 (Contd.)
Listing of all "Hard to Detect Nuclide"/Transuranic Analysis

Sample No	Analysis Date	Location/Description	Sample location See Table 5-2	H-3	Sr-90	Co-60	Cs-137	Am-241	Pu-238	Pu-239	Pu-241	C-14	Ni-63	Eu-152
SXSL0032	7/19/99	Weir Discharge to River 30' Excavation Beyond Fence	OL-1					< 0 006	< 0.0008	< 0 002				
SX10SD990022	7/21/99	Discharge Tunnel Sediment - End of Tunnel	SS-3	210	< 8	< 3	21.2	< 0 4	< 0 3	< 0.3	< 70	< 2	< 30	< 6
SXSD0027	7/21/99	South Garage Toilet Effluent to Septic Tank	OL-4					< 0 03	< 0.016	< 0 007				
SX5SD99223	7/22/99	SW Garage #4 Drain	GA-1					< 0 014	< 0 0007	< 0 002				
SX10WA990036	7/22/99	Steam Tunnel Water ~12'	OL-1	< 130										
SX10WA990035	7/22/99	Seal Chamber #1 Water	SS-8	< 130										
SXGWMWGEO	7/22/99	Composite of All GEO Well Water Samples TI#-14181	OL-1 (3)									< 20	< 200	
SX10SD990033	7/22/99	Discharge Tunnel 6" Drain Line Scraping	SS1/SS2/SS3	< 100	< 8	30	4800	5 4	1.6	2 5	< 60	< 6	55	< 20
SX10SD990034	7/22/99	1st Seal Chamber Pile Below 3" Vertical Drain Line	SS-8			< 0.09	62	< 0 05	< 0.04	< 0.04				
SX10SD990031	7/29/99	Discharge Tunnel Wall Scraping	SS-6/SS-7			0 84	120	< 0 2	< 0.04	< 0 04				
SX4PC990104	10/14/99	CV Dome Paint Chips (see 110593) (PS-12)	(2)			400	27000	2.5	1.9	5 8				
SXGWMW1	10/14/99	Bedrock Monitoring Well 1 Water	OL-1 (3)	130	< 0 8	< 6	< 5							
SXGWGEO8	10/14/99	Groundwater Well - Overburden Groundwater	OL-1 (3)	< 130		< 6	< 5							
SXGWGEO3	10/14/99	Groundwater Well - Overburden Groundwater	OL-1 (3)	< 130		< 6	< 5							
SXPCTRU1	10/14/99	CV Dome Paint-SX4PC990093 (110582) (PS-1)	(2)			< 2	32	0 012	< 0 005	0.0091				
SXPCTRU2	10/14/99	CV Paint-SX4PC990094, 95, 96, 97 & 98 (PS-2,3,4,5 &6)	(2)					0 096	0 041	0 065				
SXPCTRU3	10/14/99	CV Paint-SX4PC990099, 100, 101 & 102 (PS-7,8,9 &10)	(2)					0.11	< 0 0004	< 0 0012				
SXPCTRU4	10/14/99	CV Paint-SX4PC990103, 104, 105 & 106 (PS-11,12,13,&14)	(2)					0 61	0 49	0 91				
SX4PC990098	10/14/99	CV Dome Paint Chips (see 110607) (PS-6)	(2)			37	530	2	0.38	1.1				
SXGWGEO10	10/14/99	Groundwater Well - Overburden Groundwater	OL-1 (3)	< 130		< 2	< 3							

Table 2-34
SNEC Well Levels

Well #	T/Elevation	9/6/00		9/27/00		10/4/00		10/5/00		10/11/00	
		$$$	Level	Depth	Level	Depth	Level	Depth	Level	Depth	Level
1								21.70	790 85	21.70	790.85
2								21.10	789 87	21.10	789.87
3								20.70	790.91	20.70	790 91
4&&	813.43	813 43						21.90	791.53	21.60	791.83
5								20.82	791.21	20.98	791.05
6								21.05	789 83	21.02	789.86
7								20.55	791.20	20.55	791.20
8								21.60	790 87	21.63	790 84
9	Abandoned										
10								20.82	790 51	20.95	790.38
11								22.15	790 47	22.26	790 36
12&	802.16	802.42	789.13	10.59	791.83	10.50	791.92			10.64	791 78
OP-1	800.25	800.25		7.42	792 83	7.55	792.70			7.50	792.75
OP-2	808.21	808.21		18.19	790 02	18.05	790.16			18.10	790.11
OP-3	806 15										
OP-4	805 62										
OVERBURDEN WELLS											
OW-1	802 51	802.74	794 10	7.19	795 55	7.10	795 64			7.10	795.64
OW-2	806 21	806.40	789.30	15.90	790 50	15.77	790 63			15.85	790.55
OW-3	825 06										
OW-4	809 96										
OW-5	794 48										
OW-6	801.08										
OW-7	811.28										
Geo#1	815 06	815.25									
Geo # 2			800 52					11.00	800 82	11.20	800 62
Geo # 3	812 74	813 01						13 60	799 41	17.1[illegible]	795.91
Geo # 4	812.22	812.60	805 63							5.43	807.17
Geo # 5	813 13	813.34	807.22							6.30	807.04
Geo # 8	811.14	811.53									
Geo # 10	811.92	812.30	804.63							7.45	804 85
BDRX ROCK WELLS											
MW-2	812.77$										
MW-3	818 63	819.20								14.30	804.90
MW-4	813 59	814.17									
OW-3R	825 26										
OW-4R	810 05										
OW-5R	794.18										
OW-7R	811 14										

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL. 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17.25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells,elevation pin etc in ft.) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

Well #	T/Elevation	10/18/00 Depth	10/18/00 Level	10/25/00 Depth	10/25/00 Level	11/8/00 Depth	11/8/00 Level	11/29/00 Depth	11/29/00 Level	*12/4/00 Depth	*12/4/00 Level
1		21.44	791.11	21.60	790 95						
2		21.04	789 93	21.05	789 92						
3		20.48	791.13	20.60	791.01						
4&&	813 43	21.38	792 05	21.50	791 93	21.68	791 75	21.52	791 91	21.55	791.88
5		20 90	791.13	20.95	791 08						
6		20.96	789 92	21.00	789 88						
7		20.48	791.27	20.65	791 10						
8		21.35	791.12	21.53	790 94						
9	Abandoned										
10		20.65	790 68	20.85	790 48						
11		22.10	790 52	22.20	790 42						
12&	802.16	10.37	792.05	10.51	791.91	10.80	791 62	10.58	791 84	10.65	791.77
OP-1	800 25	7.10	793 15	7.27	792.98	7.47	792 78	7.15	793 10	7.30	792.95
OP-2	808 21	18.10	790 11	17.65	790.56	17.96	790 25	17.92	790 29	17.83	790.38
OP-3	806.15										
OP-4	805 62										
OVERBURDEN WELLS											
OW-1	802 51	7.22	795 52	7.05	795 69	7.13	795 61	7.00	795 74	7.00	795.74
OW-2	806.21	15 88	790 52	15 48	790 92	15.92	790.48	15 80	790 60	15.75	790.65
OW-3	825.06										
OW-4	809 96										
OW-5	794 48										
OW-6	801 08										
OW-7	811 28										
Geo#1	815 06							7.32	807.93	8.72	806.53
Geo # 2		10.93	800 89	9.58	802.24						
Geo # 3	812 74	12 50	800 51	12.75	800.26	13.65	799 36	12 47	800.54	13.00	800.01
Geo # 4	812.22	#	812.60	4.50	808.10	6.03	806 57	4 80	807.80	5.22	807.38
Geo # 5	813.13	4.50	808.84	4.70	808.64	6.10	807 24	4.85	808.49	4.98	808.36
Geo # 8	811.14							11.43	800.10	10.35	801.18
Geo # 10	811.92	4.97	807.33	5 90	806.40	8.13	804 17	6 40	805.90	7.10	805.20
BDRX ROCK WELLS											
MW-2	812.77$										
MW-3	818.63	10.98	808.22	11 00	808.20	12.47	806 73	10.70	808 50	10.90	808 30
MW-4	813.59							5.70	808 47	6.43	807 74
OW-3R	825 26										
OW-4R	810 05										
OW-5R	794.18										
OW-7R	811 14										

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17 25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells elevation pin etc. in ft) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

Well #	T/Elevation	12/13/00 Depth	12/13/00 Level	1/3/01 Depth	1/3/01 Level	1/11/01 Depth	1/11/01 Level	1/24/01 Depth	1/24/01 Level	2/8/01 Depth	2/8/01 Level
1											
2											
3											
4&&	813 43	21.65	791.78	21.90	791.53	21.60	791.83	21.50	791 93	21.50	791.93
5											
6											
7											
8											
9	Abandoned										
10											
11											
12&	802.16	10.70	791.46	11.15	791.01	10.68	791.48	10.33	791.83	10.25	791.91
OP-1	800 25	7.30	792.95	7.30	792.95	7.34	792.91	7 20	793 05	6.90	793 35
OP-2	808 21	17.88	790.33	17.75	790 46	17.93	790.28	17.60	790 61	16.90	791 31
OP-3	806 15										
OP-4	805 62										
OVERBURDEN WELLS											
OW-1	802.51	6.85	795 66			6.98	795 53	6.80	795 71	6.55	795 96
OW-2	806 21	15.62	790.59			15.72	790 49	15.05	791 16	14.00	792 21
OW-3	825 06			4.60	820.46	5.50	819 56	6.80	818 26	6.55	818 51
OW-4	809.96										
OW-5	794 48			8.33	786.15	8.53	785.95	8.35	786 13	6.60	787.88
OW-6	801.08			1.80	799 28	1.88	799 20	1.80	799.28	1.75	799 33
OW-7	811.28										
Geo#1	815 06	10.13	804.93	9.37	805 69	9.24	805 82	6.90	808.16	5.60	809 46
Geo # 2											
Geo # 3	812 74	13.55	799.19	13.84	798 90	14.00	798 74	12.70	800 04	12.60	800.14
Geo # 4	812 22	5.50	806 72	4.30	807.92	4.57	807.65	3.80	808 42	2.25	809 97
Geo # 5	813.13	5 40	807.73	4.60	808.53	4.45	808.68	3.45	809 68	2.20	810 93
Geo # 8	811.14	12.20	798 94	12.25	798 89	13.27	797.87	9.35	801.79	6.80	804 34
Geo # 10	811.92	7.66	804 26	6.03	805 89	6.52	805.40	5.10	806 82	3.65	808 27
BDRX ROCK WELLS											
MW-2	812.77$										
MW-3	818 63	11.00	807 63	10.59	808 04	10.50	808 13	8.90	809 73	7.05	811.58
MW-4	813 59	6 80	806 79	5.70	807.89	6.00	807.59	5.20	808 39	4.30	809 29
OW-3R	825 26			11.30	813 96	11.45	813.81	11.15	814 11	9.80	815 46
OW-4R	810 05			20 90	789 15	21.37	788 68	21.20	788 85	20.25	789 80
OW-5R	794 18			7.20	786 98	7.43	786.75	7.10	787.08	6.30	787.88
OW-7R	811 14										

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL. 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17 25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells,elevation pin etc in ft.) Level = Top Of Water In Elevation

Table 2-34
SNEC Well Levels

		2/22/01		3/8/01		3/19/01		3/28/01		4/12/01	
Well #	T/Elevation	Depth	Level	Depth	Level	Depth	Level	Depth	Level	Depth	Level
1											
2											
3											
4&&	813 43	21.25	792.18	21.50	791.93	20.75	792 68	21.00	792 43	20.25	793 18
5											
6											
7											
8											
9	Abandoned										
10											
11											
12&	802.16	10.05	792.11	10.30	791.86	9.50	792 66	9.75	792.41	9.10	793 06
OP-1	800 25	6.90	793 35	7.00	793 25	6.35	793.90	6.55	793.70	5 88	794 37
OP-2	808 21	17 00	791 21	17 25	790 96	16.70	791.51	16.65	791.56	16.28	791 93
OP-3	806 15										
OP-4	805 62										
OVERBURDEN WELLS											
OW-1	802.51	6 48	796 03	6.53	795 98	6.10	796 41	6 25	796 26	5.60	796 91
OW-2	806 21	14 25	791 96	14 85	791.36	12.80	793 41	12.65	793 56	10 95	795 26
OW-3	825 06	6 40	818 66	6 40	818 66	6.05	819 01	5.85	819 21	3.90	821 16
OW-4	809 96	***		***		14.95	795 01	14.10	795 86	***	
OW-5	794 48	6.55	787 93	6.90	787 58	5.15	789 33	5.10	789 38	4.20	790.28
OW-6	801 08	1.60	799 48	1.65	799 43	1.45	799.63	1.55	799 53	1.56	799.52
OW-7	811.28										
Geo#1	815.06	5.85	809.21	5.95	809 11	4 60	810 46	4 60	810.46	4.15	810.91
Geo # 2											
Geo # 3	812 74	12.80	799 94	12 00	800 74	11.55	801.19	12 00	800.74	10 25	802 49
Geo # 4	812 22	2 55	809 67	1.80	810 42	1.60	810 62	1.70	810.52	1.50	810 72
Geo # 5	813 13	2.30	810 83	2.45	810 68	1.60	811 53	1.60	811.53	1.70	811 43
Geo # 8	811 14	7 95	803 19	9 00	802.14	5.30	805 84	4.90	806.24	3 50	807 64
Geo # 10	811 92	3.65	808 27	3.30	808.62	2.40	809 52	2.50	809 42	2 30	809 62
BDRX ROCK WELLS											
MW-2	812 77$	12 90		12 70		11 50		11 75		10 95	
MW-3	818 63	7.25	811 38	7.50	811.13	6 33	812 30	6.50	812.13	6 25	812 38
MW-4	813.59	3 40	810.19	-0.40	813 99	0.15	813 44	2.80	810 79	-0.60	814 19
OW-3R	825 26	9 35	815.91	9.20	816 06	8 00	817 26	7.15	818 11	7.90	817 36
OW-4R	810 05	19.15	790 90	19 30	790 75	18.80	791.25	18 80	791 25	18 10	791 95
OW-5R	794 18	5.75	788 43	6 20	787 98	4 80	789 38	5.20	788 98		
OW-7R	811 14										

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17 25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells,elevation pin etc in ft) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

Well #	T/Elevation	4/26/01 Depth	4/26/01 Level	5/10/01 Depth	5/10/01 Level	5/30/01 Depth	5/30/01 Level	6/13/01 Depth	6/13/01 Level
1									
2									
3									
4&&	813.43	21.25	792.18	21.60	791.83	21.50	791.93	21.50	791.93
5									
6									
7									
8									
9	Abandoned								
10									
11									
12&	802.16	10.02	792.14	10.37	791.79	10.30	791.86	10.30	791.86
OP-1	800.25	6.80	793.45	7.25	793.00	7.15	793.10	7.40	792.85
OP-2	808 21	16.55	791.66	17.00	791.21	16.90	791.31	17.00	791.21
OP-3	806.15					14.50	791.65	14.75	791.40
OP-4	805.62					16.55	789.07	16.85	788.77
OVERBURDEN WELLS									
OW-1	802.51	5.80	796.71	6.50	796.01	6.40	796.11	6.60	795.91
OW-2	806.21	12.90	793.31	14.55	791.66	14.30	791.91	14.55	791.66
OW-3	825.06	4.30	820.76	5.80	819.26	6.30	818.76	6.45	818.61
OW-4	809.96	***		***		***		***	
OW-5	794.48	5.48	789.00	6.80	787.68	7.55	786.93	7.55	786.93
OW-6	801.08	1.75	799.33	1.82	799.26	1.90	799.18	1.95	799.13
OW-7	811.28					***		***	
Geo#1	815.06	4.90	810.16	7.15	807.91	6.85	808.21	7.85	807.21
Geo # 2									
Geo # 3	812.74	12.35	800.39	12.85	799.89	9.20	803.54	7.05	805.69
Geo # 4	812.22	3.25	808.97	4.40	807.82	5.60	806.62	6.15	806.07
Geo # 5	813 13	2.60	810.53	3.80	809.33	4.15	808.98	4.40	808.73
Geo # 8	811.14	5.15	805.99	8.80	802.34	8.35	802.79	8.85	802.29
Geo # 10	811.92	4.70	807.22	6.70	805.22	8.55	803.37	10.05	801.87
BDRX ROCK WELLS									
MW-2	812.77$	12.20		14.00		13.90		15.00	
MW-3	818.63	7.90	810.73	8.45	810.18	8.90	809.73	9.30	809.33
MW-4	813.59	4.00	809.59	5.00	808.59	5.90	807.69	5.95	807.64
OW-3R	825.26	8.40	816.86	8.90	816.36	10.00	815.26	9.80	815 46
OW-4R	810.05	19.60	790.45	19.70	790 35	19.25	790 80	18.70	791.35
OW-5R	794.18	7.00	787.18	7.00	787.18	7.60	786.58	7.65	786.53
OW-7R	811.14					17.84	793.30	19.90	791.24

Note *measurement from T/pipe from 12/13/00. Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7.8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17.25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E. top of wells,elevation pin etc. in ft) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

		7/2/01		7/31/01		8/14/01		8/29/01		9/20/01	
Well #	T/Elevation	Depth	Level	Depth	Level	Depth	Level	Depth	Level	Depth	Level
1											
2											
3											
4&&	813 43	21 43	792 00	21.57	791 86	21.95	791.48	21.60	791.83	26.78	786 65
5											
6											
7											
8											
9	Abandoned										
10											
11											
12&	802 16	10.30	791 86	10.35	791 81	10.30	791 86	11.00	791 81		
OP-1	800 25	7.30	792 95	7.85	792 40	7.90	792 35	7.80	792 45	8 10	792 15
OP-2	808 21	17 00	791 21	17 65	790.56	17.85	790.36	17.90	790 31	18.19	790 02
OP-3	806 15	14 60	791.55	15 57	790 58	15.90	790.25	15 90	790 25	****	
OP-4	805.62	16 70	788 92	17.72	787 90	18 00	787 62	18.10	787 52	****	
OVERBURDEN WELLS											
OW-1	802 51	6 45	796 06	7 05	795 46	7 15	795 36	7 10	795 41	6.55	795 96
OW-2	806 21	14.55	791 66	15.60	790 61	15 85	790 36	16 00	790 21	16.15	790.06
OW-3	825 06	7 50	817 56	8.80	816 26	9 60	815 46	10 20	814 86	11 06	814 00
OW-4	809.96	***		***		***		***		***	
OW-5	794 48	7 75	786.73	8 45	786 03	8.95	785 53	***		***	
OW-6	801 08	2 00	799 08	2 20	798 88	2.15	798 93	2.15	798 93	2 10	798 98
OW-7	811 28	***		***		***		***		***	
Geo#1	815 06	7.35	807 71	10.30	804 76	10.60	804 46	9.75	805.31	***	
Geo # 2											
Geo # 3	812 74	3.10	809 64	14.70	798 04	16 02	796 72	13 90	798 84	15.60	797 14
Geo # 4	812.22	6 30	805 92	7.67	804.55	8.16	804 06	8 72	803 50	7.93	804 29
Geo # 5	813.13	4 50	808 63	6.15	806.98	7.00	806 13	7.90	805 23	9.44	803 69
Geo # 8	811.14	8 40	802.74	13 55	797.59	14.17	796 97	14 20	796 94	****	
Geo # 10	811 92	9 05	802 87	***		***		***		***	
BDRX ROCK WELLS											
MW-2	812 77$	14.30		17.20		17.71		17.65		18.10	
MW-3	818 63	9.40	809 23	11.30	807 33	12.32	806 31	13.20	805 43	15.00	803 63
MW-4	813 59	5.20	808 39	7.50	806 09	8.35	805 24	9.20	804 39	11.00	802 59
OW-3R	825 26	10 50	814.76	12.00	813 26	12.00	813 26	12 80	812 46	13.30	811.96
OW-4R	810.05	19 60	790 45	20.90	789 15	20 90	789 15	21.50	788 55	22.20	787.85
OW-5R	794 18	7 70	786 48	8 80	785 38	8 80	785 38	8 80	785 38	9 50	784.68
OW-7R	811 14	20 00	791.14	21.00	790.14	21.15	789 99	21 20	789.94	21.30	789 84

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16.2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17 25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells,elevation pin etc. in ft) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

		7/2/01		7/31/01		8/14/01		8/29/01		9/20/01	
Well #	T/Elevation	Depth	Level	Depth	Level	Depth	Level	Depth	Level	Depth	Level
1											
2											
3											
4&&	813 43	21.43	792.00	21:57	791 86	21:95	791 48	21.60	791 83	26.78	786 65
5											
6											
7											
8											
9	Abandoned										
10											
11											
12&	802.16	10.30	791 86	10.35	791 81	10.30	791.86	11:00	791 81		
OP-1	800.25	7.30	792 95	7.85	792 40	7.90	792.35	7.80	792 45	8'10	792 15
OP-2	808.21	17.00	791.21	17.65	790 56	17.85	790.36	17.90	790 31	18.19	790.02
OP-3	806.15	14 60	791 55	15.57	790 58	15'90	790.25	15.90	790 25	****	
OP-4	805 62	16 70	788 92	17.72	787 90	18 00	787.62	18.10	787.52	****	
OVERBURDEN WELLS											
OW-1	802 51	6.45	796 06	7.05	795 46	7.15	795.36	7.10	795 41	6 55	795.96
OW-2	806 21	14.55	791.66	15.60	790 61	15'85	790.36	16.00	790 21	16.15	790 06
OW-3	825 06	7:50	817.56	8.80	816 26	9 60	815 46	10.20	814 86	11.06	814 00
OW-4	809 96	***		***		***		***		***	
OW-5	794 48	7.75	786 73	8 45	786 03	8.95	785 53	***		***	
OW-6	801.08	2 00	799 08	2 20	798 88	2.15	798 93	2.15	798 93	2.10	798 98
OW-7	811.28	***		***		***		***		***	
Geo#1	815 06	7.35	807.71	10.30	804.76	10.60	804 46	9.75	805 31	***	
Geo # 2											
Geo # 3	812 74	3 10	809 64	14 70	798 04	16.02	796 72	13.90	798 84	15'60	797.14
Geo # 4	812 22	6.30	805 92	7.67	804 55	8.16	804 06	8.72	803 50	7.93	804 29
Geo # 5	813 13	4.50	808 63	6.15	806 98	7.00	806 13	7.90	805 23	9 44	803 69
Geo # 8	811 14	8 40	802.74	13.55	797 59	14.17	796 97	14 20	796 94	****	
Geo # 10	811.92	9 05	802.87	***		***		***		***	
BDRX ROCK WELLS											
MW-2	812.77$	14 30		17.20		17.71		17.65		18.10	
MW-3	818 63	9 40	809 23	11.30	807 33	12.32	806 31	13 20	805 43	15.00	803 63
MW-4	813 59	5.20	808 39	7.50	806 09	8.35	805 24	9 20	804 39	11.00	802 59
OW-3R	825.26	10.50	814.76	12 00	813 26	12.00	813 26	12 80	812 46	13.30	811.96
OW-4R	810 05	19 60	790 45	20 90	789 15	20.90	789 15	21 50	788 55	22.20	787.85
OW-5R	794 18	7.70	786 48	8 80	785 38	8.80	785 38	8 80	785 38	9.50	784 68
OW-7R	811 14	20 00	791 14	21.00	790 14	21.15	789 99	21 20	789 94	21.30	789 84

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL. 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17 25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells elevation pin etc. in ft) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

Well #	T/Elevation	10/4/01 Depth	10/4/01 Level	10/23/01 Depth	10/23/01 Level	11/6/01 Depth	11/6/01 Level	12/4/01 Depth	12/4/01 Level	1/10/02 Depth	1/10/02 Level
1											
2											
3											
4&&	813 43	30.73	782.70								
5											
6											
7											
8											
9	Abandoned										
10											
11											
12&	802.16										
OP-1	800 25	7.49	792.76	7.45	792 80	7.65	792 60	7 70	792 55	7.90	792.35
OP-2	808 21	17.15	791.06	17.70	790 51	18.10	790 11	17.30	790 91	17.92	790 29
OP-3	806.15	14.90	791 25	15 60	790 55	16.07	790 08	15.12	791 03	11.90	794 25
OP-4	805 62	16 96	788 66	17.67	787 95	18 15	787 47	17.10	788 52	18.00	787 62
OVERBURDEN WELLS											
OW-1	802 51	6.10	796 41	6.64	795 87	7 05	795 46	6 43	796 08	6.70	795 81
OW-2	806 21	14.93	791.28	15.55	790 66	16.05	790 16	15.05	791 16	15.85	790 36
OW-3	825 06	11 40	813 66	11.85	813 21	12.20	812 86	12.40	812 66	9.75	815 31
OW-4	809 96	***		***		***		***		***	
OW-5	794.48	***		***		***		***		***	
OW-6	801 08	2 25	798 83	2.15	798 93	2 20	798.88	2.15	798 93	2.15	798.93
OW-7	811 28	***		***		***		***		***	
Geo#1	815 06	11.50	803.56	11.62	803 44	6.22^^^	808 84	7.36	807.70	9.20	805 86
Geo # 2											
Geo # 3	812.74	13.05	799 69	13 40	799 34	16 40	796 34	12 80	799 94	*****	
Geo # 4	812 22	9.75	802 47	10 40	801.82	11 05	801.17	9.34	802 88	10 60	801 62
Geo # 5	813 13	9.30	803 83	10.00	803.13	10 40	802.73	8.86	804 27	###	813 13
Geo # 8	811 14	10.54	800.60	13.80	797 34	14.20	796.94	11.30	799 84	13.15	797 99
Geo # 10	811 92	***		***		***		0.1 ###	811 82	###	811 92
BDRX ROCK WELLS											
MW-2	812 77$	16 35		17.60		20.15		17.25		18.60	
MW-3	818 63	14 49	804.14	15.20	803 43	15 00	803 63	14.10	804.53	13.70	804.93
MW-4	813 59	10.42	803 17	11.15##	802 44	11.40	802 19	10.18	803 41	10.50	803.09
OW-3R	825 26	13 50	811.76	13.75	811.51	14.15	811.11	14.20	811 06	12.45	812.81
OW-4R	810 05	22 25	787 80	23 00	787 05	23 55	786 50	23 60	786 45	23.70	786.35
OW-5R	794.18	9 01	785 17	9.70	784 48	9 70	784.48	9.45	784 73	9 00	785.18
OW-7R	811 14	20 30	790 84	21.15	789 99	21.50	789 64	20.60	790 54	20 05	791 09

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01 T/Plate EL 802 81 && well pulled out 10/10/01

**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ***** Dry Well Geo # 3 17 25'

well flooded to top may be due to sheet pile, grout curtain wall and secondary well

Depth = Top of Water from benchmark (I E top of wells,elevation pin etc. in ft) Level = Top Of Water in Elevation

Table 2-34
SNEC Well Levels

Well #	T/Elevation	1/28/02 Depth	1/28/02 Level	2/26/02 Depth	2/26/02 Level	3/11/02 Depth	3/11/02 Level	4/01/02 Depth	4/01/02 Level	4/16/02 Depth	4/16/02 Level
1											
2											
3											
4&&	813 43										
5											
6											
7											
8											
9	Abandoned										
10											
11											
12&	802 16										
OP-1	800 25	7.60	792 65			7.80	792 45	6.55	793 70	7.25	793.00
OP-2	808.21	17.55	790 66	17.77	790 44	17.80	790 41	16.65	791.56	17.20	791.01
OP-3	806 15	15.40	790.75	15.60	790 55	15.63	790 52	14.15	792 00	12.30	793 85
OP-4	805 62	17.45	788.17	17.75	787 87	17.80	787.82	16.00	789 62	17.05	788 57
OVERBURDEN WELLS											
OW-1	802 51	6.85	795.86			6.80	795.71	6.15	796 36	9.30	793 21
OW-2	806 21	15.35	790.86	16.05	790.16	15.70	790.51	13.75	792.46	14.60	791.61
OW-3	825 06	8.77	816.29	***		***		4.93	820.13	5.13	819 93
OW-4	809 96	***		***		***		***		12.80	797.16
OW-5	794 48	***		***		***		5.65	788 83	6.35	788.13
OW-6	801 08	2 00	799 08			2.05	799 03	1.70	799 38	1.60	799 48
OW-7	811 28	***		***		***		***		6.45	804.83
Geo#1	815 06	7.53	807.53			8.05	807.01	4.95	810 11	6.10	808.96
Geo # 2											
Geo # 3	812 74	******				******		******		16.00	796.74
Geo # 4	812 22	10.00	802 22			9.72	802.50	7.70	804 52	0.00#	812.22
Geo # 5	813 13	7.80	805 33			7.50	805 63	4.55	808 58	6.42	806.71
Geo # 8	811.14	8.70	802 44	12 44	798.70	13 25	797 89	4.40	806 74	8 33	802 81
Geo # 10	811.92	###	811.92			###	811 92	#? 8.95	802 97	***	
BDRX ROCK WELLS											
MW-2	812 77$	22 70				19.20		17.30		51.15	
MW-3	818 63	12.45	806 18			12.05	806 58	9.70	808 93	10.33	808 30
MW-4	813 59	9.30	804 29			8.90	804 69	0.2(+)	813.79	0.00#	813 59
OW-3R	825 26	12.10	813 16	11.80	813 46	12 30	812 96	11 55	813.71	11.10	814 16
OW-4R	810 05	23.22	786 83	23.30	786 75	23.30	786 75	21.10	788.95	28.25	781.80
OW-5R	794 18	9.03	785 15	9.90	784 28	8.55	785 63	8.00	786.18	7.88	786.30
OW-7R	811 14	20 84	790 30	21.25	789 89	21.20	789 94	18.75	792.39	25.60	785 54

Note *measurement from T/pipe from 12/13/00 Measurement before 12/13 are from T/casing $$$ elev used to adjust level

*** Dry Well OW-4 15'/13 5', OW-7 7 8'/6 5', Geo-10 10', OW-5 9 15', Geo-1 12 15', OW-3 12 8', OP-4 18 5', OP-3 16 85 deep

well flooded to top $ inclined well ## almost dry 11 15' depth #? Well water drained out mid-march 02

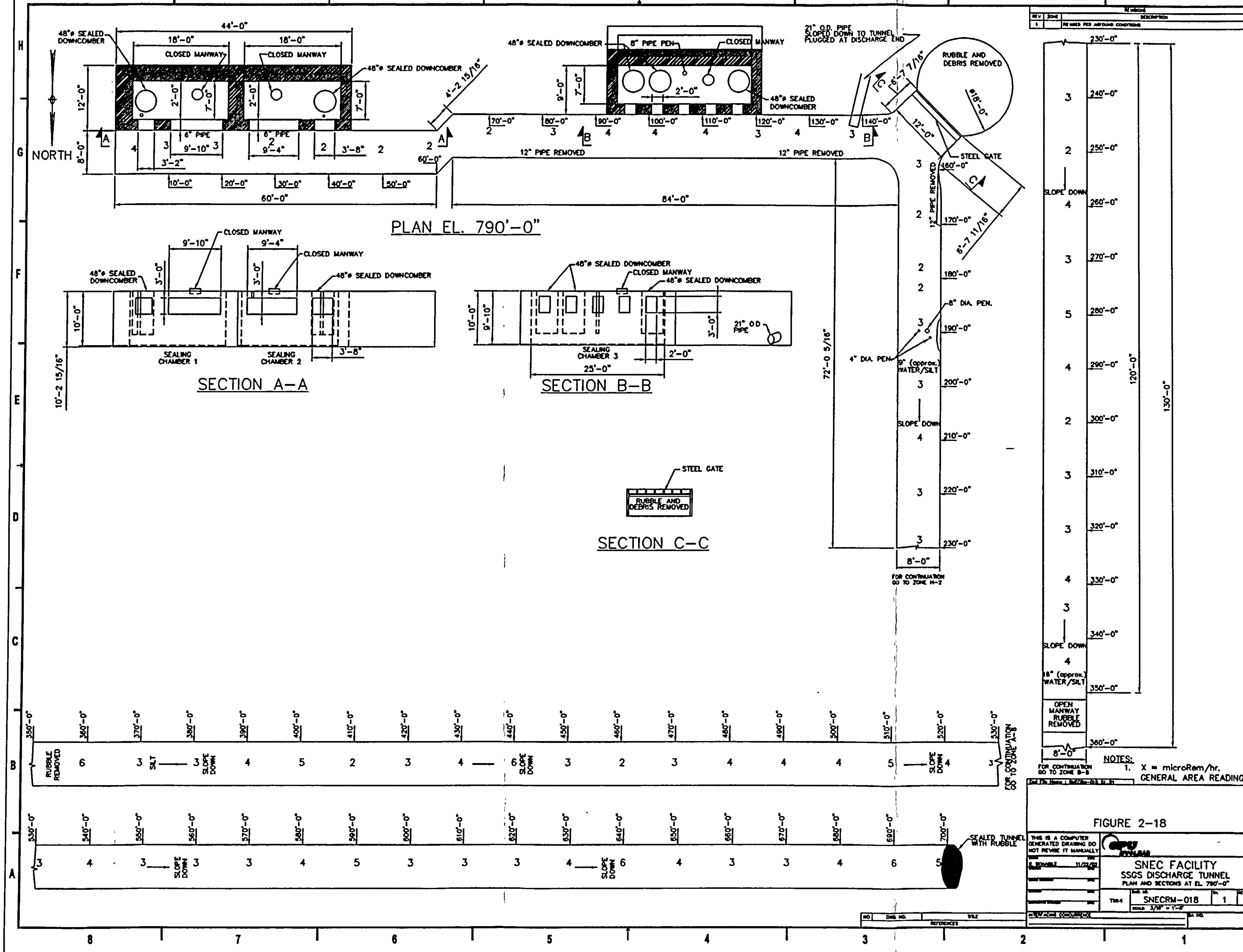
^^^ underground waterline and valve broken ** unusual reading - indicates well flooded above top of pipe

& well pulled out 8/15/01. T/Plate EL 802 81 && well pulled out 10/10/01

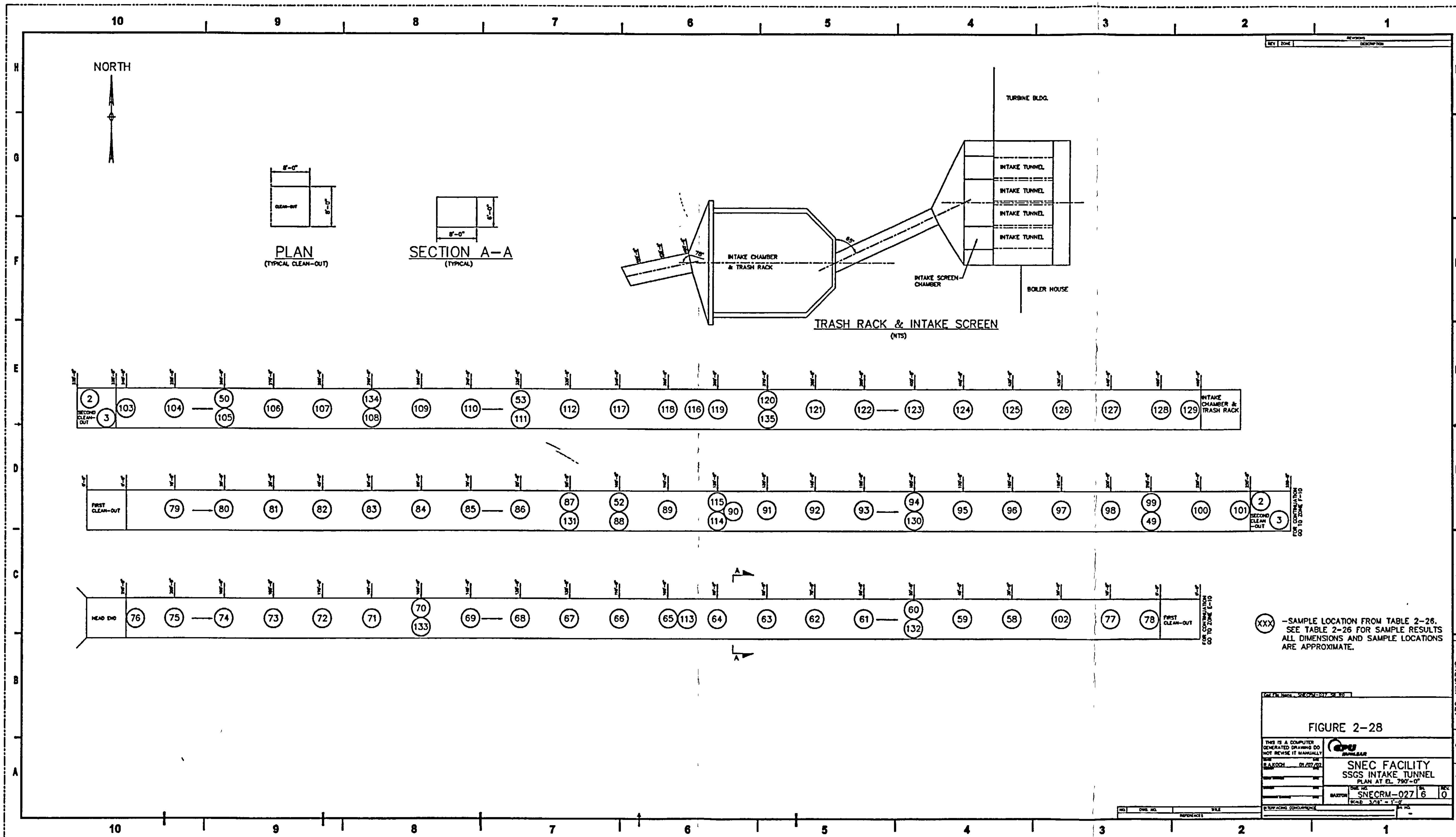
**** Almost Dry Well OP-3 16 2', OP-4 18 25', Geo-8 14 25' ****** Dry Well Geo # 3 17 25'

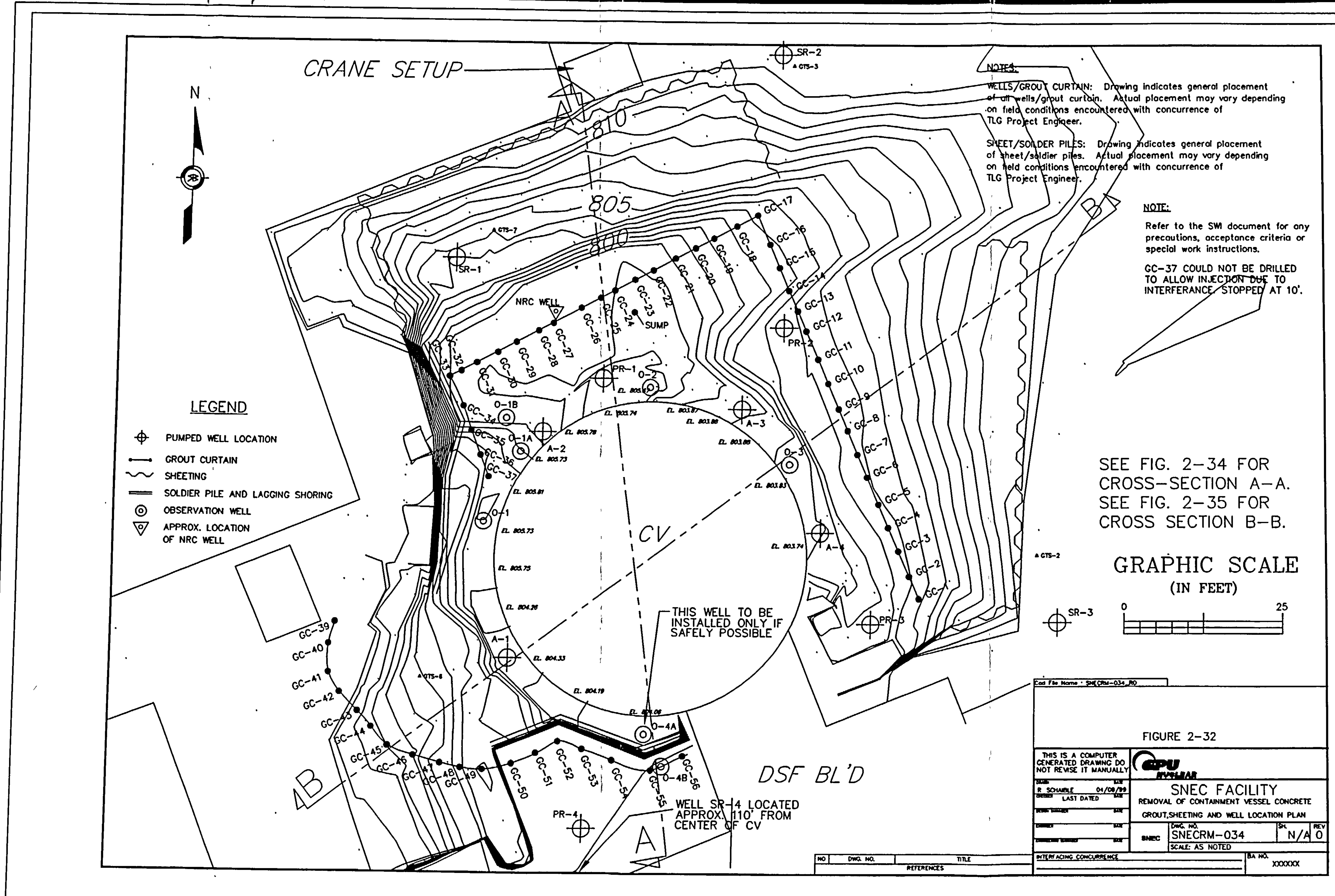
well flooded to top may be due to sheet pile, grout curtain wall and secondary well

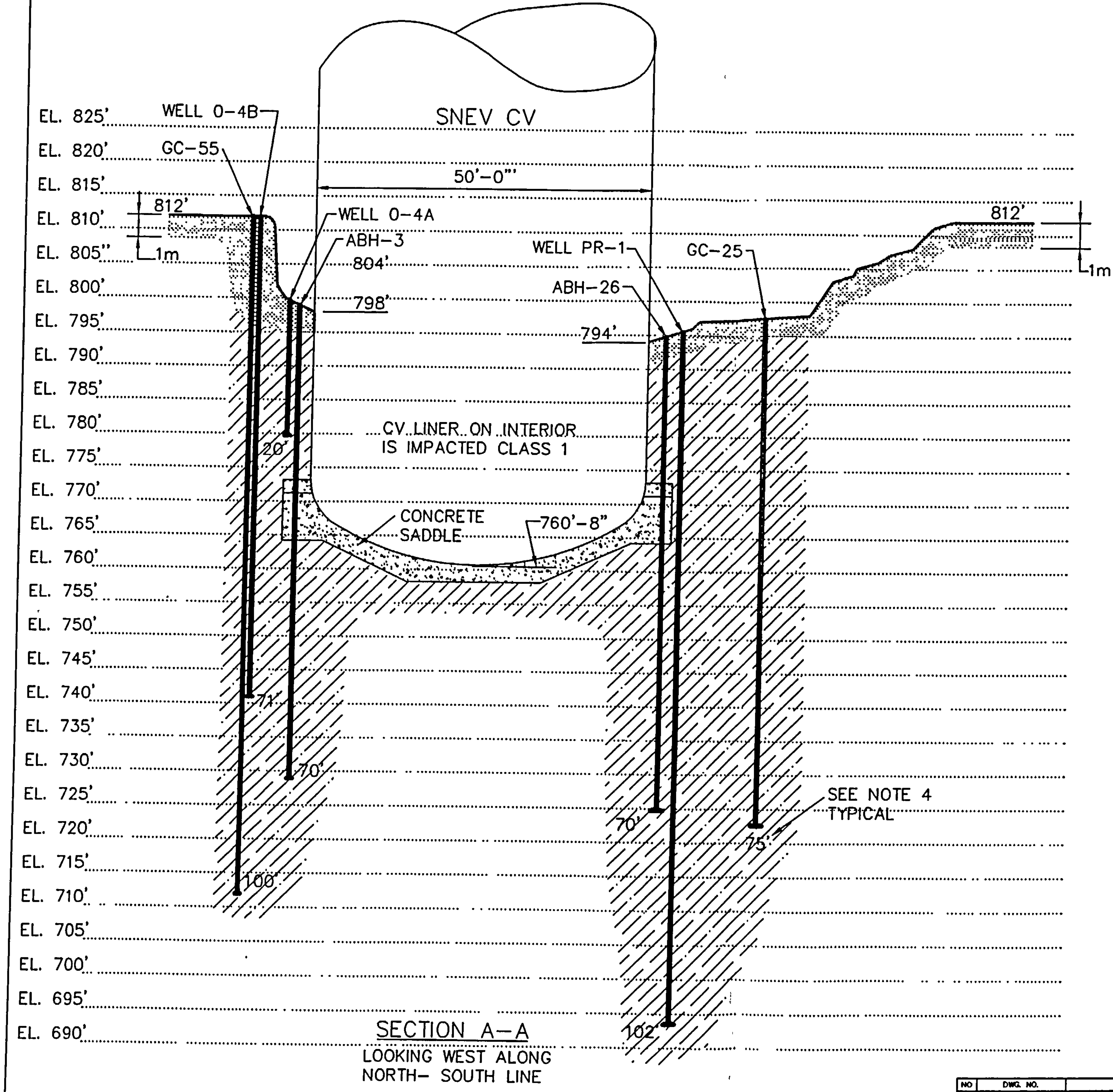
Depth = Top of Water from benchmark (I E top of wells,elevation pin etc. in ft.) Level = Top Of Water in Elevation



PLAN EL. 790'-0"
SECTION A-A
SECTION B-B
SECTION C-C
NORTH
48"ø SEALED DOWNCOMBER
CLOSED MANWAY
8" PIPE PEN
6" PIPE
12" PIPE REMOVED
21" O.D. PIPE SLOPED DOWN TO TUNNEL PLUGGED AT DISCHARGE END
RUBBLE AND DEBRIS REMOVED
STEEL GATE
8" DIA. PEN.
4" DIA. PEN.
9" (approx.) WATER/SILT
18" (approx.) WATER/SILT
SLOPE DOWN
SEALING CHAMBER 1
SEALING CHAMBER 2
SEALING CHAMBER 3
OPEN MANWAY RUBBLE REMOVED
FOR CONTINUATION GO TO ZONE H-2
FOR CONTINUATION GO TO ZONE B-8
FOR CONTINUATION GO TO ZONE A-8
RUBBLE REMOVED
SILT
SEALED TUNNEL WITH RUBBLE
NOTES:
1. X = microRem/hr. GENERAL AREA READING
FIGURE 2-18
THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY
SNEC FACILITY
SSGS DISCHARGE TUNNEL
PLAN AND SECTIONS AT EL. 790'-0"
SNECRM-018


NORTH
PLAN
(TYPICAL CLEAN-OUT)
SECTION A-A
(TYPICAL)
TURBINE BLDG.
INTAKE TUNNEL
INTAKE TUNNEL
INTAKE TUNNEL
INTAKE TUNNEL
INTAKE CHAMBER & TRASH RACK
INTAKE SCREEN CHAMBER
BOILER HOUSE
TRASH RACK & INTAKE SCREEN
(NTS)
SECOND CLEAN-OUT
INTAKE CHAMBER & TRASH RACK
FIRST CLEAN-OUT
SECOND CLEAN-OUT
FOR CONTINUATION GO TO ZONE F-10
HEAD END
FIRST CLEAN-OUT
FOR CONTINUATION GO TO ZONE E-10
XXX -SAMPLE LOCATION FROM TABLE 2-26. SEE TABLE 2-26 FOR SAMPLE RESULTS ALL DIMENSIONS AND SAMPLE LOCATIONS ARE APPROXIMATE.
FIGURE 2-28
THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY
SNEC FACILITY
SSGS INTAKE TUNNEL
PLAN AT EL. 790'-0"
SNECRM-027


CRANE SETUP
N
810
805
800
NOTES:
WELLS/GROUT CURTAIN: Drawing indicates general placement of all wells/grout curtain. Actual placement may vary depending on field conditions encountered with concurrence of TLG Project Engineer.
SHEET/SOLDIER PILES: Drawing indicates general placement of sheet/soldier piles. Actual placement may vary depending on field conditions encountered with concurrence of TLG Project Engineer.
NOTE:
Refer to the SWI document for any precautions, acceptance criteria or special work instructions.
GC-37 COULD NOT BE DRILLED TO ALLOW INJECTION DUE TO INTERFERANCE. STOPPED AT 10'.
LEGEND
PUMPED WELL LOCATION
GROUT CURTAIN
SHEETING
SOLDIER PILE AND LAGGING SHORING
OBSERVATION WELL
APPROX. LOCATION OF NRC WELL
SR-1
SR-2
SR-3
NRC WELL
SUMP
PR-1
PR-2
PR-3
PR-4
A-1
A-2
A-3
A-4
O-1
O-1A
O-1B
O-2
O-3
O-4A
O-4B
CV
THIS WELL TO BE INSTALLED ONLY IF SAFELY POSSIBLE
WELL SR-4 LOCATED APPROX. 110' FROM CENTER OF CV
DSF BL'D
SEE FIG. 2-34 FOR CROSS-SECTION A-A.
SEE FIG. 2-35 FOR CROSS SECTION B-B.
GRAPHIC SCALE
(IN FEET)
0
25
FIGURE 2-32
THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY
R SCHAIBLE 04/08/99
LAST DATED
GPU NUCLEAR
SNEC FACILITY
REMOVAL OF CONTAINMENT VESSEL CONCRETE
GROUT,SHEETING AND WELL LOCATION PLAN
SNEC
DWG. NO. SNECRM-034
SH. N/A
REV 0
SCALE: AS NOTED
INTERFACING CONCURRENCE
BA NO. XXXXXX
NO
DWG. NO.
TITLE
REFERENCES



IMPACTED

NON-IMPACTED

NOTES:

1. CV WILL BE REMOVED ABOVE APPROXIMATELY 804' ELEVATION.
2. SEE TABLES 2-30 & 2-31 FOR SAMPLE RESULTS.
3. SEE TABLE 5-2 FOR CV LINER CLASSIFICATION DETAILS.
4. BOTTOM ELEVATIONS ARE TAKEN FROM EXISTING GRADE.
5. SEE FIGURE 2-32 FOR CROSS-SECTION LOCATIONS ON PLAN.

GRAPHIC SCALE
(IN FEET)

0 25

NO	DWG. NO.	TITLE
REFERENCES		

Cad File Name : SNECRM-038_S1_R0

FIGURE 2-34

THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY

GPU NUCLEAR

R SCHABLE 12/03/02
LAST DATED

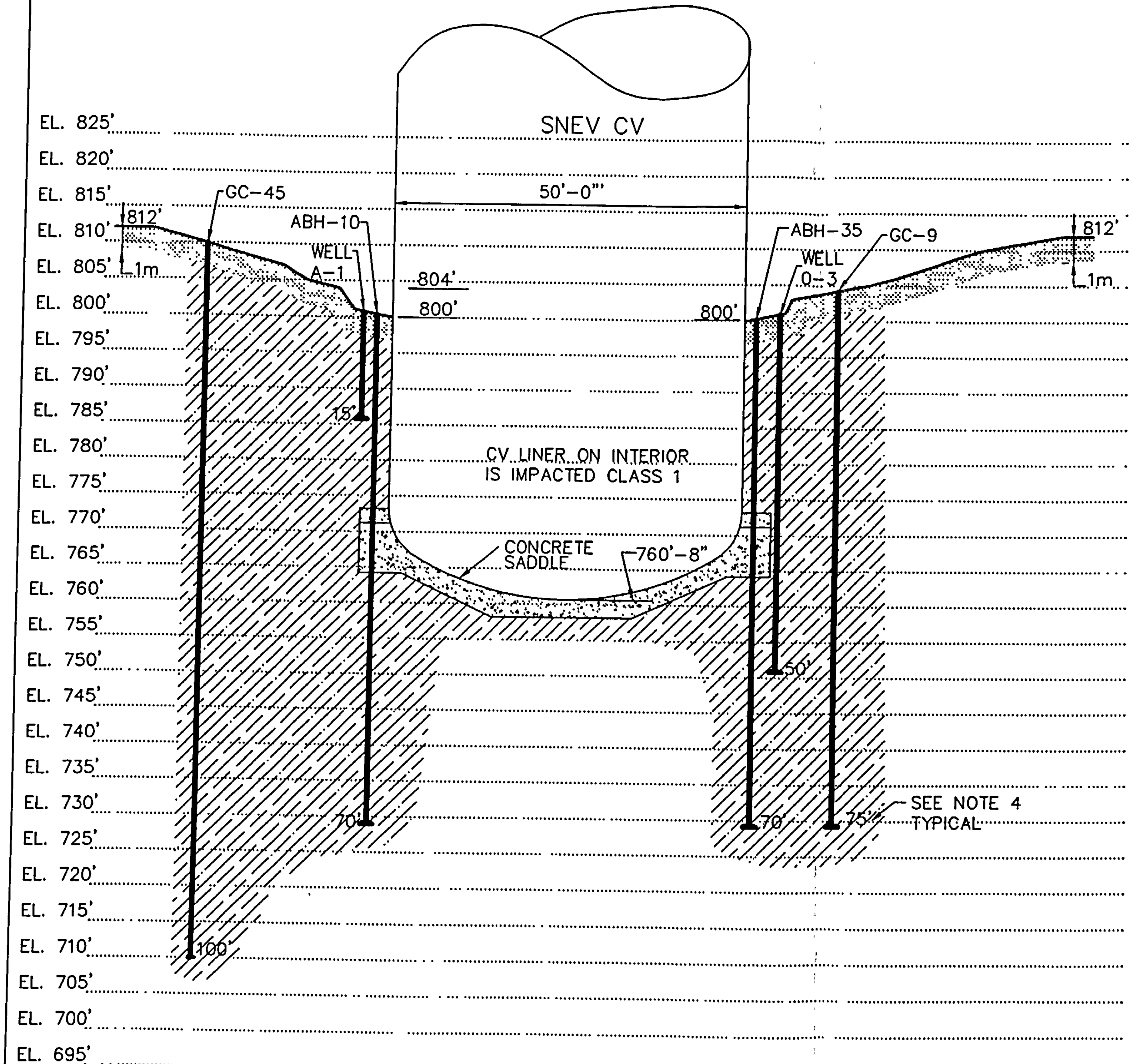
SNEC FACILITY

CROSS-SECTIONAL VIEW OF SNEC CONTAINMENT VESSEL AND SURROUNDING SUBSURFACE AREA

SNEC | DWG. NO. SNECRM-038 | SH. 1 | REV. 0

SCALE: AS NOTED

INTERFACING CONCURRENCE | BA NO.



SECTION B-B
LOOKING NORTH ALONG EAST-WEST LINE

IMPACTED

NON-IMPACTED

NOTES:
1. CV WILL BE REMOVED ABOVE APPROXIMATELY 804' ELEVATION.
2. SEE TABLES 2-30 & 2-31 FOR SAMPLE RESULTS.
3. SEE TABLE 5-2 FOR CV LINER CLASSIFICATION DETAILS.
4. BOTTOM ELEVATIONS ARE TAKEN FROM EXISTING GRADE.
5. SEE FIGURE 2-32 FOR CROSS-SECTION LOCATIONS ON PLAN.

GRAPHIC SCALE
(IN FEET)
0 25

NO.	DWG. NO.	TITLE
	REFERENCES	

Cad File Name : SNECRM-038_S2_R0

FIGURE 2-35

THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY

GPU NUCLEAR

R. SCHAIBLE 12/03/02

SNEC FACILITY
CROSS-SECTIONAL VIEW OF SNEC CONTAINMENT VESSEL AND SURROUNDING SUBSURFACE AREA

SNEC DWG. NO. SNECRM-038 SH 2 REV. 0
SCALE: AS NOTED

INTERFACING CONCURRENCE
BA NO.

5.0 SNEC FACILITY FINAL STATUS SURVEY PLAN

5.1 INTRODUCTION

The SNEC Facility Final Status Survey Plan (FSSP) has been prepared using the guidance provided in applicable regulatory guidance documents described in Section 5.1.1 below. Ultimately, this plan will be used to develop lower tier procedures and/or work instructions to accomplish the Final Status Survey for the SNEC Facility.

5.1.1 Purpose

The FSSP describes the final survey process that will be used to demonstrate that the SNEC Facility and all additional near site impacted areas meet radiological criteria for license termination. 10 CFR 50.82(a)(9)(ii)(D) (Reference 5-1), Regulatory Guide 1.179 (Reference 5-2) and NUREG-1575 (Reference 5-5) have been used as guides in the preparation of this plan. This plan incorporates the site release criteria provided in 10 CFR 20.1402 (Reference 5-3) and addresses concerns of NUREG-1727, the NMSS Decommissioning Standard Review Plan, (Reference 5-4), and NUREG-1505 (Reference 5-6). Other documents, such as Draft NUREG-1549 (Reference 5-9), were also reviewed in the process of preparing this plan.

5.1.2 Scope

The final site survey will encompass structures, land areas, and any remaining facility systems which, because of licensed activities, were originally contaminated or had the potential to be contaminated. Areas that exhibited the highest contamination levels were located within the SNEC Containment Vessel (CV), as illustrated in Chapter 2 of this License Termination Plan (LTP). As of the date of the SNEC Facility LTP submittal, the majority of all contaminated systems, components, and soils will have been removed from the site. Continued remediation in selected areas will ensure these areas satisfy unrestricted release criteria before the Final Status Survey (FSS) process begins.

5.1.3 Summary

The SNEC Facility FSSP describes the final survey process and the methodology used to develop guideline values against which residual radioactivity levels remaining at the SNEC Facility at the time of the FSS will be compared. The final survey process is described as a series of steps – survey preparation, survey design, data collection, data assessment, and final survey report preparation. However, in practice, this is an iterative process in that once the results from one step are known they may prompt repeating one or more previous steps. In addition, the process is designed to be flexible in that modifications to the survey process may be made as more information is collected.

FSS activities begin when dismantlement and decontamination activities are believed to be complete. Each survey area is divided into survey units that are classified according to their potential for retaining residual radioactivity, or in accordance with known contamination levels. Survey data collected from each survey unit are collected according to data collection requirements and frequencies established for each classification. When residual radioactivity is measured above pre-set levels, an investigation is performed. Based on the results of the investigation, the survey unit may be remediated, reclassified, resurveyed or determined to meet the release criteria.

There are three principal types of survey results collected during the FSS effort. They are 1) scan measurement data, 2) fixed-point measurement data, and 3) sampling of volumetric materials for laboratory analysis. *In-situ* gamma-ray spectrometry may also be included in the release survey process as well as the results of any special measurements or analysis. Statistical testing criteria for special measurements will be applicable to the survey methods used. All collected data are first verified to be of adequate quantity and quality, capable of supporting underlying assumptions necessary for statistical testing. Where necessary, previous survey steps are re-evaluated. Each survey unit will then be tested and compared to the release criteria. To meet the release criteria, the survey data must pass the statistical tests applied. When the data set fails statistical testing criteria, the survey unit is not suitable for unrestricted release without further actions.

Upon completion of FSS activities, a final survey report will be prepared which summarizes the data. The report will document the conclusion that the SNEC Facility and near site areas meet the 10 CFR 20.1402 release criteria and may be released for unrestricted use.

5.2 SURVEY OVERVIEW

This section describes the scope and methodology of the final survey process. It includes quality assurance measures and access control procedures. It also describes how implementation of this plan will demonstrate that the remaining structures and site areas meet the 10 CFR 20.1402 criteria for unrestricted release. Also described herein, are the methods used to develop guideline values against which residual radioactivity levels will be compared.

5.2.1 Identity of Radiological Contaminants

The radionuclide inventory at the SNEC Facility was estimated during the initial site characterization process, which was conducted between 1995 and 1996. Those data are compiled in the SNEC Facility Site Characterization Report (Reference 5-7). Station Work Instructions, site procedures, and Survey Requests have since been used to collect additional site characterization data. This more recently collected information is summarized in Chapter 2 of this plan. All of the data were reviewed and a final radionuclide listing was developed. Refer to Chapter 6, Section 6.2.2.3.

5.2.2 Site Release Criteria

5.2.2.1 Radiological Criteria for Unrestricted Use

These site release criteria correspond to the radiological criteria for unrestricted use given in 10 CFR 20.1402, which are:

- Dose Standard

  Residual radioactivity, distinguishable from background radiation and resulting in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group will not exceed 25 mrem/y, including that from groundwater sources of drinking water.

- ALARA Standard

  Residual radioactivity will be reduced to levels that are As Low As Reasonably Achievable (ALARA), as addressed in Section 6.4.

A higher sensitivity will be needed in these measurement methods, as the values of C become smaller. In addition, this may influence statistical testing considerations by increasing the number of data points necessary for application of a specific statistical test.

5.2.3.2.7 Handling of Multiple Source Terms

When determining DCGLs in areas where there are multiple source terms, Equation 6-1 will be used.

5.2.4 Facility and Site Classification

Not all areas of the site have the same potential for residual radioactivity and, accordingly, do not need the same level of survey effort to demonstrate compliance with the site release criteria. Using the criteria given below, different sections of the site are grouped into impacted and non-impacted areas based on the potential for residual radioactivity to be present. Classification of site areas is based on professional judgment, operational history (Historical Site Assessment (HSA) information, Reference 5-19), site characterization data, operational surveys performed in support of decommissioning, and routine surveillance. See the site facility diagrams Chapter 2, and the SNEC site map (Figure 5-1), which is located at the end of this chapter.

5.2.4.1 Non-Impacted Areas

Non-impacted areas have no reasonable potential for the presence of residual radioactivity from licensed activities. These areas do not need any level of survey coverage since there was no radiological impact from site operations. No surveys are performed in these areas other than those used to determine a reference area (background).

5.2.4.2 Impacted Area

Impacted areas are areas that have a reasonable potential for the presence of residual radioactivity from licensed activities. Impacted areas are subdivided into three classes described below.

5.2.4.2.1 Class 1 Areas

Class 1 areas are areas that have or have had (prior to remediation), a potential for radioactive contamination (based on site operating history), or known contamination (based on previous radiological surveys).

Examples of Class 1 areas are:

- Areas previously subjected to remedial actions
- Locations where leaks or spills are known to have occurred
- Former burial or disposal sites
- Waste storage sites
- Areas with contaminants in discrete solid pieces of material at high specific activity
- Areas containing contamination more than the $DCGL_W$ before remediation

5.2.4.2.2 Class 2 Areas

Class 2 areas are those that have or have had prior to remediation, a potential for radioactive contamination or known contamination, but are not expected to contain radioactive material greater than the $DCGL_W$. Examples of Class 2 areas are:

- Locations where radioactive materials were present in an unsealed form,
- Potentially contaminated transport routes,
- Areas downwind of stack release points,
- Upper walls and ceilings of some buildings or rooms subject to airborne radioactivity,
- Areas where low concentrations of radioactive materials were handled, and
- Areas on the perimeter of radioactive material control areas.

5.2.4.2.3 Class 3 Areas

Class 3 areas are any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the $DCGL_W$ This would again be based on site operating history and previous radiological survey information. Examples of Class 3 areas are:

- Buffer zones around Class 1 or Class 2 areas,
- Areas with a very low potential for residual contamination, but where insufficient information exists to justify a non-impacted classification.

5.2.4.3 Initial Classification

The initial classifications of the SNEC Facility are given in Table 5-2. They are based on site characterization data, the results of the Historical Site Assessment, and recommendations and concerns of SNEC Facility personnel knowledgeable of site conditions. Site characterization data and radiological history information on Table 5-2 survey areas are summarized in Chapter 2. When there was an uncertainty regarding the preliminary classification of a SNEC Facility impacted area, the area was initially assumed a Class 1 area until determined otherwise.

Table 5-2

Initial Classifications of Site Areas

Survey Unit Designations of the SNEC Facility and Surrounding Impacted Areas										
Survey Unit Number [(a)]	Description	Classification			Survey Unit Area (m^2) [(b)]				Number of Survey Units [(b)]	Type of DCGL Applied [(c)]
		1	2	3	Floor	Walls	Ceiling	Other		
MISCELLANEOUS AREAS & ITEMS										
MA1	Airborne Monitoring Stations		X					<10	1	1
MA2	SSGS Discharge Tunnel Outfall (Land Area)			X				600	1	2
MA3	Weir Outfall		X					25	1	2
MA4	Weir Outfall Buffer			X				200	1	2
MA5	Northeast Dump Site			X				7000	1	2
MA6	Northwest Open Land Area			X				4100	1	2
MA7	Northwest Open Land Area		X					100	1	2
MA8	Miscellaneous Concrete Slabs (Around Site)			X				<100	1 each	1
CONTAINMENT VESSEL (CV) - INTERIOR & EXTERIOR STEEL SHELL										
CV1-X	Interior Vertical Wall of CV Shell < ~804 5' El	X				392			4	1 [(e)]
CV2-X	Internal Support Ring Areas	X				65			22 [(d)]	1 [(e)]
CV3-X	Interior Curved Bottom of CV Shell	X						255	3	1 [(e)]
CV4-X	Exterior Wall – 802 6' El up to Cut-off	X				16 [(g)]			1	1 [(e)]
CV5	Exterior Wall 1 Meter Below Class 1 Area (Down to 797.6' El)		X			10			1	1 [(e)]
CV6	External Rock Anchor Support Ring Assembly Area	X				66			1 [(d)]	1 [(e)]
[(f)] MATERIAL HANDLING BAY (MHB) - SNEC AREA										
MH1	Floors & Walls Up to 2 Meters (Interior)	X			22	20			1	1
MH2	Upper Walls & Ceiling (Interior)		X			63	22		1	1
MH3	Roof			X			24		1	1
MH4	Exterior Walls			X		56			1	1

NOTES:

(a) "X" designates a sequential number starting with 1, and defines a survey unit within a survey area.

(b) This data was estimated with best available information No survey unit, regardless of its classification will exceed 10,000 square meters.

(c) NRC Default Surface DCGLs = 1, Site Specific Volumetric DCGLs = 2

(d) Survey units were established as the ring areas became available to field personnel doing the survey work

(e) Activation of CV steel liner to be addressed when region is accessible.

(f) This facility may be removed prior to performing Final Status Survey.

(g) Based on projected cut-off at 804.5' El.

Table 5-2 (continued)

Initial Classifications of Site Areas

Survey Unit Designations of the SNEC Facility and Surrounding Impacted Areas										
Survey Unit Number [a]	Description	Classification			Survey Unit Area (m^2) [b]				Number of Survey Units [b]	Type of DCGL Applied [c]
		1	2	3	Floor	Walls	Ceiling	Other		
[d] PERSONNEL ACCESS FACILITY (PAF) - SNEC AREA										
PF1	Floors & Walls Up to 2 Meters (Interior)	X			36	49			1	1
PF2	Upper Walls & Ceiling (Interior)		X			116	36		1	1
PF3	Roof			X			40		1	1
PF4	Exterior Walls			X		133			1	1
[d] DECOMMISSIONING SUPPORT BUILDING (DSB) - SNEC AREA										
DB1-X	Floors & Walls Up to 2 Meters (Interior)	X			212	121			5	1
DB2	Upper Walls & Ceiling (Interior)		X			290	212		1	1
DB3	Roof			X			225		1	1
DB4	Exterior Walls			X		325			1	1
DB5	DSB Carport Slab		X		62				1	1
DB6	DSB Carport Roof/Ceiling			X			124		1	1

NOTES:

(a) "X" designates a sequential number starting with 1, and defines a survey unit within a survey area.

(b) This data was estimated with best available information No survey unit, regardless of its classification will exceed 10,000 square meters.

(c) NRC Default Surface DCGLs = 1, Site Specific Volumetric DCGLs = 2

(d) This facility may be removed prior to performing Final Status Survey.

Table 5-2 (continued)

Initial Classifications of Site Areas

Survey Unit Designations of the SNEC Facility and Surrounding Impacted Areas										
Survey Unit Number [a]	Description	Classification			Survey Unit Area (m^2) [b]				Number of Survey Units [b]	Type of DCGL Applied [c]
		1	2	3	Floor	Walls	Ceiling	Other		
SAXTON STEAM GENERATING STATION (SSGS), INTAKE & DISCHARGE TUNNELS										
SS1	Floor of Discharge Tunnel (first ~150')	X			120				1	1
SS2	Floor of Discharge Tunnel (next ~235')		X		175				1	1
SS3	Floor of Discharge Tunnel (last ~315')			X	234				1	1
SS4	Ceiling of Discharge Tunnel (first ~150')		X				120		1	1
SS5	Ceiling of Discharge Tunnel (last ~550')			X			400		1	1
SS6-X	Walls of Discharge Tunnel (first ~150')	X				290			3	1
SS7	Walls of Discharge Tunnel (last ~550')			X		600			1	1
SS8-X	In DT – Seal Chambers (1, 2, & 3)	X						230	3	1
SS9	Spray Pump Pit Floor	X			120				1	1
SS10	Spray Pump Pit Walls Below 795' El		X			20			1	1
SS11	Spray Pump Pit Walls Above 795' El			X			100		1	1
SS12	SSGS Boiler Pad (811' El)			X	1800				1	1
SS13	SSGS Firing Aisle (806' El)			X	560	80			1	1
SS14-X	SSGS Basement Area Floor (790' El.)	X			360				4	1
SS15	SSGS Basement Walls – East End	X				100			1	1
SS16	SSGS Basement Walls Up to 2 Meters		X			240			1	1
SS17	SSGS Basement Walls > 2 Meters			X		350			1	1
SS18	Floor Above Seal Chambers		X		70				1	1
SS19-X	Section of SSGS Intake Tunnel Floor		X		493				3	1
SS20-X	Section of Intake Tunnel Walls		X			2150			3	1
SS21	Section of Intake Tunnel Ceiling			X			493		3	1

NOTES:

(a) "X" designates a sequential number starting with 1, and defines a survey unit within a survey area.

(b) This data was estimated with best available information No survey unit, regardless of its classification will exceed 10,000 square meters

(c) NRC Default Surface DCGLs = 1, Site Specific Volumetric DCGLs = 2: SNEC plans to use surface area DCGLs as noted in SSGS section However, if geometry of surface is not appropriate for a surface area measurement then guidance as specified in LTP Chapter 6, Section 6.2.1 may need to be implemented

Table 5-2 (continued)

Initial Classifications of Site Areas

Survey Unit Designations of the SNEC Facility and Surrounding Impacted Areas										
Survey Unit Number [(a)]	Description	Classification			Survey Unit Area (m^2) [(b)]				Number of Survey Units [(b)]	Type of DCGL Applied [(c)]
		1	2	3	Floor	Walls	Ceiling	Other		
SAXTON STEAM GENERATING STATION (SSGS) SPRAY POND AREA										
SP1	Open Land Area		X					6600	1	2
SNEC FACILITY SITE OPEN LAND AREA										
OL1-X	SNEC Facility Site & Near Site Area	X						11000	11	2
GPU ENERGY (PENELEC) SITE OPEN LAND AREA										
OL2-X	Westinghouse and Adjacent Areas [(e)]	X						5700	6	2
OL3	Warehouse Burn Area	X						200	1	2
OL4-X	Buffer Zones		X					5600	4	2
REMAINING IMPACTED OPEN LAND AREA										
OL5-X	Site Road Access Areas		X					20500	9	2
OL6-X	Stack Release Area (NNE)		X					14600	3	2
OL7-X	Stack Release Area (SSW)		X					12700	2	2
OL8-X	Buffer Zones			X				47900	5	2
[(d)] WAREHOUSE (LARGE GARAGE - SOUTH) - PENELEC AREA										
WA1-X	Floors & Walls Up to 2 Meters (Interior)		X		450	290			2	1
WA2	Upper Walls & Ceiling (Interior)			X		292	450		1	1
WA3	Exterior Walls			X		374			1	1
WA4	Roof		X				418		1	1

NOTES:

(a) "X" designates a sequential number starting with 1, and defines a survey unit within a survey area.

(b) This data was estimated with best available information No survey unit, regardless of its classification will exceed 10,000 square meters

(c) NRC Default Surface DCGLs = 1, Site Specific Volumetric DCGLs = 2

(d) This facility may be removed prior to performing Final Status Survey.

(e) Includes substation yard drainage area

Table 5-2 (continued)
Initial Classifications of Site Areas

Survey Unit Designations of the SNEC Facility and Surrounding Impacted Areas										
Survey Unit Number [a]	Description	Classification			Survey Unit Area (m^2) [b]				Number of Survey Units [b]	Type of DCGL Applied [c]
		1	2	3	Floor	Walls	Ceiling	Other		
[d] GARAGE (SMALL GARAGE - SOUTHWEST) - PENELEC AREA										
GA1-X	Floors & Walls Up to 2 Meters (Interior)		X		109	122			4	1
GA2-X	Upper Walls & Ceiling (Interior)			X		297	109		2	1
GA3	Exterior Walls			X		180			1	1
GA4	Roof		X				116		1	1
LINE SHACK - PENELEC AREA										
LS1-X	Floors & Walls Up to 2 Meters (Interior)		X		290	177			5	1
LS2-X	Upper Walls & Ceiling (Interior)		X			191	412		7	1
LS3	Exterior Walls			X		343			1	1
LS4	Roof		X				324		1	1
LS5	Roof Drainage System		X					<10	1	1, 2
PENELEC SWITCHYARD BUILDING & YARD STRUCTURES										
PS1	Interior			X	55	89	55		1	1
PS2	Exterior Walls and Roof			X		151	68		1	1
PS3	Switchyard Units – Base Pads			X	<500				1	1

NOTES:

(a) "X" designates a sequential number starting with 1, and defines a survey unit within a survey area.

(b) This data was estimated with best available information. No survey unit, regardless of its classification will exceed 10,000 square meters.

(c) NRC Default Surface DCGLs = 1, Site Specific Volumetric DCGLs = 2

(d) This facility may be removed prior to performing Final Status Survey.

5.2.4.4 Changes in Classification

Changes in classification are based on survey data and other relevant information that indicates a different area classification is more appropriate. Changes in area classifications which decrease an area classification will be in accordance with License Condition 2.E.(h).

5.2.5 Final Survey Process

In general, FSS activities do not commence in the area to be surveyed until decontamination activities are believed to be complete and radioactive waste materials are removed. The FSS process begins with survey area preparation activities such as gridding and review of final remediation support survey information, as well as survey area walk-downs. Survey design calculations and the issuance of Survey Requests to field survey teams follow this phase. Field survey teams then collect the data and assemble the survey results in an organized and understandable format in accordance with site procedures. Data assessment and documentation concludes this process.

5.2.5.1 Survey Design Overview

Survey design, as described in Section 5.4, identifies relevant components of the FSS process and establishes the assumptions, methods, and performance criteria to be used. Areas ready for FSS are classified as Class 1, Class 2 or Class 3 and are divided into survey units. Systematic scan and static measurements are prescribed according to a pattern and frequency established for each classification. Investigation levels are established which, if exceeded, initiate an investigation of the survey data. A measurement from the survey unit that exceeds an investigation level may indicate a localized area of elevated residual radioactivity. Such locations are marked and investigated to determine the area and the level of the residual radioactivity present. Depending on the results of the investigation, the survey unit may require remediation, and/or re-survey or re-classification.

Quality Control (QC) measurements are prescribed to identify and control measurement error and uncertainty attributable to measurement methods or analytical procedures used in the data collection process. QC measurements provide qualitative and quantitative information to demonstrate that measurement results are sufficiently free of error and accurately represent the radiological condition of the SNEC Facility.

5.2.5.2 Survey Data Collection

As deemed appropriate, a final post-remediation survey is performed using similar instrumentation, quality control and survey techniques to be used in the FSS process. The review of the final post-remediation survey data is then carried out to verify that residual radioactivity levels are acceptable and that no additional remediation will be needed in the survey unit. If an area of elevated residual radioactivity is identified, and remediation is determined to be ALARA, the area is remediated and re-surveyed to ensure meeting FSS requirements. The data collected during the final post-remediation survey (when performed), responsible management in writing, and actions to resolve identified deficiencies are tracked and appropriately documented. Qualified personnel will perform an independent review of the Final Status Survey Report. This review will ensure that FSS results are performed and documented in accordance with appropriate methodology, and that all conclusions reported are accurate and correctly presented.

5.2.8 Survey Records and Documentation

Generation, handling, and storage of FSS design information and survey data are controlled by approved procedures. Survey records and documentation are maintained as quality records and decommissioning records in accordance with approved facility procedures. Where possible, they are also maintained as electronic media.

At a minimum, each final status survey record will include:

1. Date and time survey was performed
2. Instrumentation used and calibration due date(s)
3. Survey location (grid location or other reference markings)
4. Type of measurement performed (scan survey, fixed-point measurements etc.)
5. Survey team member(s) involved
6. Name of field supervisor(s) responsible for reviewing survey data
7. Survey and Sample Request numbers

Generation, handling and storage of the original final status survey design and data packages shall be in accordance with the SNEC Records Retention procedure (E900-ADM-4500.04, Reference 5-16) and Radiological Surveys: Requirements & Documentation procedure (E900-ADM-4500.12, Reference 5-17).

5.2.9 Calculations

Formal calculations that support License Termination activities are prepared in accordance with the SNEC Facility Calculations Procedure (E900-ADM-4500.44, Reference 5-15). These calculations provide sufficient details with respect to purpose, method, assumptions, design input, references and units such that a person technically qualified in the subject can review and understand the analysis as well as verify the adequacy of the results without frequently consulting the originator. Calculations may be used for activities such as survey design, dose modeling, and computer code verification.

5.2.10 Schedule

Final status surveys are planned, scheduled, and tracked as a part of the overall decommissioning planning process. The schedule is dependent upon the progress and completion of several decommissioning activities and review and approval of the License Termination Plan. Presently, survey data collection is expected to begin in the fourth quarter of 2002

5.2.11 Stakeholders

The stakeholders for the SNEC decommissioning project include those organizations and concerned individuals listed below:

- Citizens Task Force (CTF)
- Concerned Citizens for SNEC Safety (CCFSS)
- Liberty Township
- Huntington and Bedford Counties
- The Commonwealth of Pennsylvania
- FirstEnergy Companies
- Applicable Contractors
- US Army Corps of Engineers

5.3 FINAL POST REMEDIATION SURVEYS

The professional judgment of the SNEC Facility staff will be used to implement final post remediation surveys in areas where former contamination levels required extensive remediation or in other areas as deemed appropriate. Properly designed, post remediation surveys can facilitate the transfer and control of areas, and minimize the impact of planned or ongoing dismantlement activities in adjacent areas.

5.3.1 Walk-down

A walk-down of the survey unit is performed prior to isolation. The principle objective of the walk-down is to assess the physical state of the survey unit and the scope of work necessary to prepare it for final survey. During the walk-down, requirements are identified for accessing, isolating, and controlling the survey unit. Support activities necessary to conduct the final survey, such as scaffolding, interference removal, and electrical tag-outs, are identified. Safety concerns such as confined space entry, high walls, and ceilings are identified. For systems, the walk-down includes a review of system flow diagrams and piping drawings. The walk-down is performed when the final configuration is known, usually near or after the completion of dismantlement activities.

5.3.2 Isolation Criteria

The following criteria will be satisfied prior to acceptance of a survey unit by the FSS team. The physical aspects of these criteria are verified during the walk-down.

1. Planned dismantlement activities within the post remediation survey unit are completed.

2. Planned dismantlement activities affecting or adjacent to the post remediation survey unit are completed, or are evaluated and determined to not have a reasonable potential to introduce radioactive material into the post remediation survey unit.

3. An operational radiation protection survey of the post remediation survey unit is completed and all outstanding items are addressed.

4. Planned physical work in, on, or around a post remediation survey unit, other than routine surveillance or maintenance, is complete.

5. Tools, non-permanent equipment, and material not needed for survey data collection are removed.

6. Housekeeping, clean up, and remediation of the survey unit are completed.

7. Scaffolding, temporary electrical and ventilation equipment and components, and other material or equipment needed for survey data collection is radiologically clean and left in place.

8. Transit paths to/through the post remediation survey unit are eliminated or re-routed.

9. Appropriate measures are instituted to prevent the re-introduction of radioactive material into isolated area from ventilation systems, drain lines, system vents, and other potential airborne and liquid contamination pathways.

10. Measures are instituted to control access and egress and otherwise restrict radioactive material from entering the survey unit.

5.3.3 Transfer of Control

Once a walk-down has been performed and the isolation criteria are met, control of activities within the post remediation survey unit is transferred from the dismantlement organization to the FSS team. The need for localized remediation within the isolated area may be identified after transfer of control. Localized remediation may be performed under the control of the FSS organization. However, if large areas require remediation, the isolated area may be transferred back to the dismantlement organization for further decontamination.

5.3.4 Isolation and Control Measures

Prior to performing the FSS, the post remediation survey unit is isolated and controlled. Routine access, equipment removal, material storage, and worker and material transit through the area without proper controls are no longer allowed. One or more of the following administrative and physical controls will be established to minimize the possibility of introducing radioactive material from ongoing decommissioning activities in adjacent or nearby areas.

1. Personnel training

2. Installation of barriers to control access to the area(s)

3. Installation of postings with access/egress requirements

4. Locking or otherwise securing entrances to the area

5. Installation of tamper-evident seals or labels

Isolation and control measures are implemented through approved facility procedures and remain in place through the FSS data collection process until license termination.

5.4 SURVEY DESIGN

The survey design identifies relevant components of the FSS process, and establishes the assumptions, methods, and performance criteria to be used. The methodology for planning a FSS, including a FSS in the subsurface region is identified in the applicable site procedure. Survey design is summarized in Table 5-5.

The application of survey design criteria to structures and land areas will vary based on the type of survey media and the relative potential for elevated residual radioactivity. For facility systems, many of the survey design criteria applicable to structures and land areas do not apply or are dictated by the physical system layout and the accessibility to the system piping and components. To accommodate these factors, the survey design integrates both non-systematic (random) and judgmental (biased) methods to data collection to achieve the overall objective of the final survey process. Survey design will be performed in accordance with SNEC procedures E900-ADM-4500.59, "Final Site Survey Planning" and E900-ADM-4500.58, "Treatment of Embedded Piping and Components". When necessary, a two-stage sampling process may also be used IAW Reference 5-20.

Each survey design package will address the following areas of interest:

1. A brief overview describing the final status survey design;
2. A description and map or drawing of impacted areas of the site, area, or building classified by residual radioactivity levels (Class 1, Class 2, or Class 3) and divided into survey units, with an explanation of the basis for division into survey units and the boundaries for each survey unit or area indicated. Maps should have compass headings indicated;
3. A description of the background reference areas and materials, if they will be used, and a justification for their selection;
4. A summary of the statistical tests that will be used to evaluate the survey results, including the elevated measurement comparison, if Class 1 survey units are present, a justification for any test methods not included in MARSSIM, and the values for the decision errors (and) with a justification for values greater than 0.05;
5. A description of scanning instruments, methods, calibration, operational checks, coverage, and sensitivity for each media and radionuclide;
6. For *in-situ* sample measurements made by field instruments, a description of the instruments, calibration, operational checks, sensitivity, and sampling methods, with a demonstration that the instruments, and methods, have adequate sensitivity;
7. A description of the analytical instruments for measuring samples in the laboratory, including the calibration, sensitivity, and methodology for evaluation, with a demonstration that the instruments and methods have adequate sensitivity;

level). Static measurements are also taken if scan measurements are not capable of providing sufficient data to characterize the elevated area. A posting plot, described in Section 5.6.2.1, is generated to document the area investigated and the levels of residual radioactivity found. Depending on the results of the investigation, the survey unit may require remediation, reclassification, and/or re-survey. Possible outcomes of the data investigation process are shown in Table 5-8 below.

Table 5-8

Possible Actions Resulting From Data Analysis

No.	Data Results	Class 1	Class 2	Class 3
1	One or more data points > $DCGL_{EMC}$ or $DCGL_W$	Perform statistical testing, remediate and re-survey as necessary	Re-classify & re-survey	Re-classify & re-survey
2	All data points ≤ $DCGL_{EMC}$	Survey Unit passes applicable elevated measurement comparisons	N/A	N/A
3	All data points ≤ $DCGL_W$	Survey Unit passes	Determine if re-classification is required as follows below.	Determine if re-classification is required as follows below:
4	One or more points > 50% of $DCGL_W$ but ≤ $DCGL_W$	Survey Unit passes	Increase survey coverage or review & re-classify & re-survey as necessary	Re-classify & re-survey
5	One or more points > 10% of $DCGL_W$ but ≤ 50% of $DCGL_W$	Survey Unit passes	Survey Unit Passes	Re-classify & re-survey
6	All data points ≤ 10% of DCGL	Survey Unit passes	Survey Unit passes	Survey Unit passes

Static measurements above the investigation/action level that should have been, but were not identified by scan measurements may indicate that the scanning method is inadequate. In that case, the scanning method is evaluated and appropriate corrective actions are taken. Corrective actions may include re-scanning affected survey units using other survey protocol or survey instrumentation.

5.4.4.3 Remediation

Areas of elevated residual radioactivity above the $DCGL_{EMC}$ are remediated to acceptable levels. Based on the survey data, it may be necessary to remediate all or a portion of a survey unit. Remediation activities are addressed in Chapter 4.0.

5.4.4.4 Subdividing Survey Units

Due to size restrictions and other considerations, a survey unit may need to be divided into two or more smaller survey units. Survey unit sizes may be adjusted as necessary as long as assumptions used to develop area dose models remain valid. Suggested survey unit sizes are provided in Table 5-5.

5.4.4.5 Resurvey

If a survey unit is reclassified or if remediation activities are performed, then a re-survey using the methods and frequency applicable to the new survey unit classification is performed. This includes the case where only a small fraction of the area (< 10%) of a Class 1-survey unit is remediated.

In the case where a new survey unit is separated out from an existing survey unit, or an existing survey unit is subdivided, Class 3 survey units need to have the survey repeated to obtain a new survey data set. Class 1 and Class 2 survey units require a new survey design based on random-start systematic measurement locations.

When a new survey unit is separated out from an existing survey unit or is subdivided, the new survey unit will include a buffer zone that adequately bounds the area of identified contamination when it borders a non-impacted area.

5.4.5 Quality Control (QC) Measurements

QC measurements are a component of the survey quality assurance process, and include quality checking and repeat measurements. Quality checking and repeat measurements are performed to identify, assess, and monitor measurement error and uncertainty attributable to measurement methods or analytical procedures used in the data collection process. Quality checking includes direct observations of survey data and sample collections, and sample preparation and analyses. Repeat measurements are multiple measurements at the same location or from the same survey unit. Repeat measurements provide quantitative information to demonstrate that measurement results are sufficiently free of error to accurately represent the radiological condition of the SNEC Facility. Results of QC measurements are documented in accordance with approved site procedures.

5.4.5.1 Type, Number, and Scheduling

QC checks will typically be performed by randomly re-sampling and/or re-surveying 5% of all sampling and/or survey points. For a low number of points (10 or less), the number of re-survey or re-sample locations will not be less than one (1). The type, number, and scheduling of QC measurements may also be determined by a performance-based method as described in Section 4.9.2 of NUREG-1575. This method is based on the potential sources of error and uncertainty, the likelihood of occurrence, and the consequences in the context of final survey data accuracy. The primary factors considered here are 1) the number of persons or organizations involved in the data collection, 2) the number of measurement types or analytical methods used, and 3) the time interval over which the data are collected. Other factors include:

1. Number of survey measurements collected,

2. Experience of personnel involved,

statistics (see Section 6.7.2.2 of NUREG-1575 (Reference 5-5) for a more complete description of this method).

For alpha survey instrumentation with backgrounds ≤ 3 cpm, a single count provides a surveyor sufficient, cause to stop and investigate further. When one or more counts are registered, the surveyor pauses scanning operations and waits for a predetermined time to determine if the counts are from elevated residual radioactivity. The time interval of the pause corresponds to a 90 percent probability of detecting counts associated with elevated residual radioactivity. This time interval may be calculated in accordance with Equation 6-13 of NUREG-1575 (Reference 5-5).

5.5.2.4.3 Gamma Scan MDC for Land Areas

The MDC_{SCAN} values for the Sodium Iodide detectors and radionuclides (shown in Table 6.7 of NUREG-1575 (Reference 5-5)), are examples of typical MDC_{SCAN} values that can be calculated assuming specific background levels are present in the survey area. The method given in NUREG-1507 (Reference 5-18), provides a more detailed example of how the scan MDC for gamma emitters can be determined. This is the method that will be used by the SNEC Facility when this survey approach is used. Site specific MDCs for all survey instrumentation will be derived and incorporated into survey packages.

5.5.2.4.4 Static MDC for Structural Surfaces

For static measurements of surfaces, the MDC_{static} may be calculated using NUREG-1727, Equation E-3 (Reference 5-4). More specific values for the calibration constant K shown in that equation are shown below in numbers 1 through 3:

1. The area of the detector (A)
2. The source efficiency factor (ε_S), and
3. The instrument efficiency for the emitted radiation(s) (ε_i)

$$MDC_{static} = \frac{3 + 4.65\sqrt{B}}{(\varepsilon_i \varepsilon_s)(A/100cm^2)\cdot t}$$

Where:

MDC_{static} = minimum detectable concentration for static counting (dpm/100 cm^2)

B = background counts during measurement time interval t (counts)

t = measurement counting time interval (minutes)

ε_i = instrument efficiency for emitted radiation (counts/emission)

ε_S = source efficiency for emitted radiation (emissions/disintegration)

A = area of detector (cm^2)

4. The total efficiency (ε_T) is the product of the instrument (ε_i) and source (ε_S) efficiencies. These values will be determined during the calibration process for the specific radionuclide mix expected in each survey area/unit (as appropriate). Actual instrument efficiencies are continuously monitored by site personnel. Any information or calculations used to establish instrument efficiencies for final status survey work will be available at the site for NRC on-site inspection purposes.

5.5.2.5 Detection Sensitivity

The detection sensitivity of typical detectors for surface contamination measurements is estimated and the results summarized in Table 5-10. The results are shown for the principal instruments that are expected to be used for alpha and beta-gamma direct surface contamination measurements.

Count times are selected to ensure that the measurements are sufficiently sensitive with respect to the $DCGL_W$. For example, the count times associated with measurements for surface contamination and gamma spectral analysis (soil and bulk materials) are normally set to ensure an MDC_{static} is equal to or less than 50 percent of the DCGL. The scan rate associated with surface scans is normally set to ensure an MDC_{SCAN} of no more than 75 percent of the DCGL. If the MDC_{SCAN} exceeds the DCGL, additional static measurements may be required, as discussed in Appendix 5.1.

coefficient) values have been developed for relevant site radionuclides. These K_d values have then been used to develop final site $DCGL_W$ values for all volumetric material types at the SNEC site. By selecting the most conservative DCGLw developed from these various material types, a universally applicable $DCGL_W$ may then be used for all SNEC Facility volumetric materials. As a result of this modeling and pathways analysis technique, SNEC site $DCGL_w$ values may be used for both surface and subsurface soil and construction debris (re-fill or otherwise). Any residual activity allowed to remain in SNEC site structures or in soil materials will meet the site dose criteria for unrestricted release based on these $DCGL_w$ values.

A sampling and measurement program will be implemented to monitor and control residual contamination levels in re-fill materials. The sampling program will be statistically based and be applied through the implementation of fully reviewed SNEC site procedures and/or work instructions. Sampling and analysis will meet requirements stated in Section 5.2.7.6 of this plan.

5.5.3.4.5 Paved Parking Lots, Roads, Sidewalks, And Other Paved Areas

Paved parking lots, roadways, concrete slabs, and other paved areas are treated as structure surfaces. Scan and static measurements are taken as prescribed by the survey design. Where remediation has occurred or where residual radioactivity above background levels is suspected, direct surface contamination measurements are taken and a representative number of subsurface samples (below 15 cm) will be collected and analyzed. Depending on the size of the paved area and the distribution of the residual radioactivity, the paved area may be a separate survey unit or be included as part of a larger survey unit. Sampling of these areas is also appropriate where there is reason to believe that contamination resides in, on, or below these structures.

5.5.3.4.6 Trailers And Temporary Facilities

Trailers or other temporary facilities used to support FSS or decommissioning work are not included in this study, but instead will be released in accordance with current SNEC Facility Radiological Controls work practices and procedures. Any temporary facilities remaining at the time of FSS activities shall be classified and surveyed in accordance with the applicable area or use classification.

5.5.3.4.7 Subsurface Soil Contamination Survey

The subsurface sampling/measurement program will be controlled by site procedures and will follow a systematic process for collecting subsurface information. In this methodology, each zone (surface, subsurface and buffer zone below the potentially contaminated region) will represent a sample population. The buffer layer will extend below the depth of any formerly buried components and the suspected depth of the contamination zone. The buffer layer depth and starting point will also be adjusted as indicated by sampling. The number of cores to be taken within each zone is the number N required for the applicable statistical test applied. The core samples will be homogenized over each 1 meter of depth during the sample preparation process. The appropriate test (WRS or Sign) will be applied to the results, as applicable. If the test indicates that the layer being assessed fails, the layer or the volume will be considered for remediation. Additionally, *in-situ* measurements may be considered when any layer exhibits results approaching 50% of the release criteria to verify and determine extent of contamination.

Areas where subsurface contamination may be present at the SNEC site are identified and sampled through the following process:

- Characterization and Historical Site Assessment (HSA) information were reviewed and used to determine the appropriate area classification. The area classification chosen considers both surface and subsurface volumes below structures as well as any previous remediation or survey efforts.

- A review of any existing measurement and/or sample results in the subsurface volume is then performed to determine if sufficient sampling results are available for planning a FSS.

- These areas are then made accessible; i.e. obstacles to sampling and survey work are removed (where possible), including any structural impediments.

- Where sampling below structures is prohibitively difficult or expensive; sampling through floor/slab structures or road coverings may be the appropriate choice rather than removing the entire structure to access the subsurface volume.

- The final state subsurface regions are identified including the depth and thickness of the buffer zone.

- Each subsurface layer is sampled and surveyed IAW a survey and sampling plan.

When any sample or survey result suggests or necessitates remediation of a volume, the remediation is performed before a final round FSS design is planned.

Identified locations where subsurface sampling/measurements will be planned include:

1. The Spray Pond area (~5500 square meters)

2. The 1.148 acre SNEC Facility site. To date, a significant portion of this area has been remediated.

3. Any suspect subsurface areas identified by site management that have shown contamination levels approaching the DCGLw.

5.5.3.4.8 CV Steel Shell Activation Area Survey

The activated section of the CV steel liner is currently assumed to be a region of the CV shell that extends from about the 790' El (operational water line in the reactor cavity) up to the proposed cut off region at about the 805' El (~15 feet). Additionally, the region is assumed to extend for a full quadrant of the CV or about 39' of the circumference of this building (centered horizontally at the former location of the reactor).

When the interior surface of the CV shell is thoroughly decontaminated, from residual surface contamination, samples of the steel shell will be collected within the activation zone previously described. The analysis of these samples will provide the best average concentration for the steel shell in the activation region. Additionally, a gamma measurement of the shell in this region may be used to augment the sampling efforts. These types of gamma measurements are special measurements and are described in more detail in Section 5.5.3.4.9. The direct and indirect dose contribution will be added to the dose contribution from residual surface contamination. The sum from these two sources will be maintained below 25 mrem/y TEDE.

5.5.3.4.9 CV Steel Support Ring Surveys

During 2002, SNEC was tasked with surveying and releasing several steel surface areas of the SNEC Containment Vessel (CV) steel shell in support of installation of steel I-beams, which were designed to stabilize the shell during removal of concrete. Survey areas were first aggressively cleaned using methods such as surface grinding which removed surface oxides, paint and any residual concrete that had adhered to the SNEC CV steel surface, as well as a thickness of the steel itself. This cleaning process removed contaminants to essentially the base metal, thus ensuring that the vast majority of surface contamination had been removed before the surveys began. Pre and post cleaning surveys were performed to verify that the cleaning effort was successful.

The survey was designed using NRC screening DCGLs for surface contamination as described in Table 5-1. A conservative scanning speed was set to locate elevated areas within the survey units which when detected, were re-measured for a full one minute of count time. Elevated measurement locations were re-cleaned and re-surveyed as necessary. Randomly located static measurement points were also counted for one minute.

These areas have been surveyed "at risk" in that they have been surveyed before NRC approval of the SNEC License Termination Plan (LTP). Conservative survey planning and remediation efforts have been used to ensure that all ring installation areas were decontaminated thoroughly below potential site release limits. In addition, radiological controls remained in place throughout the survey process to prevent survey area re-contamination.

This survey information will be included in the Final Status Survey Report.

5.5.3.5 Investigation Measurements

Removable activity, dose rate, and *in-situ* gamma spectrometry measurements may be used as diagnostic tools to further characterize the radiological conditions in selected areas, and to evaluate potential response actions. Sodium iodide detectors can also be used, both for hard to reach areas e.g., embedments, piping and duct work, as well as for subsurface monitoring efforts such as gamma-logging. Sodium iodide detectors become especially useful when employed in conjunction with multi-channel analyzers that are capable of discerning between natural occurring and site-specific radionuclides.

Gamma-logging using a multi-channel analyzer is useful in both screening surveys (to determine depth and average concentration of contamination) and in final status surveys (to provide an upper limit of the average radionuclide concentration). If no significant counts are obtained in the detection system's region of interest (ROI), within a bore hole or piping system, then a "less than" value, or minimum detectable concentration (MDC), can be quoted for the soil around the bore hole or for a measured section of system piping at a given confidence level (95%). By ensuring that the MDC is less than the release criteria, the surveyor can designate the soil in the vicinity of the detector (or section of pipe) to be below the release criteria. Additionally, this type of measurement system is sensitive to elevated materials in adjacent buried piping or elevated pockets of contamination outside of the immediate sampling zone. Therefore, GPU Nuclear, Inc. will consider using gamma-logging as a compliment to sampling in areas where volumetrically contaminated materials approach the release criteria or when contamination is thought to be present in piping systems within a survey area.

5.5.3.6 Hard-To-Detect (HTD) Radionuclides

Many radionuclides are comparatively simple to detect in the field at environmental levels using routine gamma-ray spectroscopy analysis techniques. In contrast, the "Hard-To-Detect" (HTD) radionuclides are not easily identified using any routinely applied field measurement practices. SNEC has identified H-3, C-14 and Ni-63 as being the only HTD type nuclides of significance at the SNEC Facility. A summary of the radionuclide selection process can be found in Section 6.2.2.3.

5.5.4 Sample Handling and Analysis

When sample custody is transferred (e.g., when samples are sent off-site to another lab for analysis), a chain-of-custody record accompanies the sample for tracking purposes. The sample chain of custody record documents the custody of samples from the point of measurement or collection until final results are obtained. These tracking records are controlled and maintained in accordance with approved site procedures. On-site laboratory capabilities are used to perform gamma spectroscopy of bulk sample materials, gross beta-gamma and alpha counting of smears and Tritium analysis in liquid samples. Off-site laboratory services are procured as needed for Sr-90, TRU and other Hard-To-Detect (HTD) radionuclides. Laboratory analytical methods are generally capable of measuring levels at 10 to 50 percent (or less) of applicable $DCGL_W$ values.

5.5.5 Data Management

Final survey data may be collected from post remediation surveys, final surveys, investigation surveys or special measurement evaluations such as those made to determine embedment or sub-surface activity levels.

5.5.5.1 Other Scan Measurements

When 100% of any area is scanned at a high detection efficiency, capable of discerning low levels of residual activity (well below established $DCGL_W$ levels), collected results have a greater assurance that survey areas meet the site release criteria. Consequently, some scan survey measurement efforts performed for initial phase and/or investigative purposes, may be accepted as final survey data provided the following conditions are met:

1. The MDA for the scan is a small fraction of the required $DCGL_W$ for the survey area, and there is sufficient sensitivity present in the survey design at an acceptable confidence level.

2. All applicable survey data collection requirements as prescribed in Section 5.5 and 5.6.1 are followed.

3. The area was isolated after the survey activity.

5.5.5.2 Other Static Measurements

Other static measurements performed during post remediation and investigation surveys are based on professional judgment. Since they are biased and not random, they may not be used in the statistical tests. However, this does not necessarily preclude their acceptance as final survey data. These measurements may be accepted as final survey data provided:

1. All applicable survey data collection requirements as prescribed in Section 5.5 and 5.6.1 are followed.

2. Thirty or more data points are collected within the survey unit. For piping and other embedments, accessibility to interior surfaces may not allow this number of measurements. In these cases, similar survey methodology encompassing historical assessment, characterization, remediation, and post remediation survey data will be used as a basis for biased measurements and sampling, to ensure that the release criteria are met.

3. None of the data points exceeds the $DCGL_W$.

4. The area was isolated after the survey activity.

5.5.5.3 Data Recording

Survey measurements will be recorded in units appropriate for comparison to the $DCGL_W$ by correcting for material specific background, efficiency, geometry, detector area, and measurement size as applicable. The recording units are dpm/100 cm^2 for surface contamination and pCi/g for volumetric radionuclide concentrations.

Records of survey data are maintained in accordance with approved site procedures. Survey data records include the identification of the surveyor, type of measurement, location, instrumentation used, results, time and date measurement was performed and the instrument calibration information.

5.6 SURVEY DATA ASSESSMENT

The data assessment process checklist is illustrated in Figure 5-2. Final survey data, described in Section 5.5, are reviewed to verify they are of adequate quantity and quality. Graphical representations and statistical comparisons of the data can be made which may provide both quantitative and qualitative information about the data. An assessment is performed to verify the data. If the quantity or quality of the data is called into question, previous survey steps are re-evaluated. The statistical tests are applied and conclusions are drawn from the data as to whether the survey unit meets the site release criteria.

5.6.1 Data Verification and Validation

The final survey data will be reviewed to verify they are authentic, appropriately documented, and technically defensible. The review criteria for data acceptability are:

1. The instruments used to collect the data are capable of detecting the radiation of interest at or below the investigation level. If not, acceptable compensatory measures have been taken.

2. The calibration of the instruments used to collect the data is current and radioactive sources used for calibration are traceable to recognized standards or calibration organizations.

3. Instrument response is checked before and, where required, after instrument use each day data are collected.

4. Survey team personnel are properly trained in the applicable survey techniques, and this training is adequately documented.

5. The MDCs and the assumptions used to develop them are appropriate for the instruments and the survey methods used to collect the data.

6. The survey methods used to collect the data are appropriate for the media and types of radiation being measured.

7. Special measurement methods used to collect data are applied as warranted by survey conditions, and are properly documented in accordance with an approved site procedure or Station Work Instruction.

8. The custody of samples that are to be sent for off-site laboratory analysis, are tracked from the point of collection until the final results have been obtained, and

9. The final survey data set consists of qualified measurement results representative of current facility status are collected as prescribed by the survey design package.

If a discrepancy exists where one or more criteria are not met, the discrepancy will be reviewed and corrective actions taken (as appropriate) in accordance with site procedures.

measurements have the same value, they are all assigned the average rank of that group of measurements.

4. Sum the ranks of the adjusted background reference area measurements to obtain Wr.

5. Calculate the critical value using equation I.1, NUREG-1575 (Reference 5-5). This equation is used when there are several measurements that have the same value.

$$Critical\ Value = ((m(n+m+1))/2) + (z\sqrt{nm(n+m+1)/12})$$

Where:

z = The (1 - α) percentile of a standard normal distribution, which can be found in the Table 5-14 below.

Table 5-14

Values For α and z

α	z
0.001	3.090
0.005	2.575
0.01	2.326
0.025	1.960
0.05	1.645
0.1	1.282

NOTE: The value of α is obtained from the survey design (initial value is 0.05 - see Appendix 5-2) NRC approval is required to increase the α (type 1 decision error) >0.05 in accordance with License Condition 2.E (g) Where m and n are less than 20, the critical value is given in Table I 4 of NUREG-1575 (Reference 5-5)

6. Compare the value of Wr with the critical value calculated above. If Wr is greater than the critical value, the survey unit meets the site release criteria. If Wr is less than the critical value, the survey unit fails to meet the criterion.

5.6.5 Data Conclusions

The results of the statistical test allow one of two conclusions to be drawn. The first conclusion is the survey unit meets the site release criteria. The data have provided statistically significant evidence that the level of residual radioactivity in the survey unit does not exceed the site release criteria. The decision that the survey unit is acceptable for unrestricted release can be made with sufficient confidence and without further analysis.

The second conclusion that is that the survey unit fails to meet the site release criteria. The data does not provide sufficient statistically significant evidence that the level of residual radioactivity in the survey unit does not exceed the site release criteria. The data is analyzed further to determine why the statistical test result led to this conclusion.

Possible reasons the survey unit fails to meet the site release criteria are:

1. It is in fact true,

2. It is a random statistical fluctuation, or

3. The test did not have sufficient power to detect that it is not true. The power of the test is primarily based on the actual number of measurements obtained and their standard deviation. A retrospective power analysis for the test may be performed as described in Appendices I.9 and I.10 of NUREG-1575 (Reference 5-5) If the power of the test is insufficient due to the number of measurements, additional data may be collected. If it appears that the failure may be due to statistical fluctuations, the survey unit may be resurveyed and another set of discrete measurements collected for statistical analysis. A larger number of measurements increases the probability of passing if the survey unit actually meets the site release criteria. If it appears that the failure was caused by the presence of residual radioactivity in excess of the site release criteria, the survey unit is remediated and resurveyed.

5.7 SURVEY RESULTS

Survey results are documented in history files, survey unit release records, and are summarized in the final survey report. Other detailed and summary data reports may be generated as requested by the NRC or SNEC Management.

5.7.1 Survey Unit Release Record

The survey unit release record is the complete release record in a standardized format prepared for each survey unit or group of survey units with similar histories. The survey unit release record is a collection of information necessary to demonstrate compliance with the site release criteria. This record includes:

1. A history file checklist:

   The history file checklist references relevant operational and decommissioning data. The purpose of this checklist is to provide a basis for the survey unit classification. The history file will reference relevant sections of the Historical Site Assessment (Reference 5-19) and other compiled records including:

   - History of remediation
   - The survey unit operating history affecting radiological status
   - Scoping, site characterization and post remediation survey data
   - Other relevant information.

2. Description of the survey unit

3. Survey design information for the survey unit

4. Survey unit ALARA analysis, if performed

5. Survey measurement locations and corresponding survey data

6. Survey unit investigations performed with documented results, as applicable

7. Any survey unit data assessment results

8. Results of any special measurements performed for the survey unit

5.7.2 Final Survey Report

A final survey report will be prepared and submitted to the NRC. The report will provide a summary of any ALARA analysis, survey data results, and overall conclusions, which demonstrate that the SNEC Facility and site meet the radiological criteria for unrestricted use. Information such as the number and type of measurements, basic statistical quantities, and statistical test results will be included in the report.

The following outline illustrates a general format that may be used for the final status survey report. The outline below may be adjusted to provide a clearer presentation of the information. The level of detail will be sufficient to clearly describe the final status survey program and certify the results.

Information to be submitted (Reference 5-4, Section 14.5):

1. A summary of the results of the final status survey.

2. A discussion of any changes that were made in the final status survey from what was proposed in the LTP or other prior submittals.

3. A description of the method by which the number of samples were determined for each survey unit (see Reference 5-5, Section 5.5.2).

4. A summary of the values used to determine the numbers of samples and a justification for these values (see Reference 5-5, Section 5.5.2).

5. Survey results for each survey unit including:

    - Number of samples taken for the survey unit.

    - A map or drawing of the survey unit showing the reference system and random start systematic sample locations for Class 1 and 2 survey units, and random locations shown for Class 3 survey units and reference areas.

    - Measured sample concentrations.

    - Statistical evaluation of the measured concentrations (see Reference 5-5, Section 8.3, 8.4 and 8.5).

    - Judgmental and miscellaneous sample data sets reported separately from those samples collected for performing the statistical evaluation.

- Discussion of anomalous data including any areas of elevated direct radiation detected during scanning that exceeded the investigation level or measurement locations in excess of the DCGLw.

- A statement that a given survey unit satisfied the DCGLw and the elevated measurement comparison if any sample points exceeded the DCGLw.

6. A description of any changes in initial survey unit assumptions relative to the extent of residual radioactivity.

7. When a survey unit failed, a description of the investigation conducted to ascertain the reason for the failure and a discussion of the impact that the failure has on the conclusion that the facility was ready for final radiological surveys.

8. If a survey unit failed, a description of the impact that the reason for the failure has on other survey unit information.

5.7.3 Other Reports

If requested by the NRC, computer-generated and/or summary data reports will be provided in hard copy or electronic form. Survey data include date, instrument, location, type of measurement, and mode of instrument operation. Other data, such as conversion factors, background reference areas, and the MDCs used, are available which will allow independent verification of the results. Measurement results will also be presented graphically. The FSS report will be independently reviewed.

Any independent verification survey performed will be performed by an organization outside the SNEC Facility staff and management organization. Reports generated as a result of any independent verification survey process initiated by the SNEC Facility, will be available upon request.

5.8 DEFINITIONS

1. Accessible Surface Area - An area available to a radiation detector for direct scanning or fixed-point measurements.

2. Area Factor (A_{EMC}) - A factor used to adjust the $DCGL_W$ to estimate $DCGL_{EMC}$ and the minimum detectable concentration for scanning surveys in Class 1 survey units ($DCGL_{EMC} = DCGL_W \times A_{EMC}$. The area factor ($A_{EMC}$) is the magnitude by which the residual radioactivity in a small area of elevated activity can exceed the $DCGL_W$, while maintaining compliance with the release criterion. SNEC Facility area factors are listed in Table 5-15 of Appendix 5-1.

3. Background Radiation - Naturally occurring radiation which may include cosmic, terrestrial (radiation from the naturally radioactive elements) and man-made radiation from global fallout.

4. Characterization Survey - A radiological survey and its supporting evaluations performed to establish the SNEC Facility radiological condition for planning decommissioning activities.

5. Confidence Level - The probability associated with a confidence interval which expresses the probability that the confidence interval contains the population parameter value being estimated.

6. Derived Concentration Guideline Level (DCGL) - Residual radioactivity levels that equate to the site release criteria for that particular pathway or measurement. The two (2) basic DCGLs defined in this plan are 1) the $DCGL_W$ and, 2) the $DCGL_{EMC}$. The $DCGL_W$ is the average concentration limit for the standard size survey area. The $DCGL_{EMC}$ is the elevated measurement area DCGL, which is used for small areas of elevated activity (above the $DCGL_W$). When not defined, DCGL refers to the $DCGL_W$. Other DCGLs discussed in this plan (e.g., $DCGL_{GA}$ etc.) are derived from these two basic definitions and are sometimes referred to as an "effective DCGL".

7. Elevated Area - Areas of residual contamination exceeding the guideline value.

8. Final Status Survey (FSS) - Radiological measurements, evaluations and supporting activities undertaken to demonstrate that the SNEC Facility satisfies the criteria for unrestricted use.

9. Hard-to-Detect Nuclide (HTD) - A radionuclide emitting radiation(s) that are difficult to detect with field or laboratory based instrumentation.

10. History File - A compilation of information used to justify the classification and survey design for the survey unit. It should reference sections of the Historical Site Assessment, characterization survey data, remediation surveys and other information used to establish the basis for the design of the final status survey.

11. Independent Verification Survey - An information only radiological survey, performed by an organization independent of the SNEC Facility staff and

management, which will provide SNEC Facility management with an additional level of confidence concerning the validity of the Final Survey results.

12. Minimum Detectable Activity (MDA) - The minimum level of radiation or radioactivity that can be measured by a specific instrument and technique. The MDA is usually established on the basis of assuring false positive and false negative rates of less than 5%.

13. Minimum Detectable Concentration (MDC) - The minimum activity concentration on a surface or material volume that can be statistically detected above background. This is usually set at the 95 % confidence level.

14. Multiple Source Terms - Generic term used when more then one source term element is encountered (e.g., a remaining site structure with surface contamination and embedments).

15. Operational Survey - A radiological survey performed in accordance with SNEC procedures in support of routine site operations.

16. Quality Control Survey - A survey that consists of repeat measurements on a specified fraction of the survey areas. The survey areas are usually selected at random to provide an additional check of final status survey measurements.

17. Release Criteria - A term used to identify the radiological requirements for release of the SNEC Facility for unrestricted use.

18. Remediation Survey - Any survey performed that is used to determine the effectiveness of remediation activities. The final post remediation survey is a special remediation effectiveness survey performed with instrumentation similar to the type used for the FSS. The survey methodology is also similar to actual FSS methodology.

19. Scan Survey - A qualitative radiological monitoring technique that is performed by moving a detector over a surface at a specified speed and distance to detect elevated activity areas or locations. Also called a "Surface Scan".

20. Scoping Surveys – A type of survey that is conducted to identify. 1) radionuclide contaminants, 2) relative radionuclide ratios, and 3) general levels and extent of contamination.

21. Structures - All SNEC Facility site buildings and their surfaces. In addition, platforms, restraints and supports, and external surfaces of piping systems, heating and ventilation systems, tanks, stacks, etc., are also treated as structures in the final status survey if they exist beyond remediation efforts.

22. Surface Contamination - The total of both fixed and removable contamination. For the purposes of this plan, this would also include any remaining neutron-activated material near the surface. Also called total surface contamination.

23. Survey Area - The basic survey entity for the management of the Final Status Survey. It is comprised of one or more survey units, the bounds of which are

defined by existing facility physical features, such as a room, intersection of walls, column-and-row layout of a floor elevation, or structural I-beams.

24. Survey Location - In a structural or open land survey area, a survey location is usually represented by a single grid block. In a system survey area, a specified length of piping or a component such as a valve or tank is referred to as a survey location. A survey location can contain one or more survey points. Also referred to as measurement locations.

25. Survey Unit Release Record - A collection of information in a standardized format for controlling and documenting field measurements taken for the Final Status Survey. A survey unit release record is prepared for each survey area. The survey unit release record may include the survey instructions, a control form, grid map(s), survey measurement data sheets and survey maps. It may also be called a survey package.

26. Survey Point - A smaller subdivision within a survey location (grid block, system, component) where local measurements are taken. For structures and systems, a survey point generally refers to an area covered by a detector, or an area of 100 cm2 when a smear is taken. For open land areas, a survey point refers to the area covered by a detector (for paved surfaces), the point at which a dose rate measurement is taken, or the point at which a soil or pavement sample is collected.

27. Survey Unit - A geographical area consisting of structures or land areas of specified size and shape at a remediated site for which a separate decision will be made whether the unit attains the site-specific reference-based cleanup standard for the designated pollution parameter. Survey units are generally formed by grouping contiguous site areas with a similar use history and the same classification of contamination potential. Survey units are established to facilitate the survey process and the statistical analysis of survey data.

28. Total Effective Dose Equivalent (TEDE) - The sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

29. Unity Rule - Where more than one radionuclide is present, the sum of the ratios of each radionuclide concentration to its respective DCGL should not exceed unity. When this method is used, the effective DCGL is equal to one (1).

5.9 REFERENCES

5-1 Code of Federal Regulations, Title 10, Part 50.82, "Termination of License"

5-2 Regulatory Guide 1.179, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors," January 1999

5-3 Code of Federal Regulations, Title 10, Part 20.1402, "Radiological Criteria for Unrestricted Use"

5-4 NUREG-1727, "NMSS Decommissioning Standard Review Plan", September 2000.

5-5 NUREG-1575, Revision 1, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," August 2001

5-6 NUREG-1505, "A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys"

5-7 SNEC Facility Site Characterization Report, May, 1996

5-8 NUREG/CR-5512, "Residual Radioactive Contamination From Decommissioning, Final Report," Volume 1, October 1992

5-9 Draft NUREG-1549, "Using Decision Methods for Dose Assessment to Comply With Radiological Criteria for License Termination," July 1998

5-10 Yu, C. F. et al., Manual for Implementing Residual Radioactivity Materials Guidelines Using RESRAD, Environmental Assessment Division, Argonne National Laboratory

5-11 Yu, C. F. et al., RESRAD-Build, A Computer Model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material. Environmental Assessment Division, Argonne National Laboratory

5-12 Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) – Effluent Streams and the Environment"

5-13 SNEC Procedure, 1000-PLN-3000.05, "SNEC Facility Decommissioning Quality Assurance Plan"

5-14 SNEC Procedure, E900-PLN-4542.01, "SNEC Radiation Protection Plan"

5-15 SNEC Procedure, E900-ADM-4500.44, "SNEC Facility Calculations"

5-16 SNEC Procedure, E900-ADM-4500.04, "SNEC Records Retention Procedure"

5-17 SNEC Procedure, E900-ADM-4500.12, "Radiological Surveys: Requirements & Documentation Procedure"

5-18 NUREG-1507, "Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions," June 1998

5-19 SNEC Facility Historical Site Assessment Report, January 2000

5-20 Deleted

APPENDIX 5-1

ELEVATED MEASUREMENT COMPARISON (EMC)

The EMC, sometimes called a "hot spot test," is a simple comparison of measured values against a limit. There are two applications of this comparison in the final survey process. It is used when the sensitivity of the scanning technique is not sufficient to detect levels of residual radioactivity below the DCGL (i.e., where the MDC_{scan} is greater than the DCGL). In this application, the number of static measurements may need to be adjusted. Appendix 5-2 describes how this is done. The second application in this appendix, is when one or more scan or static measurement data points exceed the DCGL. The use of the EMC for measurements above the DCGL provides assurance that unusually large measurements receive the proper attention and that any area having the potential for significant dose contributions is identified. The EMC is intended to flag potential failures in the remediation process.

Locations, identified by scan or static measurements, with levels of residual radioactivity, which exceed the DCGL, are investigated (see Section 5.4.4). The size of the area where the elevated residual radioactivity exceeds the DCGL and the level of the residual radioactivity within the area are determined. The average level of residual radioactivity is then compared to the $DCGL_{EMC}$. If a background reference area is to be applied to the survey unit, the mean of the background reference area measurements may be added to the DCGL or the $DCGL_{EMC}$ to which the average level of residual radioactivity is compared.

The $DCGL_{EMC}$ is calculated using the following equation (NUREG-1575, Equation 8-1):

$$DCGL_{EMC} = Area\ Factor \times DCGL$$

The area factor is the multiple of the DCGL that is permitted in the area of elevated residual radioactivity without requiring remediation. The area factor is related to the size of the area over which the elevated residual radioactivity is distributed. That area, denoted A_{EMC}, is generally bordered by levels of residual radioactivity below the DCGL, and is determined by the investigation. The area factor is the ratio of dose per unit area or volume for the default surface area for the applicable dose modeling scenario to that generated using the area of elevated residual radioactivity, A_{EMC}. It is calculated based on the methodology given in chapter 8 of NUREG-1505 (Reference 5-6).

If the average level of the elevated residual radioactivity is less than the $DCGL_{EMC}$, there is reasonable assurance the site release criteria is still satisfied and the area does not require remediation. Radioactivity at the $DCGL_{EMC}$ distributed over the area A_{EMC} delivers the same calculated dose as does residual radioactivity at the DCGL distributed over the default surface area. If the $DCGL_{EMC}$ is exceeded, the area is remediated and resurveyed. Area factors for open land areas at the SNEC Facility are provided in Table 5-15. Area factors for surface area DCGLs supplied by the NRC are provided in Table 5-15A.

Table 5-15

Area Factors (AF) For Open Land Areas

Based on 25 mrem/y TEDE and Upper 1 Meter Volumetric Surface Modeling

File Names ⇒	NEW XXXXX.RAD*		NEW XXXXXA.RAD		NEW XXXXXB.RAD		NEW XXXXXC.RAD		NEW XXXXXD.RAD		NEW XXXXXE.RAD	
AREA ⇒	10000 m^2		2500 m^2		400 m^2		100 m^2		25 m^2		1 m^2	
Radionuclides	Base DCGL	AF	Implied DCGL EMC	AF	Implied DCGL EMC	AF	Implied DCGL EMC	AF	Implied DCGL EMC	AF	Implied DCGL EMC	AF
Am-241	25.7	1.0	47.7	1.9	110.1	4.3	321.7	12.5	699.1	27.2	3005	116.9
C-14	26.8	1.0	151.1	5.6	984.8	36.7	2.69E+03	100.2	7206	268.9	1.79E+05	6682.8
Co-60	3.5	1.0	4.4	1.3	4.9	1.4	5.4	1.6	7.0	2.0	43.4	12.4
Cs-137	6.6	1.0	14.9	2.3	19.9	3.0	23.8	3.6	31.1	4.7	189.3	28.7
Eu-152	10.1	1.0	10.5	1.0	11.1	1.1	12.1	1.2	15.5	1.5	94.3	9.3
H-3	645	1.0	1.47E+03	2.3	3.23E+03	5.0	7.87E+03	12.2	1.78E+04	27.6	3.55E+05	550.2
Ni-63	747	1.0	3 66E+03	4.9	1.29E+04	17.2	5.14E+04	68.8	2.05E+05	275	5.07E+06	6789.8
Pu-238	30.1	1.0	57.7	1.9	142.9	4.7	408.2	13.6	694.4	23.1	1.08E+04	358.8
Pu-239	6.8	1.0	11.9	1.7	26.9	4.0	56.4	8.3	114.8	16.9	1374	202.1
Pu-241	866	1.0	1607	1.9	3713	4.3	1.09E+04	12.6	2.39E+04	27.6	1.02E+05	118.1
Sr-90	1.2	1.0	3.6	3.0	9.8	8.1	38.5	32.1	146.7	122.3	2826	2355

* Where "XXXXX" is the radionuclide computer file name, as an example "Am241".

NOTE 1: Base case DCGLs (in pCi/g) are for 10,000 square meter surface model only.

NOTE 2: The above set of DCGL values are used only to determine the Area Factors (AF) that will then be applied to the values listed in Table 5-1 (surface materials only).

NOTE 3: When AF values are calculated in the RESRAD computer code, the settings for contaminated fractions for plant food, meat and milk must be re-set to their default condition (-1) in order to allow the computer code to scale the food supply for the size of the areas appropriately.

Table 5-15A

Area Factors For Structural Surfaces

(Based on NRC Screening Values - see Table 5-1)

Nuclide	36 m^2	25 m^2	16 m^2	9 m^2	4 m^2	1 m^2
Am-241	1	1.5	2.3	4.1	9.2	36.2
C-14	1	1.4	2.2	4.0	8.9	35.9
Co-60	1	1.2	1.5	2.0	3.4	10.1
Cs-137	1	1.2	1.5	2.2	3.7	11.2
Eu-152	1	1.2	1.5	2.1	3.5	10.7
H-3	1	1.4	2.2	4.0	8.9	35.8
Ni-63	1	1.4	2.2	4.0	9.0	35.3
Pu-238	1	1.4	2.3	4.0	9.1	36.9
Pu-239	1	1.4	2.2	4.0	9.0	35.4
Pu-241	1	1.4	2.2	4.0	9.0	34.8
Sr-90	1	1.4	2.2	3.9	8.8	34.7

NOTE: DCGL is in dpm/100 cm^2

DECISION ERRORS

The principal study question or statement is, **"are the levels of residual radioactivity in all survey units below applicable release criterion and can the site be released?"** Results from surveys and other environmental testing will be used to determine the answer to this question.

A decision error is the probability of making an error in the decision on a survey unit, either passing a survey unit that should fail or failing a survey unit that should pass. The first decision error, passing a survey unit that should fail, is referred to as a false positive or TYPE I decision error. The probability of making this error is denoted by α. Setting high value for α results in a higher risk of passing a survey unit that should fail. Setting low value of α lowers the risk of passing a survey unit that should fail.

The second decision error, failing a survey unit that should pass, is referred to as a false negative or TYPE II decision error and is denoted by β. Selecting a high value for β results in a higher risk of failing a survey unit that should pass and subjecting it to further investigation. Selecting a low value for β lowers the risk and minimizes these investigations. The cost of setting a low value for either α or β is a higher value for the other or an increased number of measurements to demonstrate compliance with the release criteria.

When using the statistical testing procedures as described in NUREG-1575 and NUREG-1505 (Reference 5-5 and 5-6) documents i.e., the Sign Test or the Wilcoxon Rank Sum (WRS), larger decision errors may be unavoidable when encountering difficult or adverse conditions. This is particularly true when trying to measure residual radioactivity concentrations close to the variability in the concentration of those materials in natural background. In order to avoid an unreasonable number of samples when Δ/σ is very small, larger values of α may be considered as shown in Table 5-16 below.

Table 5-16

Acceptable Decision Error α as a Function of DCGL

DCGL/σ	α
>3	0.05
1.2 to 3	0.10
0.6 to 1.2	0.25
<0.6	0.30

Table 5-16 values are based on the assumption that the LBGR should not have to be set to less than 0.5 times the DCGL, and that if α is allowed to increase, β will also be allowed to increase.

There are no constraints on the value of β. However, decreasing β increases the number of samples needed, making vary small values of β unattractive.

The survey design objective is then to establish the value of α equal to or less than 0.05 and to minimize the value of β while maintaining the minimum number of measurements at an optimal number. NRC approval is required to increase the α (type 1 decision error) >0.05, in accordance with License Condition 2.E.(g).

NUMBER OF MEASUREMENTS

The statistical parameters α, β and Δ/σ are used to estimate the number of measurements that will produce the desired values of α and β. The number of measurements are based on the statistical test which is applied to the survey unit. The two statistical tests used in the final survey data analysis process are the Sign Test and the Wilcoxon Rank Sum (WRS) Test. The criteria for using these testing procedures are summarized in Table 5-17.

Table 5-17

Statistical Tests and Criteria For Their Use

Statistical Test	Criteria for Use
WRS Test	Radionuclide of concern appears in background, or measurements are used that are not radionuclide-specific.
Sign Test	Radionuclide of concern is not present in background and radionuclide-specific measurements are made, or radionuclides are present in background at such small fractions of the DCGL as to be considered insignificant.

NOTE: For specific information on statistical testing procedures, see Table 2 3 of NUREG-1505 (Reference 5-6).

The number of measurements is determined by rounding up the number calculated using the appropriate statistical test and adding 20% more measurements. Additional measurements are added to protect against the possibility of lost or unusable data.

Wilcoxon Rank Sum (WRS) Test

The two-sample WRS test is used when the radionuclide of concern appears in background or if measurements are used that are not radionuclide specific. Because gross activity measurements are not radionuclide specific, they must be performed for both the survey unit(s) being evaluated by the WRS test and for corresponding reference area(s). The number of measurements needed for the WRS test is determined from the following equation (NUREG - 1727, Equation E-5) (Reference 5-4):

$$n = (1/2)\frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{(3)(P_r - 0.5)^2}$$

Where:

- n = number of measurements in survey unit
- $Z_{1-\alpha}$ = percentile represented by decision error α (NUREG-1575, Table 5.2)
- $Z_{1-\beta}$ = percentile represented by decision error β (NUREG-1575, Table 5.2)
- P_r = probability that a random measurement from survey unit exceeds random measurement from background reference area by less than DCGL when

input. This switch to volumetric consideration brings the resident farmer scenario back as the release scenario. Since some of the material will be buried 3 feet below grade, the contamination zone may be in the saturated zone. A subsurface volumetric dose model has been developed to evaluate this condition.

Exposure pathway (d) listed above applies to areas where there is penetrating radiation from embedded sources of radioactivity, such as embedded piping or activated metal. To the extent practical embedded pipe sources will be filled with grout or concrete. For modeling these scenarios a bounding calculation has been performed (Reference 6-19) using the sum of the fractions method. This method combines applicable surface and volumetric DCGLs along with the Microshield shielding code to calculate the respective dose from residual activity remaining on structural surfaces, within residual piping, walls and floors or within activated metal (e.g. CV steel liner). Two scenarios have been evaluated in the calculation. They are:

- Bounding Limit 1 – Dose from an activated region of the SNEC CV steel shell is combined with the dose from surface contamination. The annual direct gamma dose calculated by MicroShield for the activated region is 7.2 mrem.

- Bounding Limit 2 – Dose from post remediation surface contamination and volumetric contamination of concrete surfaces within the SSGS Discharge Tunnel are combined with several hypothetical direct exposures from pipe sections. The annual direct gamma dose calculated by MicroShield for the SSGS pipe sections is 0.611 mrem.

As a result of the Reference 6-19 calculation the direct gamma dose will remain fixed and bounding based on the applicable scenario. Only the surface contamination or volume concentration parameters are allowed to vary in Equation 6-1. Use of Equation 6-1 will ensure the combined exposure is bounded for the applicable source terms over the entire survey unit and result in less than the 25 mrem/yr limit.

Equation 6-1

$$\sum_{i=1}^{n}\left(\frac{C_{si}}{DCGL_{si}}+\frac{C_{vi}}{DCGL_{vi}}\right)+\left[\frac{Direct\ \gamma\ Dose}{25}\right]\leq 1$$

Where: C_{si} = Surface contamination of radionuclide i (dpm/100 cm^2).

C_{vi} = Specific volume concentration of radionuclide i (pCi/g).

$DCGL_{si}$ = Surface contamination DCGL of radionuclide i from Table 6-2.

$DCGL_{vi}$ = Volumetric DCGL (25 mrem/yr) of radionuclide i from Table 6-2.

Direct γ Dose = MicroShield shielding code calculation (mrem/yr).

For the following bounding cases Equation 6-1 reduces to:

Activated CV Steel - $\sum (C_{si} / DCGL_{si}) + 0.288 \leq 1$

SSGS - $\sum (C_{si} / DCGL_{si} + C_{vi} / DCGL_{vi}) + 0.024 \leq 1$

6.2.1.1 Surface Area Factors

Surface area factors have been developed using comparative analyses between DandD, 1.0 and RESRAD-BUILD, 3.0. Derivation of these area factors has been documented in Reference 6-10. These area factors have been used to develop $DCGL_{EMC}$ screening values for residual radioactivity on building surfaces. Default surface area screening values (Reference 6-8) were used as inputs into the RESRAD-BUILD, 3.0 program to determine the annual default dose at 36 m^2. This dose was then used to ratio against doses calculated for 25, 16, 9, 4, and 1-m^2 areas. The calculated ratio is equal to the area factor value for the respective area sizes. The surface area DCGL can be multiplied by the derived area factor to determine the $DCGL_{EMC}$. Surface area factors for SNEC are listed in Chapter 5, Table 5-15A.

6.2.2 Resident Farmer Scenario

For this scenario the assumption is that residual radioactivity is distributed in a surface soil layer covering the plant site (surface model) or in subsurface fill materials (subsurface model). The receptor is considered to reside in a home in or near any of the areas of concern. Use of the site is for residential or light farming activities. The scenario assumes continuous exposure via multiple exposure pathways to the critical group. The critical group is the resident farming family who lives on the plant site following site remediation, grows some portion of their diet on the site, and drinks water from a source at the site. The most conservative parameters are selected from each of the areas of concern to identify a site-wide residential scenario, which results in the highest exposure. This site-wide exposure is then used to determine nuclide-specific DCGLs for each surface and subsurface layer. The pathways that apply to the residential farming scenario include:

a) External exposure (while indoors and outdoors) to penetrating radiation from volume sources in the contamination layer;

b) Inhalation of resuspended surface sources

- through wind erosion while indoors or outdoors,
- tracked indoors,
- while excavating and spreading contaminated overburden material during home construction and yard leveling;

c) Ingestion of drinking water from a groundwater source (e.g. bedrock well);

d) Ingestion of plant products grown in contaminated soil and/or irrigated with contaminated groundwater;

e) Ingestion of animal products (e.g. beef and milk from cattle raised onsite that ingested contaminated drinking water, plant products and soil);

f) Direct soil ingestion;

g) Ingestion of fish from a contaminated surface water source; and

h) Direct exposure from re-excavated volume sources.

At SNEC, the shallow water table and boulders in the overburden layer discourage construction of a basement for an on-site residence. However, excavation and spreading of fill material from beneath the top meter and into the upper overburden layer could occur in leveling sloped areas for a home site. This scenario was analyzed as part of the subsurface modeling.

Two models have been developed covering surface (Reference 6-9) and sub-surface (Reference 6-11) open land areas for the Resident Farmer scenario. Both models were developed using the RESRAD Version 6.1 computer code using the deterministic and probabilistic options. GPU Nuclear, Inc. developed the surface model while URS Corporation developed a sub-surface model, incorporating many of the same input parameters used in the surface model. Due to the voluminous nature of the dose modeling results documentation has been included in electronic media (CD-ROM) and submitted to the NRC for review (Reference 6-12). The dose modeling approach and input parameter selection are illustrated in Figure 6-1. General approaches and selection of key input parameters are discussed in the following sub-sections.

DCGL results were compared between the two models. **The most conservative DCGL values were combined to form a single list for the 25 mrem/yr release limit. The most conservative DCGLs to implement SNEC's 4 mrem/yr drinking water dose goal were similarly derived.** These DCGL values are listed in Table 6-2.

6.2.2.1 Probabilistic Approach

For each radionuclide RESRAD 6.1 (in the probabilistic mode) was used to perform uncertainties analyses and determine the sensitive parameters. The appropriate input file containing all physical, behavior and metabolic parameters was generated. This file included Haley & Aldrich hydrogeology values (Reference 6-17), K_ds developed by Argonne National Lab (Reference 6-15), and contaminated zone dimensions. DandD default values were used for metabolic and behavior inputs. RESRAD default values and distributions were used for physical parameters that could not be empirically tested or where no site-specific data existed.

A random seed of 1000 was used for uncertainty sampling. The Latin Hypercube Sample (LHS) method was used to generate samples of input values for the probabilistic analysis. Uncertainty correlations were established between density and total porosity, density and effective porosity, and total porosity and effective porosity with a correlation value specified as 0.99 for all three zones (i.e. contaminated, saturated and unsaturated).

The first 6 correlation tables (coefficients for 'peak of mean dose time dose' and 'peak all pathways dose') of the MCSUMMAR.REP computer file were extracted. Within these tables, the higher correlation coefficient (r^2 value) between the PRCC and PCC columns was selected. These values determine the sensitive nature of the parameter. Sensitive parameters were identified with correlation values greater than or equal to 0.25 or less than or equal to –0.25.

A default case of RESRAD was run in the probabilistic mode with only the sensitive parameters varying. An LHSBIN.DAT report was then generated and imported into an EXCEL spreadsheet to identify the means and 25th and 75th percentile values for the sensitive parameter distributions. Applicable values were then used as base deterministic inputs.

With the exception of C-14 and H-3, K_d values were developed for each SNEC related radionuclide by Argonne National Laboratories (ANL) from analysis of a group of samples collected at the SNEC site that included materials such as soils and fly ash, and building construction materials such as pulverized concrete, brick and block, etc. These values were then reviewed to determine their impact on dose. In all cases the lowest K_d developed for each radionuclide from each sample type produced the highest site dose. GPU Nuclear then selected the most conservative K_d value for each radionuclide to represent all material types at the site, thus site soils and re-fill materials may be placed in any location at the site without exceeding site dose limits.

For C-14 and H-3, ANL recommended a value near 1 as the appropriate K_d to be used at the site based on the type of volumetric materials present. Since these values were recommended and not empirically derived, a review of the impact on dose at K_d values within a range of possible K_d values near 1 was conducted by GPU Nuclear, Inc. The results indicated that a default value of 0.25 for H-3 and 1 for C-14 would provide the greater impact on dose and therefore these values were selected for use when the probabilistic analysis indicated K_d was a non-sensitive parameter. When sensitive, the approach previously described using the 25th or 75th percentile of the RESRAD K_d default parameter set was selected.

6.2.2.2 Deterministic Approach

Prior to running RESRAD in the deterministic mode, a new input file containing information from probabilistic mode runs, was created as follows:

- Suppression of the uncertainty analysis.
- The 75th percentile value was used to replace the base-deterministic input value for those sensitive parameters with sensitivity coefficients greater than or equal to 0.25.
- The 25th percentile value was used to replace the base-deterministic input value for those sensitive parameters with sensitivity coefficients less than or equal to -0.25.
- The mean value was used to replace the base-deterministic input value for those sensitive parameters not bounded by the 25th and 75th percentile values.
- Except when the coefficients of sensitivity for the distribution coefficients (K_d) are greater than or equal to 0.25, the minimum Argonne developed K_d was used.

To determine the applicable DCGL values for each radionuclide, RESRAD was run in the deterministic mode with the revised input file. The summary report provided the peak dose, year of occurrence and pathway breakdown for each peak dose. The 25 mrem/yr dose limit was divided by the peak dose to determine a DCGL representing exposure from all pathways. This process was used for each radionuclide, soil region and SNEC area of concern. For 4 mrem/yr drinking water dose goal, the above process was repeated with all pathways turned off except for the drinking water pathway. Files generated for drinking water dose analysis were appended with DW.

6.2.2.3 Radionuclide Selection

To date, eleven (11) radionuclides have been identified as being significant dose contributors for the SNEC site with Cs-137 being identified as the most predominant. Reference 6-13 provides the analysis for determining site-related radionuclides. These radionuclides have been loaded into both RESRAD and DandD software codes to determine applicable DCGLs for each respective model. Guidance from NUREG/CR-3474 and NUREG/CR-0130 was used to first develop a comprehensive list of radionuclides that could potentially be found in media at the SNEC site, during its operation and post shutdown periods. From this list various criteria was used to deselect radionuclides. Information on site-specific radionuclides was also determined using results of characterization surveys, waste stream analyses and historical site assessments that are appropriate for each medium. Once a list was developed a 4-step process was used to deselect radionuclides that are not applicable to SNEC.

Step 1 - SNEC has been shut down for almost 30 years. All radionuclides with half lives less than 3 years have been deselected since they have decayed 10 half lives.

Step 2 - Over 500 samples in various media have been analyzed as part of the characterization process. Radionuclide results below minimum detectable activity (MDA) levels were deselected.

Step 3 - Radionuclides in media that were < 1% of the total mix activity and < 10% of the dose limit were also deselected. Per Appendix E of NUREG-1727 (Reference 6.5), radionuclides contributing < 10% of the dose limit can be screened out.

Step 4 - Evaluate which sample media contain certain radionuclides.

From this analysis, seven (7) nuclides were deselected for meeting the <1% of the mix and <10% of the dose limit criteria. Together, all these nuclides contributed 3.45% of the total dose limit (25 mrem/yr). DCGLs will be adjusted in the final site design process to take into account this small fraction of the dose limit. As a result of the deselection process and most recent characterization data, Table 6-1 has been developed listing radionuclides present at the SNEC site. This table represents the list of radionuclides potentially found in volumetric media and on structural surface areas.

Table 6-1

SNEC Radionuclide List

H-3	Eu-152
C-14	Pu-238
Co-60	Pu-239
Ni-63	Pu-241
Sr-90	Am-241
Cs-137	

To date the results of sample analyses at the SNEC site have provided no valid confirmation for the presence of Np-237 above minimum detectable activity (MDA). Since this radionuclide is a daughter of Am-241 there is a minimal possibility of it showing up as a positively identified radionuclide. In the DandD and RESRAD codes the computer analysis takes into account the dose of the parent and all the daughters in the decay chain. Therefore, Np-237 is accounted for in the dose analyses for Am-241 and not included in the list of radionuclides of concern for the SNEC site. This is similar to how Cs-137 (parent) and its daughter, Ba-137m, are treated in the dose analysis. Laboratory analyses are reviewed to ensure radionuclides in Table 6-1 continue to be representative of the site. Should a radionuclide appear which is not on Table 6-1, a technical analysis will be performed to determine its validity.

6.2.2.4 Contaminated Zone Description

The soil guideline (DCGL) is defined as the radiological concentration in soil that is acceptable if the site is to be used without radiological restrictions. The SNEC surface model is based on a maximum sized 10,000 m^2-contaminated area, one meter thick with no cover material. The concentration of a radionuclide is considered to exceed background concentrations if it is greater than the mean background plus twice the standard deviation of the background measurements. Based on years of radiological surveys at the site the 10,000 m^2 contaminated area dimension was selected as a dose model default parameter and is considered bounding. The one-meter thickness was selected based on remediation work conducted in 1994 at the site (Reference 6-14) and the average below grade groundwater level. For areas less than 10,000 m^2, area factors have been developed and listed in Chapter 5, Table 5-15. Soil at the SNEC site is defined as unconsolidated earth materials, including concrete and other structural debris that might be present.

The subsurface model calculates the dose from contaminants that may be in the saturated zone as a result of reuse of fill and debris materials. Subsurface materials for the Spray Pond and general site areas are very similar, consisting of approximately two meters of overburden and a greater thickness of underlying bedrock. The subsurface material in the SSGS consists of crushed, homogenized site construction debris that is covered with one meter of clean fill. Because of these differences, DCGLs were developed for only one material (homogenized debris) in the SSGS and for two materials (overburden and bedrock) in the Spray Pond and general areas.

6.2.2.5 Dose Calculation Times (years)

Radiation doses, health risks, soil guidelines and media concentrations are calculated over user-specified time intervals. The source is adjusted over time to account for radioactive decay and ingrowth, leaching, erosion and mixing. Although the regulatory recommendation is to use a 1000-year period, a 10,000-year period (more conservative assumption) was used to account for in-growth and decay of long-lived transuranic nuclides that have a potential impact on the ground water pathway dose. RESRAD uses a one-dimensional groundwater model that accounts for different transport of parent and daughter radionuclides with different distribution coefficients (K_d).

6.2.2.6 Site Geology and Hydrology

Subsurface investigations have been conducted at the SNEC Facility since 1981. The purpose of the investigations was to define the geologic and hydrogeologic characteristics at the site. Several of the early investigations focused on monitor well installations at key plant locations. Recent investigations examine groundwater trends beyond the immediate plant area at more distant locations in order to characterize a broader aspect of the geologic conditions, groundwater flow and hydraulic conductivity.

There is reportedly approximately 7 to 18 feet of overburden material overlying bedrock (a fractured siltstone). The overburden materials generally consist of a fill overlying a natural boulder layer in a dense sandy, silty, clay matrix. Groundwater occurs in both the overburden/bedrock interface and bedrock.

Groundwater flow is toward the northwest from the Facility in both the overburden/bedrock interface and bedrock. The direction of flow is not effected by seasonal water level changes.

The groundwater data indicates that the Raystown Branch of the Juniata River is a groundwater discharge feature. A subsurface discharge tunnel of a former coal fired generating station affects groundwater flow at the overburden/bedrock interface, acting as both a barrier and a drain. Groundwater flow in bedrock is controlled by northwest trending fractures.

Site-specific geometry (cross-section view) and hydrology data were used for input into the RESRAD code. This input data was based on studies conducted by a contracted geology firm (Reference 6-17) or default parameters determined by the RESRAD code, whichever was more conservative.

6.2.2.7 Chemical Form and K_ds

The chemical form of the SNEC residual radioactivity is bounded by the use of the default dose conversion factors (DCFs) in the RESRAD 6.1 code. These DCF values are based on chemical form information in Federal Guidance Report # 11 that give the individual the highest dose per unit intake.

Distribution coefficient (K_d) values are used in the RESRAD 6.1 code to predict the behavior of radionuclides in soil. Argonne National Laboratory has conducted tests and provided K_d measurements on SNEC soils and fill materials. Results of these tests are contained in Reference 6-15.

6.2.2.8 Water Transport Parameters

The well from which water is withdrawn for domestic use or irrigation is conservatively assumed to be located either in the center of the contamination zone (in the mass balance, MB, model) or at the downgradient edge of the contaminated zone (in the nondispersion, ND, model). For either location, radionuclides are assumed to enter the well as soon as they reach the water table. Usually, the MB model is used for smaller contaminated areas (e.g. 1000 m^2 or less) and the ND model is used for larger areas. For the SNEC surface model the ND input was used as the RESRAD input. For the SNEC subsurface model the MB input was used.

6.2.2.9 Volumetric Area Factors

Volumetric area factors were developed using RESRAD 6.1 and SNEC inputs for the surface modeling parameters (Reference 6-9). In the base-case surface model the contaminated fraction of plant, meat and milk products was assumed to equal one (1) using the resident farmer scenario. Default values of –1 were substituted for these three input parameters for areas less than 10,000 m^2. This was done so RESRAD could also scale smaller contaminated areas (2500 m^2, 400 m^2, 100 m^2, 25 m^2, and 1 m^2). The three default parameter values (-1) appropriately size the contaminated fractions of plants, meat and milk obtained from the site when smaller and smaller area sizes are input into the RESRAD computer code. Volumetric area factors for SNEC are listed in Table 5-15.

6.3 DCGL SUMMARY & DOSE ASSESSMENT

The DandD and RESRAD codes were run to determine compliance with 10CFR20.1402. DCGL results are listed in Table 6-2. Detailed information from dose modeling computer runs is contained on electronic media (CD-ROM) that has been submitted to the NRC (Reference 6-12).

Table 6-2

SNEC Facility DCGL Values [a]

Radionuclide	25 mrem/y Limit Surface Area (dpm/100cm^2)	25 mrem/y Limit (All Pathways) Open Land Areas (Surface & Subsurface) (pCi/g)	4 mrem/y Goal (Drinking Water) Open Land Areas [b] (Surface & Subsurface) (pCi/g)
Am-241	2.7E+01	9.9	2.3
C-14	3.7E+06	2	5.4
Co-60	7.1E+03	3.5	67
Cs-137	2.8E+04	6.6	397
Eu-152	1.3E+04	10.1	1440
H-3	1.2E+08	132	31.1
Ni-63	1.8E+06	747	1.9E+04
Pu-238	3.0E+01	1 8	0.41
Pu-239	2.8E+01	1.6	0.37
Pu-241	8.8E+02	86	19 8
Sr-90	8.7E+03	1.2	0.61

Footnotes:

a) While drinking water DCGLs will be used by SNEC to meet the drinking water 4 mrem/yr goal, only the DCGL values that constitute the 25 mrem/yr regulatory limit will be controlled under this LTP and the NRC's approving license amendment.

b) Listed values are from the subsurface model. These values are most conservative between the two models (i e. surface & subsurface).

The dose assessment using these values indicates that the dose will be below 25 mrem/year TEDE release limit and the 4 mrem/year groundwater dose goal. Therefore, there is a high degree of confidence that additional refinement of the source terms and modeling assumptions are unnecessary and the site can be released for unrestricted use.

7.0 UPDATE OF THE SITE-SPECIFIC DECOMMISSIONING COSTS

NRC's request for additional information dated November 8, 2000 requested additional information with respect to the site-specific decommissioning cost information provided in Revision 0 of the SNEC License Termination Plan. GPU Nuclear's response to this request was reviewed and accepted by the NRC in conjunction with their review of the merger between FirstEnergy Corp. and GPU, Inc. The adequacy of decommissioning funding assurance for the SNEC Facility was documented by the Nuclear Regulatory Commission in the "Order Approving Application Regarding Proposed Merger of GPU, Inc. and FirstEnergy Corp. – Saxton Nuclear Experimental Facility (TAC NO. MB0215)" dated March 7, 2001.

Since that time the cost and schedule associated with the current Containment Vessel (CV) concrete removal project has exceeded what was assumed in this response. This has resulted in an overall $7 million increase in the remaining project cost beyond the $19.8 million estimate provided in GPU Nuclear letter E910-01-002 dated February 14, 2001, "Partial Response to Request for Additional Information, RE: License Termination Plan, (TAC NO. MA8076) dated November 8, 2000). Thus the current overall project cost estimate is approximately $63 million. As of July 31, 2002 approximately $51 Million has been spent on the SNEC Decommissioning Project. Thus the remaining cost to complete the project is approximately $12 Million. Table 7-1 provides a breakdown of the remaining costs.

GPU Nuclear Letter E910-01-004, dated February 19, 2001, "Parent Guarantee for Decommissioning Funding" committed the SNEC Owners to carry out the required activities or setup a trust fund in favor of the NRC in the event GPU Nuclear failed to perform the required decommissioning activities. The amount of this guarantee is $20 million, which exceeds the remaining cost estimate of $12 million. Thus adequate funding exists to complete the project.

Table 7-1

Outstanding Decommissioning Work

Cost Element	2002 Budget (08/01-12/31)	2003 Budget	Total
Project Management	189,000	179,000	368,000
Engineering	197,000	140,000	337,000
Radiological Controls	315,000	0	315,000
QA-Licensing	480,000	170,000	650,000
Miscellaneous	326,000	197,000	523,000
Radioactive Waste	3,527,000	148,000	3,675,000
Material & Supplies	143,000	150,000	293,000
Site Restoration	100,000	743,000	843,000
Final Status Survey	759,000	931,000	1,690,000
Communications	46,000	47,000	93,000
Decon & Dismantlement	1,892,000	0	1,892,000
Overheads	319,000	935,000	1,254,000
Total	8,293,000	3,640,000	11,933,000

Re Memo # E910-02-054

Attachment 3

Calculation No. 6900-02-025

GPU NUCLEAR

CALCULATION COVER SHEET

Subject:	Calculation No.	Revision Number
Multiple Source Term Bounding Calculation	6900-02-025	0

DESCRIPTION OF REVISION

	Signature	Date
Originator	B. Brosey/ B. Brosey	10/6/02
Reviewer	J.P. Donnachie/ J.P. Donnachie	10/7/02
Additional Reviewer		
Additional Reviewer		
Additional Reviewer		
Management Approval	AF Paynter Art Paynter	07Oct02

GPU NUCLEAR

Calculation Sheet

Subject	Calc. No.	Rev. No.	Sheet No.
Multiple Source Term Bounding Calculation	6900-02-025	0	1 of 44

Originator	Date	Reviewed by	Date
Barry H. Brosey B. Brosey	October 6, 2002	J. P. Donnachie	10/7/02

1.0 PROBLEM STATEMENT

1.1 The purpose of this calculation is to provide a bounding estimate of dose from multiple source terms found on and/or in remediated structures and plant piping at the SNEC site.

1.2 Areas are assumed to have residual contamination residing on the surface and be volumetrically contaminated. Doses are assumed to be additive, producing an upper bounding estimate of dose within the SSGS area. Areas reviewed include the following:

- Dose from activation products found in the steel of the SNEC CV is augmented with dose from residual surface contamination.
- Concrete surfaces in the SSGS area are described as a two component source term, with a surface contamination component and a volumetric component.
- Volumetrically contaminated piping is treated as a separate dose contributor.

2.0 SUMMARY OF RESULTS

2.1 The results of this evaluation demonstrate that the dose from residual pipe sections will be extremely small when compared with the 25 mrem/y limit imposed by 10 CFR 20. In addition, the dose from activated steel within the SNEC CV when added to the dose resulting from surface contamination in this structure will be controlled by the equation shown in Section 4.1.

3.0 REFERENCES

3.1 Microsoft Excel 97, Microsoft Corporation Inc., SR-2, 1985-1997.

3.2 GPU Nuclear Calculation No. 6900-02-011, "CV Stiffener Region Radionuclide Mix – Pre-Survey", 3/12/02.

3.3 SNEC License Termination Plan Draft (LTP), Revision 1, 2002.

3.4 GPU Nuclear Calculation No. 6900-02-019, "Interior CV Weld Ring Areas @ 792.5 ft. El – Survey Plan", 6/24/02.

3.5 "Embedded Pipe Radiation Survey Report", for GPU Nuclear, Saxton Nuclear Experimental Corporation, Saxton, PA, by CoPhysics Corporation, 1242 Route 208, Monroe, NY, 10950, October 2001 to January 2002.

4.0 ASSUMPTIONS AND BASIC DATA

4.1 This estimate considers applicable radionuclide concentrations found at the SNEC site, and applies the sum of fractions methodology presented in Chapter 6, Revision 1 of the SNEC License Termination Plan, when summing multiple source term dose. The equation for this type of summation process is shown below.

Equation 6-1 from SNEC LTP (Reference 3.3)

$$\sum_{i=1}^{n}\left(\frac{C_{si}}{DCGL_{si}}+\frac{C_{vi}}{DCGL_{vi}}\right)+\left[\frac{Direct\ \gamma\ Dose}{25}\right]\leq 1$$

Calculation Sheet

GPU NUCLEAR

Subject	Calc. No.	Rev. No.	Sheet No.
Multiple Source Term Bounding Calculation	6900-02-025	0	2 of 44
Originator Barry H. Brosey B. Brosey / **Date** October 6, 2002	**Reviewed by** J. P. Donnachie		**Date** 10/7/02

Where: C_{si} = Surface contamination of radionuclide i (dpm/100 cm^2).

C_{vi} = Specific volume concentration of radionuclide i (pCi/g).

$DCGL_{si}$ = Surface contamination DCGL of radionuclide i from Table 6-2 of **Reference 3.3**.

$DCGL_{vi}$ = Volumetric DCGL (25 mrem/yr) of radionuclide i from Table 6-2 of **Reference 3.3**.

Direct γ Dose = MicroShield (or equivalent) shielding code calculation (mrem/yr).

4.2 SNEC sample analysis results for a sample taken in the area of the 792' El support ring survey, indicated that a gross survey unit limit of 3700 dpm/100 cm2 (for Cs-137) would be the maximum limit for that support ring location (SNEC Sample No. SXSD3055). See Attachment 1-1 & 1-2. This surface source mix is a conservative estimate for the entire interior surface of the CV steel shell.

4.3 Activation samples from the SNEC CV steel structure were examined by an off-site laboratory and the results of these analysis are provided in Attachment 2-1 to 2-10.

4.4 The SSGS footprint area including the Discharge Tunnel is contaminated with radionuclide concentrations similar to that found in the following samples. Sample identification numbers are shown below. See Attachments 3-1 to 3-12. In general, these sample materials indicate that the effective DCGL is near 6 pCi/g for Cs-137 (as the surrogate).

1) SXSD723   2) SXCF828   3) SX10SD00366   4) SXSD1377

4.5 The SSGS Discharge Tunnel is assumed to be contaminated with the materials found in sample SX10SD990033, which was taken from the nuclear plant effluent discharge line. This material is similar to that found in the SSGS area. See **Attachment 4-1 to 4-3.**

4.6 For purposes of this bounding analysis, radioactive decay is not considered.

4.7 For purposes of this calculation, it is assumed that a person spends 50% of the time on-site and 50% of the time at point "A" on **Attachment 5-1**. This location is 0.5 meters from the CV shell wall at the center of the activated region.

4.8 The thickness of the CV steel shell is assumed to be 11/16 inches (1.75 cm). Steel is assumed to have a density of 7.86 g/cc. The Co-60 concentration input to the MicroShield computer shielding code is (1.95 pCi/g x 7.86 g/cc)/1E+06 pCi/uCi = 1.5327E-05 uCi/cc.

GPU NUCLEAR

Calculation Sheet

Subject	Calc. No.	Rev. No.	Sheet No.
Multiple Source Term Bounding Calculation	6900-02-025	0	3 of 44
Originator: Barry H. Brosey B. Brosey — Date: October 6, 2002	Reviewed by: J. P. Donnachie J. P. Donnachie	Date: 10/7/02	

5.0 CALCULATION

5.1 Two scenarios have been evaluated within this calculation. They are:

5.1.1 Bounding Limit 1 - Dose from an activated region of the SNEC CV steel shell is coupled with the dose from surface contamination.

5.1.2 Bounding Limit 2 - Dose from post remediation surface contamination and volumetric contamination of concrete surfaces within the SSGS Discharge Tunnel are combined with several hypothetical direct exposures from pipe sections.

5.2 Bounding Limit 1

5.2.1 Sampling of the SNEC CV steel shell in the region where activation has occurred, has shown that the average concentration of Co-60 in the sampled region is ~1.95 pCi/g ± 0.74 pCi/g (for purposes of this bounding estimate MDA values are included in the average). See **Attachment 2.**

5.2.2 On **Attachment 5-1,** the activated region of the CV shell is assumed to be made up of three individual plates X, Y and Z, with a Co-60 concentration as described in 5.2.1 above. Each plate is 30 degrees of circumference or ~39.2 feet/3 = 13 feet wide. The height of these plates is assumed to be 20 feet.

5.2.3 Three models were run in MicroShield. The first run (CVSHELL.MS5) was for plate Y and yielded an exposure rate of 2.541E-03 mR/h (2.541 uR/h). The second run (CVXPLUS.MS5) was for plate X and Z and yielded an exposure rate of 9.474E-04 mR/h (0.9474 uR/h). The third run (CVMINUS.MS5) yielded an exposure rate of 5.724E-04 mR/h (0.5724 uR/h) which must be subtracted from the previous run to adjust for the off center characteristics of plates X and Z. Then the exposure rate at the center of the activated region is estimated to be 2.541 + 2 x (0.9474 – 0.5724) = 3.291 uR/h. See **Attachments 5-2 to 5-7.**

5.2.4 3.291 uR/h x 8766 hrs/year x 0.5 site occupancy x 0.5 occupancy at dose point A in **Attachment 5-1,** yields 7.2 mR which is approximately 7.2 mrem. Residual surface contamination on the CV shell can therefore not contribute more than 25 mrem - 7.2 mrem = 17.8 mrem.

5.2.5 Contamination on the CV surface is assumed to have a maximum effective DCGL (using Cs-137 as a surrogate) of ~3700 dpm/100 cm^2 (see Section 4.2). This represents a 25 mrem dose from residual surface contamination and must be adjusted downward because of the direct exposure rate from the activated metal. Therefore, the residual surface contamination should not be more than (17.8/25) x 3700 = ~ 2600 dpm/100 cm^2 in the region of the activated steel. The equation used to combine dose is:

$$\frac{2600\,dpm/100\,cm^2}{3700\,dpm/100\,cm^2}+\frac{7.2\,mrem}{25\,mrem}\le 1$$

GPU NUCLEAR

Calculation Sheet

Subject	Calc. No.	Rev. No.	Sheet No.
Multiple Source Term Bounding Calculation	6900-02-025	0	4 of 44

Originator	Date	Reviewed by	Date
Barry H. Brosey B. Brosey	October 6, 2002	J. P. Donnachie JP Donnachie	10/7/02

5.3 Bounding Limit 2

5.3.1 The SSGS area has similar radionuclide mix characteristics. See **Attachments 3-1 to 3-12**. Using the source term and effective DCGLs provided on **Attachment 4-1** and **4-2**, it can be seen that surface contamination in the Discharge Tunnel cannot be more than ~8150 dpm/100 cm^2 for Cs-137 on concrete and steel surfaces, and volumetric contamination would have to be below 6.38 pCi/g (Cs-137). As an example, if residual surface contamination was remediated to ~20% of the 8150 dpm/100 cm^2 (or about 1630 dpm/100 cm^2), then volumetric contamination within the Discharge Tunnel would be maintained below 80% of the 6.38 pCi/g limit or about 5.1 pCi/g. Additionally, any dose resulting from remaining contaminated pipe sections would be considered using the equation presented in Section 4.1, and may result in an additional reduction in the above values. However, most contaminated pipe runs have been removed from the SSGS area including those in the Discharge Tunnel, leaving only short pipe stubs less than ~2 foot in length and one 18" tie line that connects the Intake Tunnel and Discharge Tunnels.

5.3.2 From **Reference 3.5**, the maximum contamination level found in remaining piping located in the SSGS area, is approximately 5.6 pCi/g (Cs-137) (see Table 4.10, **Reference 3.5**). This is very near the maximum permissible limit of 6.38 pCi/g (for Cs-137 as a surrogate) listed above for the SSGS area in general (assumes sample number SX10SD990033 has been chosen to represent the SSGS area).

Note that the cross-over sump piping in the SSGS footprint was more highly contaminated but was completely remediated from the SSGS facility (see Table 4.3, **Reference 3.5**).

5.3.3 To estimate an upper bounding dose contribution from one pipe end in the SSGS area or Discharge Tunnel, it is assumed that the pipe end is completely filled with contaminated materials. It is also assumed that the pipe is 2 feet long and jutting out perpendicularly from one wall. An 8 inch diameter pipe size from **Reference 3.5** was used as the model. The mix is assumed to contain 6.38 pCi/g Cs-137 and 0.04 pCi/g Co-60 (the effective DCGL). The impact of pipe wall shielding was ignored and the density of the fill materials is assumed to be 1.4 g/cc. The dose point is assumed to be 0.5 meters from the pipe stub end. MicroShield input concentrations are shown below.

Cs-137 concentration = (6.38 pCi/g x 1.4 g/cc)/1E+06 pCi/uCi = 8.932E-06 uCi/cc

Co-60 concentration = (0.04 pCi/g x 1.4 g/cc)/1E+06 pCi/uCi = 5.6E-08 uCi/cc.

5.3.4 The results from the MicroShield run indicates that a dose rate of 5.107E-05 mR/h (0.051 uR/h) would be generated from this model. See **Attachments 6-1** and **6-2**. Using the same assumptions of Section 5.2.4, the yearly dose from this pipe model is 8766 hrs/yr x 0.5 x 0.5 x 0.051 uR/h = 112 uR = 0.112 mR = ~0.112 mrem. This evaluation would be performed for relevant pipe sections remaining in the SSGS area and any residual dose would be considered within the equation listed in Section 4.1. This bounding estimate is an exaggerated case since the pipe is assumed to be completely filled with contaminated materials at the maximum concentration allowed.

5.3.5 In case two (2), a 10' section of the 18" cross-over tie line is assumed to be contaminated to the same concentration level as in 5.3.4 above for the pipe stub end. The tie line has been confirmed to be essentially empty with only residual surface deposits remaining at about 4 pCi/g Cs-137 (see **Reference 3.5**), but for purposes of this bounding calculation the assumptions previously stated will be used. Additionally, the contaminant materials are assumed to be held up in a 1" thick layer on the internal surface of the pipe. The wall thickness is assumed to be 0.562" (schedule 40). The dose point is assumed to be 0.5 meters from the pipe at the center of the pipes length.

5.3.6 The results from the MicroShield run indicates that a dose rate of 1.254E-04 mR/h (0.1254 uR/h) would be generated from this model. See **Attachments 6-3** and **6-4**. Using the same assumptions of Section 5.2.4, the yearly dose from this pipe model is 8766 hrs/yr x 0.5 x 0.5 x 0.1254 uR/h = 275 uR = 0.275 mR = ~0.275 mrem. This bounding estimate is an exaggerated case since the pipe is assumed to contain contaminated materials at the maximum concentration allowed.

5.3.7 Assuming that there are three (3) stub end pipe sections and the 18" tie line in the same area, the total gamma dose would be:

(0.112 mrem) x 3 + 0.275 mrem = 0.611 mrem from exposed pipe sections at the maximum allowed concentration. Then the dose controling equation for this area of the SNEC SSGS is:

$$\frac{X\,dpm/100\,cm^2}{8150\,dpm/100\,cm^2}+\frac{Y\,pCi/g}{6.38\,pCi/g\,(Cs-137\,Surrogate)}+\frac{0.611\,mrem}{25\,mrem}\leq 1$$

Since the area has no more than about 2 pCi/g of Cs-137 present in the surrounding concrete volumes, the permissible surface contamination limit on all surfaces in the area cannot be more than:

1 - 0.337 = 0.662 or 66.2% of the 8150 dpm/100 cm^2 surface contamination limit for this area or about 5300 dpm/100 cm^2 (see **Attachment 4-2** for permissible sum of fractions calculation for surface contamination). Thus area dose would be controlled by the bounding conditions.

6.0 LIST OF ATTACHMENTS

6.1 Attachments 1-1 to 1-2, "Sample Results for the Steel CV Shell", Sample No.SXSD3055.

6.2 Attachments 2-1 to 2-10, "CV Steel Shell Samples", Samples SXST3067 to 3087.

6.3 Attachment 3-1 to 3-12, Examples of Sample Materials from the SSGS Footprint Area.

6.4 Attachments 4-1 to 4-3, "Sample Results from the Discharge Tunnel", Sample SX10SD990033.

6.5 Attachments 5-1 to 5-7, Diagram and Layout for the MicroShield runs of the CV Steel Shell.

6.6 Attachments 6-1 to 6-4, MicroShield Run for 8" and 18" Diameter Pipe Models.

ATTACHMENT 1.1

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

Total Allowable Limit (a+b)		Cs-137 Allowable Limit	
4256	dpm/100 cm^2	3707	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		2780	dpm/100 cm^2

SAMPLE NO(s)⇒ CV Steel Shell Scraping - Interior @ 792' El

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241	4.98E-01	0.342%	27	14.54	13.46	N/A	14.54	Am-241
2	C-14	4.90E-01	0.336%	3,700,000	14.30	0.00	14.30	N/A	C-14
3	Co-60	1.21E+00	0.830%	7,100	35.32	0.12	35.32	N/A	Co-60
4	Cs-137	1.27E+02	87.101%	28,000	3707.25	3.31	3707.3	N/A	Cs-137
5	Eu-152		0.000%	13,000	0.00	0.00	0.00	N/A	Eu-152
6	H-3	2.88E+00	1.975%	120,000,000	84.07	0.00	Not Detectable	N/A	H-3
7	Ni-63	9.53E+00	6.536%	1,800,000	278.19	0.00	Not Detectable	N/A	Ni-63
8	Pu-238	1.12E-01	0.077%	30	3.27	2.72	N/A	3.27	Pu-238
9	Pu-239	8.33E-02	0.057%	28	2.43	2.17	N/A	2.43	Pu-239
10	Pu-241	3.85E+00	2.640%	880	112.39	3.19	Not Detectable	N/A	Pu-241
11	Sr-90	1.55E-01	0.106%	8,700	4.52	0.01	4.52	N/A	Sr-90
			100.000%		4256	25.0	3761	20	
					Maximum Permissible dpm/100 cm^2				

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SNEC SAMPLE RESULTS

LAB or LAB No.	Location/Description
Teledyne-75451; L18556-2	CV Steel Shell Scrapings - Interior @ ~792' El (C & D QAD)
SNEC Sample No.	Comments:
SXSD3055	
Other Identifier	
CV Dome Other	
Analysis Date=>	***June 18, 2002***

	Isotope	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
1	Am-241	< 0.498
2	C-14	0.49
3	Cm-243	< 0.179
4	Cm-244	< 0.179
5	Co-60	1.21
6	Cs-134	< 8.99E-02
7	Cs-137	127
8	Eu-152	—
9	Eu-154	—
10	Eu-155	—
11	Fe-55	< 16.1
12	H-3	2.88
13	Nb-94	—
14	Ni-59	—
15	Ni-63	< 9.53
16	Pu-238	< 0.112
17	Pu-239	0.0833
18	Pu-240	0.0833
19	Pu-241	< 3.85
20	Pu-242	—
21	Sb-125	—
22	Sr-90	0.155
23	Tc-99	< 0.322
24	U-234	0.824
25	U-235	< 1.28E-02
26	U-238	0.754

Other Isotopes	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
On-site Analysis for Cs-137	—
On-site Analysis for Co-60	—
On-site Analysis for H-3	—
I-129	< 0.0692
Gross Alpha	—
Gross Beta	—
K-40	2.6
Ra-226	< 3.5
Th-232	—
Cm-242	< 0.196
Th-228	< 0.837
Np-237	0.293
Ce-144	< 6.75E-01

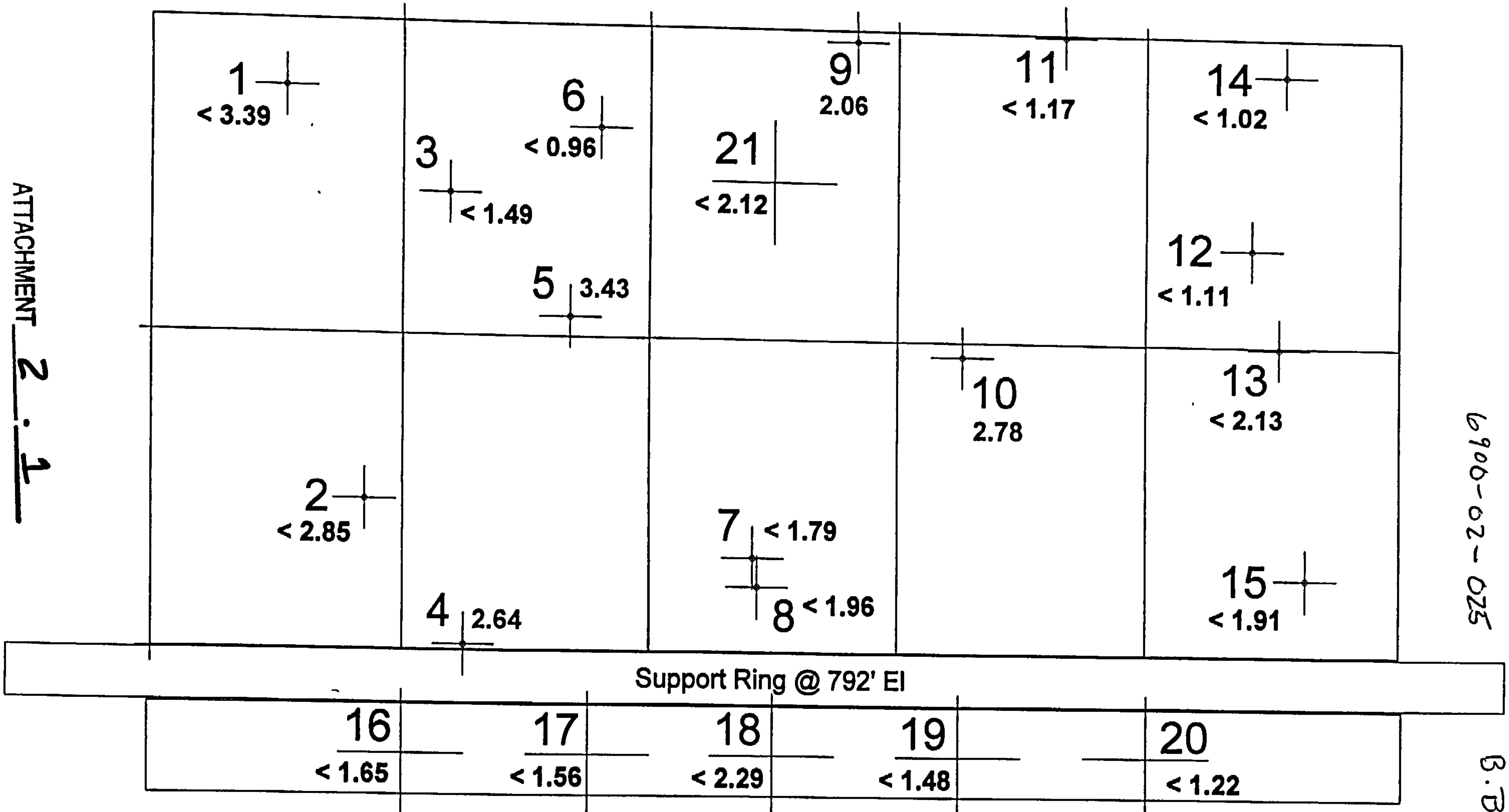
ATTACHMENT 1 . 2

Sample Plan - Activation Zone

20' by 10' AREA of CV Shell - Ten 20 ft^2 Zones

(Co-60 Concentrations in pCi/g)

ATTACHMENT 2.1



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08/27/02 TUE 15:07 FAX 804 522 6860 BWXT SERVICES

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B. Brosey
10/6/02

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BWX Technologies, Incorporated
BWXT Services, Inc.

Nuclear & Environmental Operations
2016 Mt. Athos Road
Lynchburg, VA 24504-5447

FAX Number: (434) 522-6860

FAX TRANSMITTAL COVER PAGE

To: Barry Brosey Fax No.: 717-948-8878

To: — Fax No.: —

From: Jim Clark Phone: 434-522-6738

Message: Data Report – 59,63Ni results added.

Number of Pages: 7 Including Cover Page

Date: 8/27/02

ATTACHMENT 2 . 2

A N A L Y S I S   R E P O R T

BWXT Services, Inc. - NEL Services • 2016 Mt. Athos Rd. • Lynchburg, VA 24504-5447 • (434) 522-5165 • Fax (434) 522-6860

Report Date:	August 27, 2002	**Report #:**	0207047	**NELS Contract #:**	1030-003-10-01
Customer:	GPU Nuclear/Saxton	**Customer Contact:**	Barry Brosey	**Customer Authorization #:**	0760084 (CN-1)
Project Description:	SNEC Metal Samples	**Sample Description:**		See Attached Cust COC	
Sample Receipt Date:	July 18, 2002	**Sample Collection/Reference Date:**		See Attached Cust COC	
		Total pages in this report:		6 including 2 page(s) of attachments	

Comments: Co-60 and Cs-137 MDA's elevated as the result of limited sample quantity.
Note: Some Ni-59 / Ni-63 MDA's elevated due to matrix interference.

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date	Comments
SX-ST-3067	0207047-01	EPA 901.1	Co-60	MDA	NA	1.39	pCi/g	07/25/02	07/25/02	
SX-ST-3067	0207047-01	EPA 901.1	Cs-137	16.90	2 48	2 76	pCi/g	07/25/02	07/25/02	
SX-ST-3067	0207047-01	LEPS	Ni-59	MDA	NA	261.60	pCi/g	08/20/02	08/21/02	Note
SX-ST-3068	0207047-01	Liq Scint	Ni-63	MDA	NA	10.35	pCi/g	08/20/02	08/26/02	Note
SX-ST-3068	0207047-02	EPA 901.1	Co-60	MDA	NA	2.85	pCi/g	07/25/02	07/25/02	
SX-ST-3068	0207047-02	EPA 901.1	Cs-137	59 00	3.80	2 30	pCi/g	07/25/02	07/25/02	
SX-ST-3068	0207047-02	LEPS	Ni-59	MDA	NA	25 89	pCi/g	08/20/02	08/21/02	
SX-ST-3069	0207047-02	Liq Scint	Ni-63	MDA	NA	10.36	pCi/g	08/20/02	08/26/02	
SX-ST-3069	0207047-03	EPA 901.1	Co-60	MDA	NA	1.49	pCi/g	07/25/02	07/25/02	
SX-ST-3069	0207047-03	EPA 901 1	Cs-137	2 26	0 64	0.92	pCi/g	07/25/02	07/25/02	
SX-ST-3069	0207047-03	LEPS	Ni-59	MDA	NA	85 12	pCi/g	08/20/02	08/21/02	Note
SX-ST-3070	0207047-03	Liq Scint	Ni-63	MDA	NA	10.96	pCi/g	08/20/02	08/26/02	
SX-ST-3070	0207047-04	EPA 901.1	Co-60	2.64	1.07	1 52	pCi/g	07/25/02	07/25/02	
SX-ST-3070	0207047-04	EPA 901.1	Cs-137	180 00	5 84	1 83	pCi/g	07/25/02	07/25/02	
SX-ST-3070	0207047-04	LEPS	Ni-59	MDA	NA	72 84	pCi/g	08/20/02	08/21/02	Note
SX-ST-3071	0207047-04	Liq Scint	Ni-63	20.23	7.57	10.80	pCi/g	08/20/02	08/26/02	
SX-ST-3071	0207047-05	EPA 901.1	Co-60	[illegible]	1.07	1 56	pCi/g	07/25/02	07/26/02	
SX-ST-3071	0207047-05	EPA 901.1	Cs-137	9.26	1 09	1 34	pCi/g	07/25/02	07/26/02	
SX-ST-3071	0207047-05	LEPS	Ni-59	MDA	NA	182.82	pCi/g	08/20/02	08/21/02	Note
SX-ST-3072	0207047-05	Liq Scint	Ni-63	MDA	NA	[illegible]	pCi/g	08/20/02	08/26/02	Note

[1] All results are reported "as received" unless otherwise specified: (d) = dry weight, (w)=wet weight

ATTACHMENT 2.3

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ANALYSIS REPORT

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Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date	Comments
SX-ST-3072	0207047-06	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/26/02	
SX-ST-3072	0207047-06	EPA 901.1	Cs-137	1.12	0.43	0.60	pCi/g	07/25/02	07/26/02	
SX-ST-3072	0207047-06	LEPS	Ni-59	MDA	NA	61.62	pCi/g	08/20/02	08/21/02	Note
SX-ST-3073	0207047-06	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3073	0207047-07	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/29/02	
SX-ST-3073	0207047-07	EPA 901.1	Cs-137	3.03	0.77	1.04	pCi/g	07/25/02	07/29/02	
SX-ST-3073	0207047-07	LEPS	Ni-59	MDA	NA	33.15	pCi/g	08/20/02	08/21/02	
SX-ST-3074	0207047-07	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3074	0207047-08	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/31/02	
SX-ST-3074	0207047-08	EPA 901.1	Cs-137	3.36	1.15	1.67	pCi/g	07/25/02	07/31/02	
SX-ST-3074	0207047-08	LEPS	Ni-59	MDA	NA	31.51	pCi/g	08/20/02	08/23/02	
SX-ST-3075	0207047-08	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3075	0207047-09	EPA 901.1	Co-60	[redacted]	0.68	0.94	pCi/g	07/25/02	07/29/02	
SX-ST-3075	0207047-09	EPA 901.1	Cs-137	1.37	0.53	0.79	pCi/g	07/25/02	07/29/02	
SX-ST-3075	0207047-09	LEPS	Ni-59	MDA	NA	9.21	pCi/g	08/20/02	08/21/02	
SX-ST-3076	0207047-09	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3076	0207047-10	EPA 901.1	Co-60	[redacted]	0.85	1.17	pCi/g	07/25/02	07/31/02	
SX-ST-3076	0207047-10	EPA 901.1	Cs-137	24.80	1.49	1.02	pCi/g	07/25/02	07/31/02	
SX-ST-3076	0207047-10	LEPS	Ni-59	MDA	NA	24.35	pCi/g	08/20/02	08/21/02	
SX-ST-3077	0207047-10	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3077	0207047-11	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/29/02	
SX-ST-3077	0207047-11	EPA 901.1	Cs-137	MDA	NA	1.16	pCi/g	07/25/02	07/29/02	
SX-ST-3077	0207047-11	LEPS	Ni-59	MDA	NA	32.61	pCi/g	08/20/02	08/22/02	
SX-ST-3078	0207047-11	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3078	0207047-12	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/26/02	
SX-ST-3078	0207047-12	EPA 901.1	Cs-137	2.30	0.52	0.72	pCi/g	07/25/02	07/26/02	
SX-ST-3078	0207047-12	LEPS	Ni-59	MDA	NA	186.79	pCi/g	08/20/02	08/22/02	Note
SX-ST-3079	0207047-12	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	Note

[1] All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

ATTACHMENT 2.4

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B. Brown 10/8/02

ANALYSIS REPORT

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ATTACHMENT 2.5

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date	Comments
SX-ST-3079	0207047-13	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/29/02	
SX-ST-3079	0207047-13	EPA 901.1	Cs-137	5.08	1.09	1.41	pCi/g	07/25/02	07/29/02	
SX-ST-3079	0207047-13	LEPS	Ni-59	MDA	NA	38.84	pCi/g	08/20/02	08/26/02	
SX-ST-3080	0207047-13	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3080	0207047-14	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/29/02	
SX-ST-3080	0207047-14	EPA 901.1	Cs-137	1.90	0.52	0.65	pCi/g	07/25/02	07/29/02	
SX-ST-3080	0207047-14	LEPS	Ni-59	MDA	NA	42.97	pCi/g	08/20/02	08/26/02	
SX-ST-3081	0207047-14	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3081	0207047-15	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/29/02	
SX-ST-3081	0207047-15	EPA 901.1	Cs-137	3.44	0.96	1.45	pCi/g	07/25/02	07/29/02	
SX-ST-3081	0207047-15	LEPS	Ni-59	MDA	NA	13.20	pCi/g	08/20/02	08/26/02	
SX-ST-3082	0207047-15	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3082	0207047-16	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/30/02	
SX-ST-3082	0207047-16	EPA 901.1	Cs-137	3.00	0.86	1.15	pCi/g	07/25/02	07/30/02	
SX-ST-3082	0207047-16	LEPS	Ni-59	MDA	NA	37.40	pCi/g	08/20/02	08/26/02	
SX-ST-3083	0207047-16	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3083	0207047-17	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/30/02	
SX-ST-3083	0207047-17	EPA 901.1	Cs-137	MDA	NA	1.69	pCi/g	07/25/02	07/30/02	
SX-ST-3083	0207047-17	LEPS	Ni-59	MDA	NA	39.32	pCi/g	08/20/02	08/26/02	
SX-ST-3084	0207047-17	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3084	0207047-18	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/26/02	
SX-ST-3084	0207047-18	EPA 901.1	Cs-137	2.55	0.94	1.38	pCi/g	07/25/02	07/26/02	
SX-ST-3084	0207047-18	LEPS	Ni-59	MDA	NA	97.43	pCi/g	08/20/02	08/23/02	Note
SX-ST-3085	0207047-18	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3085	0207047-19	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/30/02	
SX-ST-3085	0207047-19	EPA 901.1	Cs-137	MDA	NA	1.38	pCi/g	07/25/02	07/30/02	
SX-ST-3085	0207047-19	LEPS	Ni-59	MDA	NA	41.33	pCi/g	08/20/02	08/26/02	

[1] All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

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B. Brown 10/6/02

A N A L Y S I S   R E P O R T

BWXT Services, Inc. - NEL Services • 2016 Mt. Athos Rd. • Lynchburg, VA 24504-5447 • (434) 522-5165 • Fax (434) 522-6860

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date	Comments
SX-ST-3086	0207047-19	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	
SX-ST-3086	0207047-20	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/26/02	
SX-ST-3086	0207047-20	EPA 901.1	Cs-137	MDA	NA	1.13	pCi/g	07/25/02	07/26/02	
SX-ST-3086	0207047-20	LEPS	Ni-59	MDA	NA	280.85	pCi/g	08/20/02	08/26/02	Note
SX-ST-3087	0207047-20	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	Note
SX-ST-3087	0207047-21	EPA 901.1	Co-60	MDA	NA	[redacted]	pCi/g	07/25/02	07/31/02	
SX-ST-3087	0207047-21	EPA 901.1	Cs-137	MDA	NA	1.45	pCi/g	07/25/02	07/31/02	
SX-ST-3087	0207047-21	LEPS	Ni-59	MDA	NA	14.65	pCi/g	08/20/02	08/26/02	
SX-ST-3087	0207047-21	Liq Scint	Ni-63	MDA	NA	[redacted]	pCi/g	08/20/02	08/26/02	

ATTACHMENT 2.6

6900-02-025

Data Released By: James L. Clark   Date: 8/27/02

Name /Title: James L. Clark / Project Manager

Unless noted as a comment, this report meets all requirements of NELAC

[1] All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

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ANALYSIS REPORT

BWXT Services, Inc. - NEL Services • 2016 Mt. Athos Rd. • Lynchburg, VA 24504-5447 • (434) 522-5165 • Fax (434) 522-6860

ATTACHMENT 2.7

Exhibit

0207047

SNEC SAMPLE ANALYSIS REQUEST SHEET

DESTINATION : BWXT

Sample Description/Sample Location	Lab ID Number *	Start Date/Time	Stop Date/Time	Sample Volume	Timer Reading	Analysis Requested/Comments	LLD required
SX-ST-3067		N/A	7/12 1000	~10cc	N/A	Co-60, Ni-63, Ni-65 γ-scan 59	Cs137-0.1 pCi/g Co-60-0.1 pCi/g Ni-63-16.5 pCi/g Ni-59-46.0 pCi/g
3068			7/12 0905				
3069			7/12 0930				
3070			7/12 0912				
3071			7/12 0925				
3072			7/12 1340				
3073			7/12 0940				
3074			7/12 0950				
3075			7/12 1350				
3076			7/12 1025				
3077		N/A	7/12 1306				

* To be completed by Lab Staff upon receipt

Send Results To: D. Sage Phone: (814) 635-2829 Collected By: Marquette/Lane Date: 7/12/02

Delivered By: ________ Date ________ Received By: [signature] Date: 7/15/02 0940

6900-02-025

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B. Brosey 10/6/02

(1) All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

ANALYSIS REPORT

BWXT Services, Inc. - NEL Services • 2016 Mt. Athos Rd. • Lynchburg, VA 24504-5447 • (434) 522-5165 • Fax (434) 522-6860

ATTACHMENT 2.8

6900-02-025

0207047

SNEC SAMPLE ANALYSIS REQUEST SHEET

DESTINATION : BWXT

Sample Description/Sample Location	Lab ID Number *	Start Date/Time	Stop Date/Time	Sample Volume ~~(wt)~~	Timer Reading	Analysis Requested/Comments	LLD required
SX-ST-3078		N/A	7/12 1345	10cc	N/A	γ-scan Co 60, Ni-63, Ni-59	Cs-137 · 0.1 pCi/g Co-60 · 0.05 pCi/g
3079		N/A	7/12 1040	10cc	N/A		Ni-59 · 24.0 pCi/g Ni-63 · 16.0 pCi/g
3080		N/A	7/12 1306	10cc	N/A		
3081		N/A	7/12 1010	10cc	N/A		
3082		N/A	7/12 1030	10cc	N/A		
3083		N/A	7/12 1059	10cc	N/A		
3084		N/A	7/12 1055	10cc	N/A		
3085		N/A	7/12 1049	10cc	N/A		
3086		N/A	7/12 1041	10cc	N/A		
3087		N/A	7/12 1330	10cc	N/A		

* To be completed by Lab Staff upon receipt

Send Results To: D. Sieg Phone: (814) 635-2829 Collected By: Margaretha, Lee Date: 7/12/02

Delivered By: ____ Date: ____ Received By: [signature] Date: 7/18/02 1240

(1) All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

Report Number 0207047

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B. Brungs 10/6/02

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B. Brunz 10/6/02

StatMost for Windows Saturday, October 05, 2002 2:46:53 PM

*********************************** Statistics Report ***********************************

Co-60 Steel Activation of SNEC CV

Sample size (N)	21
Num missings	0
Minimum	0.9600
Maximum	3.4300
Std deviation	**0.7356**
Variance	0.5411
Mean	**1.9529**
Geometric mean	1.8248
Quadratic mean	2.0806
Harmonic mean	1.7041
Sum	41.0100
Absolute Sum	41.0100
Median	1.9100
Percentiles:	
10	1.0380
25	1.3500
50	1.9100
75	2.4650
90	3.2820
Quartiles:	
First quartile:	1.3500
Second quartile:	1.9100
Third quartile:	2.4650
95.00% Confidence Interval:	
lower limit	1.6180
upper limit	2.2877

************************************* The End *************************************

ATTACHMENT 2 - 9

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B. Brown 10/6/02

Activated Steel.dmd Saturday, October 05, 2002 2:57:53 PM

	Sample Names	Co-60 Steel Activation (pCi/g)	Ni-59 pCi/g	Ni-63 pCi/g	Cs-137 pCi/g	Grams
1	SXST3067-1	< 3.39	< 261.6	< 30.35	16.9	2.1
2	SXST3068-2	< 2.85	< 25.89	< 10.38	59	2.535
3	SXST3069-3	< 1.49	<85.12	< 10.96	2.28	4.226
4	SXST3070-4	2.64	< 72.84	20.23	180	2.749
5	SXST3071-5	3.43	< 182.82	< 27.11	9.26	1.515
6	SXST3072-6	< 0.96	< 61.62	< 12.8	1.12	6.685
7	SXST3073-7	< 1.79	< 33.15	< 3.8	3.03	2.749
8	SXST3074-8	< 1.96	< 31.51	< 5.25	3.36	3.163
9	SXST3075-9	2.06	< 9.21	< 4.46	1.37	3.591
10	SXST3067-1	2.78	< 24.35	< 8.54	24.8	3.248
11	SXST3077-11	< 1.17	< 32.61	< 4.84	< 1.16	4.712
12	SXST3078-12	< 1.11	< 186.79	< 20.46	2.3	5.674
13	SXST3079-13	< 2.13	< 38.84	< 4.29	5.08	2.198
14	SXST3080-14	< 1.02	< 42.97	< 4.99	1.9	4.76
15	SXST3081-15	< 1.91	< 13.2	< 4.02	3.44	2.129
16	SXST3082-16	< 1.65	< 37.4	< 4.33	3	3.492
17	SXST3083-17	< 1.56	< 39.32	< 5.11	< 1.69	3.292
18	SXST3084-18	< 2.29	< 97.43	< 9.46	2.55	1.808
19	SXST3085-19	< 1.48	< 41.33	< 5.9	< 1.38	2.798
20	SXST3086-20	< 1.22	< 280.85	< 36.21	< 1.13	5.881
21	SXST3087-21	< 2.12	< 14.65	< 3.89	< 1.45	3.046

ATTACHMENT 2.10

Effective DCGL Calculator for Cs-137 (in pCi/g)

SAMPLE NUMBER(s) ⇨ SSGS SE Sump, Au-133

Total Allowable pCi/g		Cs-137 Allowable Limit	
6.95	pCi/g	6.02	pCi/g
SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		[illegible]	pCi/g

2641.42%	25.0	mrem/y TEDE Limit
163.71%	4.0	mrem/y Drinking Water (DW) Limit

☑ Check for 25 mrem/y

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B
1	Am-241	0.014	0.008%	9.9	2.39	0 00	0.01	0.00
2	C-14	4 07	2.217%	2.0	6.4	0.15	2.49	0.15
3	Co-60	0.54	0.294%	3.5	67.0	0.02	0.33	0.02
4	Cs-137	159	86 623%	6.6	397	6.02	97.12	[illegible]
5	Eu-152	0.04	0.022%	10.1	1440	0.00	0.02	0.00
6	H-3	12.1	6.592%	132	31.1	0.46	7.38	0.46
7	Ni-63	7.2	3.923%	747	19000	0.27	4.40	0.27
8	Pu-238	0 003	0.002%	1.8	0.41	0.00	0.00	0.00
9	Pu-239	0 004	0.002%	1.6	0.37	0.00	0.00	0.00
10	Pu-241	0.562	0.306%	86	19.8	0.02	0.34	0.02
11	Sr-90	0.02	0.011%	1.2	0.61	0.00	0.01	0 00
		1.84E+02	100.000%			6.95	112.12	6.95
						Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)	

This Sample mrem/y TEDE	This Sample mrem/y DW	
0.04	0.02	Am-241
50.88	3.01	C-14
3 86	0.03	Co-60
602.27	1.60	Cs-137
0.10	0.00	Eu-152
2.29	1.56	H-3
0.24	0.00	Ni-63
0 04	0.03	Pu-238
0 06	0.04	Pu-239
0 16	0.11	Pu-241
0.42	0.13	Sr-90
660.356	6.549	

To Use This Information, Sample Input Units Must Be in pCi/g

ATTACHMENT 3-1

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B. Brown 10/6/02

ATTACHMENT 3-2

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

Total Allowable Limit (a + b)		Cs-137 Allowable Limit	
25617	dpm/100 cm^2	22191	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		16643	dpm/100 cm^2

SAMPLE NO(s)⇒ SSGS SE Sump, Au-133

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241	1.40E-02	0.008%	27	1.95	1.81	N/A	1.95	Am-241
2	C-14	4.07E+00	2.217%	3,700,000	568.02	0.00	568.02	N/A	C-14
3	Co-60	5.40E-01	0.294%	7,100	75.36	0.27	75.36	N/A	Co-60
4	Cs-137	1.59E+02	86.623%	28,000	22190.64	19.81	22190.6	N/A	Cs-137
5	Eu-152	4.00E-02	0.022%	13,000	5.58	0.01	5.58	N/A	Eu-152
6	H-3	1.21E+01	6.592%	120,000,000	1688.71	0.00	Not Detectable	N/A	H-3
7	Ni-63	7.20E+00	3.923%	1,800,000	1004.85	0.01	Not Detectable	N/A	Ni-63
8	Pu-238	3.00E-03	0.002%	30	0.42	0.35	N/A	0.42	Pu-238
9	Pu-239	4.00E-03	0.002%	28	0.56	0.50	N/A	0.56	Pu-239
10	Pu-241	5.62E-01	0.306%	880	78.43	2.23	Not Detectable	N/A	Pu-241
11	Sr-90	2.00E-02	0.011%	8,700	2.79	0.01	2.79	N/A	Sr-90
			100.000%		25617	25.0	22842	3	
					Maximum Permissible dpm/100 cm^2				

6900-02-025 20 of 44 B. B[illegible] 10/6/02

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B. Brosey 10/6/02

SNEC SAMPLE RESULTS

LAB or LAB No.	Location/Description
BWXT, 0111056-02	SSGS SE Sump, AU-133, SR-0003
SNEC Sample No.	Comments:
SXSD723	
Other Identifier	
SSGS/DT/IT Area Sample	
Analysis Date=>	***February 20, 2001***

	Isotope	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
1	Am-241	< 0.014
2	C-14	< 4.07
3	Cm-243	—
4	Cm-244	< 0.004
5	Co-60	0.54
6	Cs-134	< 0.05
7	Cs-137	159
8	Eu-152	< 0.04
9	Eu-154	< 0.03
10	Eu-155	< 0.17
11	Fe-55	< 28.3
12	H-3	< 12.1
13	Nb-94	< 0.01
14	Ni-59	< 16
15	Ni-63	< 7.2
16	Pu-238	< 0.003
17	Pu-239	< 0.004
18	Pu-240	< 0.004
19	Pu-241	< 0.562
20	Pu-242	< 0.003
21	Sb-125	< 0.23
22	Sr-90	< 0.02
23	Tc-99	< 0.37
24	U-234	0.26
25	U-235	0.011
26	U-238	0.209

Other Isotopes	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
On-site Analysis for Cs-137	—
On-site Analysis for Co-60	—
On-site Analysis for H-3	—
I-129	< 1.68
Gross Alpha	—
Gross Beta	—
K-40	—
Ra-226	—
Th-232	—
Cm-242	< 0.019
Th-228	—
Np-237	< 0.005
Ce-144	< 0.57

ATTACHMENT 3-3

Effective DCGL Calculator for Cs-137 (in pCi/g)

SAMPLE NUMBER(s)⟹ SSGS East Disk # 1

Total Allowable pCi/g		Cs-137 Allowable Limit	
6.74	pCi/g	6.42	pCi/g

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		4.81	pCi/g

10281.04%	25.0	mrem/y TEDE Limit
380.73%	4.0	mrem/y Drinking Water (DW) Limit

☑ Check for 25 mrem/y

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B
1	Am-241	0.29	0.042%	9.9	2.3	0.00	0.08	0.00
2	C-14	3 68	0.531%	2.0	5.4	0.04	0.97	0 04
3	Co-60	2.01	0.290%	3.5	57.0	0.02	0.53	0.02
4	Cs-137	660	95.268%	6.6	397	6.42	173.33	6.42
5	Eu-152	0 31	0.045%	10.1	1440	0.00	0.08	0.00
6	H-3	11.7	1.689%	132	311	0.11	3.07	0.11
7	Ni-63	7.73	1.116%	747	19000	0.08	2.03	0 08
8	Pu-238	0 046	0.007%	1.8	0.41	0.00	0.01	0.00
9	Pu-239	0.145	0 021%	1.6	0.37	0 00	0.04	0 00
10	Pu-241	6.819	0.984%	86	19.8	0.07	1.79	0.07
11	Sr-90	0.05	0.007%	1.2	0.61	0.00	0.01	0.00
		6.93E+02	100.000%			6.74	181.96	6.74
						Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)	

This Sample mrem/y TEDE	This Sample mrem/y DW	
0.73	0.50	Am-241
46.00	2.73	C-14
14.36	0.12	Co-60
2500 00	6.66	Cs-137
0.77	0.00	Eu-152
2.22	1.50	H-3
0 26	0.00	Ni-63
0.64	0.45	Pu-238
2.27	1.57	Pu-239
1.98	1.38	Pu-241
1.04	0.33	Sr-90
2670.260	16.229	

To Use This Information, Sample Input Units Must Be in pCi/g

ATTACHMENT 3-4

6960-02-025

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B. Brosey 10/6/02

ATTACHMENT 3.5

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

Total Allowable Limit (a + b)		Cs-137 Allowable Limit	
14112	dpm/100 cm^2	13444	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		10083	dpm/100 cm^2

SAMPLE NO(s)⇒ *SSGS, East, Disk # 1*

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241	2.90E-01	0.042%	27	5.91	5.47	N/A	5.91	Am-241
2	C-14	3.68E+00	0.531%	3,700,000	74.96	0.00	74.96	N/A	C-14
3	Co-60	2.01E+00	0.290%	7,100	40.94	0.14	40.94	N/A	Co-60
4	Cs-137	[illegible]	[illegible]	28,000	13444.42	[illegible]	13444.4	N/A	Cs-137
5	Eu-152	3.10E-01	0.045%	13,000	6.31	0.01	6.31	N/A	Eu-152
6	H-3	1.17E+01	1.689%	120,000,000	238.33	0.00	Not Detectable	N/A	H-3
7	Ni-63	7.73E+00	1.116%	1,800,000	157.46	0.00	Not Detectable	N/A	Ni-63
8	Pu-238	4.60E-02	0.007%	30	0.94	0.78	N/A	0.94	Pu-238
9	Pu-239	1.45E-01	0.021%	28	2.95	2.64	N/A	2.95	Pu-239
10	Pu-241	6.82E+00	0.984%	880	138.91	3.95	Not Detectable	N/A	Pu-241
11	Sr-90	5.00E-02	0.007%	8,700	1.02	0.00	1.02	N/A	Sr-90
			100.000%		14112	25.0	13568	10	
					Maximum Permissible dpm/100 cm^2				

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E. Brown 10/6/02

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B. Brosey 10/6/02

SNEC SAMPLE RESULTS

LAB or LAB No.	Location/Description
BWXT, 0111056-04	SSGS, East, Disk # 1
SNEC Sample No.	Comments:
SXCF828	
Other Identifier	
SSGS/DT/IT Area Sample	
Analysis Date=>	***May 4, 2001***

	Isotope	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
1	Am-241	0.29
2	C-14	< 3.68
3	Cm-243	—
4	Cm-244	< 0.05
5	Co-60	2.01
6	Cs-134	< 0.33
7	Cs-137	660
8	Eu-152	< 0.31
9	Eu-154	< 0.24
10	Eu-155	< 1.02
11	Fe-55	< 3.41
12	H-3	< 11.7
13	Nb-94	< 0.07
14	Ni-59	< 6.49
15	Ni-63	< 7.73
16	Pu-238	< 0.046
17	Pu-239	0.145
18	Pu-240	0.145
19	Pu-241	< 6.819
20	Pu-242	< 0.046
21	Sb-125	< 1.83
22	Sr-90	< 0.05
23	Tc-99	< 0.67
24	U-234	0.282
25	U-235	0.009
26	U-238	0.263

Other Isotopes	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
On-site Analysis for Cs-137	—
On-site Analysis for Co-60	—
On-site Analysis for H-3	—
I-129	< 1.68
Gross Alpha	—
Gross Beta	—
K-40	—
Ra-226	—
Th-232	—
Cm-242	< 0.123
Th-228	—
Np-237	< 0.056
Ce-144	< 2.96

ATTACHMENT 3 - 6

Effective DCGL Calculator for Cs-137 (in pCi/g)

SAMPLE NUMBER(s)⇒ SSGS Footprint East Turbine Sump Area

Total Allowable pCi/g		Cs-137 Allowable Limit	
17.16	pCi/g	5.40	pCi/g
SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		4.05	pCi/g

1811.94%	25.0	mrem/y TEDE Limit
978.15%	4.0	mrem/y Drinking Water (DW) Limit

☑ Check for 25 mrem/y

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B
1	Am-241	0.2	0.064%	9.9	2.3	0.01	0.02	0 01
2	C-14	2	0.643%	2.0	5.4	0.11	0.20	0.11
3	Co-60	0.37	0.119%	3.5	57.0	0.02	0.04	0.02
4	Cs-137	98	31.446%	6.6	397	5.40	10.00	[redacted]
5	Eu-152	0.18	0.058%	10.1	1440	0.01	0.02	0.01
6	H-3	90	28.938%	132	311	4.97	0.20	4.97
7	Ni-63	20	6.431%	747	19000	1.10	2.04	1.10
8	Pu-238	0.2	0.064%	1.8	0.41	0.01	0.02	0.01
9	Pu-239	0.2	0 064%	1.6	0.37	0 01	0.02	0.01
10	Pu-241	100	32.153%	86	19.8	5.52	10.22	5 52
11	Sr-90	0.06	0.019%	1.2	0.61	0 00	0.01	0.00
		3.11E+02	100.000%			17.16	31.80	17.16
						Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)	

This Sample mrem/y TEDE	This Sample mrem/y DW	
0.51	0.35	Am-241
25.00	1.48	C-14
2.64	0.02	Co-60
370.45	0.99	Cs-137
0.45	0.00	Eu-152
17.05	11.58	H-3
0.67	0.00	Ni-63
2.78	1.95	Pu-238
3.13	2.16	Pu-239
29.07	20.20	Pu-241
1.25	0.39	Sr-90
452.985	39.126	

To Use This Information, Sample Input Units Must Be In pCi/g

ATTACHMENT 3-7

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B. Brosey 10/6/02

ATTACHMENT 3.8

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

25.0	mrem/y TEDE Limit

SAMPLE NO(s)⇒ SSGS Footprint East Turbine Sump Area

Total Allowable Limit (a + b)		Cs-137 Allowable Limit	
2247	dpm/100 cm^2	706	dpm/100 cm^2

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		530	dpm/100 cm^2

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241	2.00E-01	0.064%	27	1.44	1.34	N/A	1.44	Am-241
2	C-14	2.00E+00	0.643%	3,700,000	14.45	0.00	14.45	N/A	C-14
3	Co-60	3.70E-01	0.119%	7,100	2.67	0.01	2.67	N/A	Co-60
4	Cs-137	9.78E-01	31.448%	28,000	706.49	0.83	706.5	N/A	Cs-137
5	Eu-152	1.80E-01	0.058%	13,000	1.30	0.00	1.30	N/A	Eu-152
6	H-3	9.00E+01	28.938%	120,000,000	650.14	0.00	Not Detectable	N/A	H-3
7	Ni-63	2.00E+01	6.431%	1,800,000	144.48	0.00	Not Detectable	N/A	Ni-63
8	Pu-238	2.00E-01	0.064%	30	1.44	1.20	N/A	1.44	Pu-238
9	Pu-239	2.00E-01	0.064%	28	1.44	1.29	N/A	1.44	Pu-239
10	Pu-241	1.00E+02	32.153%	880	722.38	20.52	Not Detectable	N/A	Pu-241
11	Sr-90	6.00E-02	0.019%	8,700	0.43	0.00	0.43	N/A	Sr-90
			100.000%		2247	25.0	725	4	
					Maximum Permissible dpm/100 cm^2				

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B Brown 10/6/02

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B. Brung 10/6/02

SNEC SAMPLE RESULTS

LAB or LAB No.	Location/Description
Teledyne-TI#-38253	SSGS Footprint East Turbine Sump Area AV-133 (Pumped)
SNEC Sample No.	Comments:
SX10SD00366	
Other Identifier	
SSGS/DT/IT Area Sample	
Analysis Date=>	***June 5, 2000***

	Isotope	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
1	Am-241	< 0.2
2	C-14	< 2
3	Cm-243	< 0.1
4	Cm-244	< 0.1
5	Co-60	0.37
6	Cs-134	< 0.0636
7	Cs-137	97.8
8	Eu-152	< 0.18
9	Eu-154	< 0.118
10	Eu-155	< 0.211
11	Fe-55	< 50
12	H-3	< 90
13	Nb-94	< 0.0479
14	Ni-59	< 50
15	Ni-63	< 20
16	Pu-238	< 0.2
17	Pu-239	< 0.2
18	Pu-240	< 0.2
19	Pu-241	< 100
20	Pu-242	< 0.2
21	Sb-125	< 0.401
22	Sr-90	< 0.06
23	Tc-99	< 0.4
24	U-234	1.1
25	U-235	< 0.2
26	U-238	0.57

Other Isotopes	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
On-site Analysis for Cs-137	—
On-site Analysis for Co-60	—
On-site Analysis for H-3	—
I-129	< 0.06
Gross Alpha	—
Gross Beta	—
K-40	2.58
Ra-226	0.326
Th-232	< 0.249
Cm-242	—
Th-228	—
Np-237	—
Ce-144	—

ATTACHMENT 3-9

Effective DCGL Calculator for Cs-137 (in pCi/g)

SAMPLE NUMBER(s)⇒ SSGS 790' El., East - Debris from Pump Stand Small Pipe

Total Allowable pCi/g		Cs-137 Allowable Limit	
6.62	pCi/g	6.55	pCi/g
SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		4.91	pCi/g

47776.16%	25.0	mrem/y TEDE Limit
980.61%	4.0	mrem/y Drinking Water (DW) Limit

☑ Check for 25 mrem/y

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B
1	Am-241	0.11	0.003%	9.9	2.3	0.00	0.01	0.00
2	C-14	4.15	0.131%	2.0	54	0.01	0.42	0.01
3	Co-60	3.98	0.126%	3.5	67.0	0.01	0.41	0.01
4	Cs-137	3130	98.956%	6.6	397	6.55	318.19	6.55
5	Eu-152	0.24	0.008%	10.1	1440	0.00	0.02	0.00
6	H-3	11	0.348%	132	31.1	0.02	1.12	0.02
7	Ni-63	8 61	0.272%	747	19000	0.02	0.88	0.02
8	Pu-238	0.07	0.002%	1.8	0.41	0 00	0.01	0.00
9	Pu-239	0.08	0.003%	1.6	0.37	0.00	0.01	0.00
10	Pu-241	4.74	0.150%	86	19.8	0.01	0.48	0.01
11	Sr-90	0.04	0.001%	1.2	0.81	0.00	0.00	0 00
		3.16E+03	100.000%			6.62	322.56	6.62
						Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)	

This Sample mrem/y TEDE	This Sample mrem/y DW	
0.28	0.19	Am-241
51.88	3.07	C-14
28.43	0.24	Co-60
11856 06	31.54	Cs-137
0.59	0.00	Eu-152
2 08	1.41	H-3
0.29	0.00	Ni-63
0.97	0.88	Pu-238
1.25	0.88	Pu-239
1.38	0.96	Pu-241
0 83	0.26	Sr-90
11944.041	39.224	

To Use This Information, Sample Input Units Must Be in pCi/g

ATTACHMENT 3-10

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B. Brown 10/6/02

ATTACHMENT 3-11

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

Total Allowable Limit (a + b)		Cs-137 Allowable Limit	
24901	dpm/100 cm^2	24641	dpm/100 cm^2

25.0 mrem/y TEDE Limit

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		18480	dpm/100 cm^2

SAMPLE NO(s)⇒ SSGS 790' El., East - Debris from Pump Stand Small Pipe

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241	1.10E-01	0.003%	27	0.87	0.80	N/A	0.87	Am-241
2	C-14	4.15E+00	0.131%	3,700,000	32.67	0.00	32.67	N/A	C-14
3	Co-60	3.98E+00	0.126%	7,100	31.33	0.11	31.33	N/A	Co-60
4	Cs-137	3.13E+03	98.956%	28,000	24640.58	22.00	24640.6	N/A	Cs-137
5	Eu-152	2.40E-01	0.008%	13,000	1.89	0.00	1.89	N/A	Eu-152
6	H-3	1.10E+01	0.348%	120,000,000	86.60	0.00	Not Detectable	N/A	H-3
7	Ni-63	8.61E+00	0.272%	1,800,000	67.78	0.00	Not Detectable	N/A	Ni-63
8	Pu-238	7.00E-02	0.002%	30	0.55	0.46	N/A	0.55	Pu-238
9	Pu-239	8.00E-02	0.003%	28	0.63	0.58	N/A	0.63	Pu-239
10	Pu-241	4.74E+00	0.150%	880	37.32	1.06	Not Detectable	N/A	Pu-241
11	Sr-90	4.00E-02	0.001%	8,700	0.31	0.00	0.31	N/A	Sr-90
			100.000%		24901	25.0	24707	2	
					Maximum Permissible dpm/100 cm^2				

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B. Brunz 10/6/02
6900-02-025

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B. Brown 10/6/02
6900-02-025

SNEC SAMPLE RESULTS

LAB or LAB No.	Location/Description
BWXT, 0109078-01	SSGS 790' El., East - Debris From Pump Stand Small Pipe
SNEC Sample No.	Comments:
SXSD1377	
Other Identifier	
SSGS/DT/IT Area Sample	
Analysis Date=>	*September 4, 2001*

	Isotope	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
1	Am-241	< 0.11
2	C-14	< 4.15
3	Cm-243	—
4	Cm-244	< 0.13
5	Co-60	3.98
6	Cs-134	< 0.47
7	Cs-137	3130
8	Eu-152	< 0.24
9	Eu-154	< 0.16
10	Eu-155	< 1.55
11	Fe-55	< 66.8
12	H-3	< 11
13	Nb-94	< 0.07
14	Ni-59	< 6.46
15	Ni-63	< 8.61
16	Pu-238	0.07
17	Pu-239	0.08
18	Pu-240	0.08
19	Pu-241	< 4.74
20	Pu-242	< 0.01
21	Sb-125	< 2.7
22	Sr-90	< 0.04
23	Tc-99	< 0.45
24	U-234	1.42
25	U-235	0.04
26	U-238	0.79

Other Isotopes	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
On-site Analysis for Cs-137	—
On-site Analysis for Co-60	—
On-site Analysis for H-3	—
I-129	< 3.46
Gross Alpha	—
Gross Beta	—
K-40	—
Ra-226	—
Th-232	—
Cm-242	< 0.14
Th-228	—
Np-237	< 0.01
Ce-144	< 3.23

ATTACHMENT 3-12

Effective DCGL Calculator for Cs-137 (in pCi/g)

Total Allowable pCi/g		Cs-137 Allowable Limit	
6.77	pCi/g	6.38	pCi/g
SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		4.78	pCi/g

SAMPLE NUMBER(s)⇨ SSGS Discharge Tunnel 6" Drain Line

75201.87%	25.0	mrem/y TEDE Limit
4603.38%	4.0	mrem/y Drinking Water (DW) Limit

☑ Check for 25 mrem/y

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	25 mrem/y TEDE Limits (pCi/g)	4 mrem/y DW Limits (pCi/g)	A - Allowed pCi/g for 25 mrem/y TEDE	B - Allowed pCi/g for 4 mrem/y DW	Value Checked from Column A or B
1	Am-241	5.4	0.106%	9.9	2.3	0.01	0.12	0.01
2	C-14	6	0.118%	2.0	5.4	0.01	0.13	0.01
3	Co-60	30	0.590%	3.5	67.0	0.04	0.65	0.04
4	Cs-137	4800	94.330%	6.6	397	6.38	104.27	6.38
5	Eu-152	20	0.393%	10.1	1440	0 03	0.43	0.03
6	H-3	100	1.965%	132	31.1	0.13	2.17	0.13
7	Ni-63	55	1 081%	747	19000	0.07	1.19	0.07
8	Pu-238	1.6	0.031%	1.8	0.41	0.00	0.03	0.00
9	Pu-239	2.5	0.049%	1.6	0.37	0.00	0.05	0.00
10	Pu-241	60	1.179%	86	19.8	0.08	1.30	0.08
11	Sr-90	8	0.157%	1.2	0.61	0.01	0.17	0.01
		5.09E+03	100.000%			6.77	110.54	6.77
						Maximum Permissible pCi/g (25 mrem/y)	Maximum Permissible pCi/g (4 mrem/y)	

This Sample mrem/y TEDE	This Sample mrem/y DW	
13 64	9.39	Am-241
75 00	4.44	C-14
214.29	1.79	Co-60
18181.82	48.36	Cs-137
49.50	0.06	Eu-152
18.94	12.86	H-3
1.84	0.01	Ni-63
22.22	15.61	Pu-238
39.06	27.03	Pu-239
17.44	12.12	Pu-241
166.67	52.46	Sr-90
18800.419	184.135	
To Use This Information, Sample Input Units Must Be In pCi/g		

ATTACHMENT 4-1

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B. Brosey 10/6/02

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ATTACHMENT 4.2

Effective DCGL Calculator for Cs-137 (dpm/100 cm^2)

25.0	mrem/y TEDE Limit

SAMPLE NO(s)⇒ SSGS Diacharge Tunnel 6" Drain Line

Total Allowable Limit (a + b)		Cs-137 Allowable Limit	
8640	dpm/100 cm^2	8150	dpm/100 cm^2

SNEC AL	75%	SNEC Cs-137 Allowable Limit	
		6113	dpm/100 cm^2

	Isotope	Sample Input (pCi/g, uCi, etc.)	% of Total	Individual Limits (dpm/100 cm^2)	Allowed dpm/100 cm^2	mrem/y TEDE	Beta dpm/100 cm^2	Alpha dpm/100 cm^2	
1	Am-241	5.40E+00	0.106%	27	9.17	8.49	N/A	9.17	Am-241
2	C-14	6.00E+00	0.118%	3,700,000	10.19	0.00	10.19	N/A	C-14
3	Co-60	3.00E+01	0.590%	7,100	50.94	0.18	50.94	N/A	Co-60
4	Cs-137	4.80E+03	94.330%	28,000	8150.16	7.28	8150.2	N/A	Cs-137
5	Eu-152	2.00E+01	0.393%	13,000	33.96	0.07	33.96	N/A	Eu-152
6	H-3	1.00E+02	1.965%	120,000,000	169.79	0.00	Not Detectable	N/A	H-3
7	Ni-63	5.50E+01	1.081%	1,800,000	93.39	0.00	Not Detectable	N/A	Ni-63
8	Pu-238	1.60E+00	0.031%	30	2.72	2.26	N/A	2.72	Pu-238
9	Pu-239	2.50E+00	0.049%	28	4.24	3.79	N/A	4.24	Pu-239
10	Pu-241	6.00E+01	1.179%	880	101.88	2.89	Not Detectable	N/A	Pu-241
11	Sr-90	8.00E+00	0.157%	8,700	13.58	0.04	13.58	N/A	Sr-90
			100.000%		8640	25.0	8259	16	
					Maximum Permissible dpm/100 cm^2				

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D. Brown 11/6/02

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B. Brosey
10/6/02
6900-02-025

SNEC SAMPLE RESULTS

LAB or LAB No.	Location/Description
Teledyne-TI#-16599	Discharge Tunnel 6" Drain Line Scraping
SNEC Sample No.	Comments:
SX10SD990033	
Other Identifier	
SSGS/DT/IT Area Sample	
Analysis Date=>	***July 22, 1999***

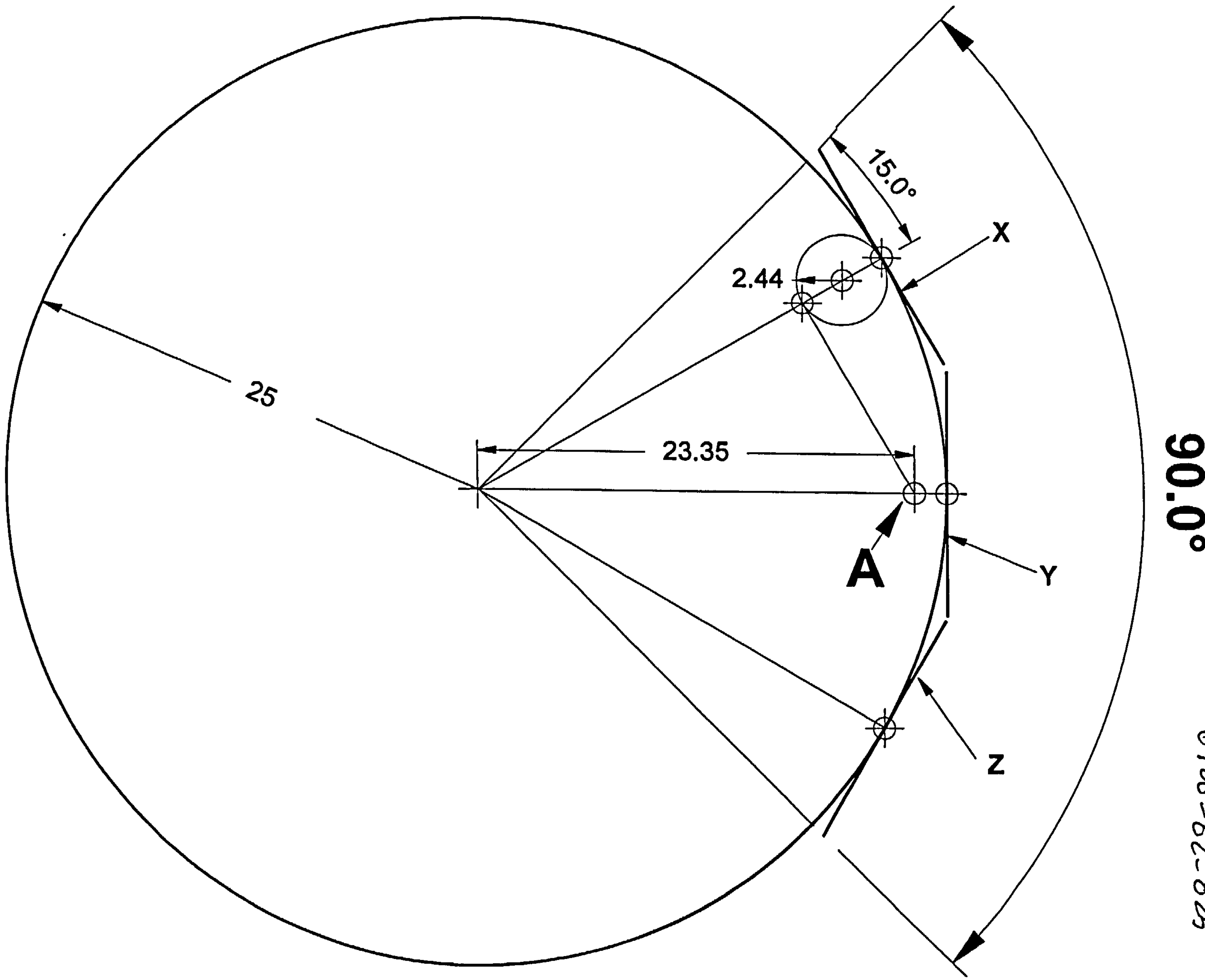
	Isotope	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
1	Am-241	5.4
2	C-14	< 6
3	Cm-243	< 0.4
4	Cm-244	< 0.4
5	Co-60	30
6	Cs-134	< 2
7	Cs-137	4800
8	Eu-152	< 20
9	Eu-154	< 5
10	Eu-155	< 9
11	Fe-55	—
12	H-3	< 100
13	Nb-94	< 2
14	Ni-59	< 100
15	Ni-63	55
16	Pu-238	1.6
17	Pu-239	2.5
18	Pu-240	2.5
19	Pu-241	< 60
20	Pu-242	< 0.4
21	Sb-125	< 20
22	Sr-90	< 8
23	Tc-99	< 10
24	U-234	0.45
25	U-235	< 0.2
26	U-238	0.57

Other Isotopes	pCi/g (soilids) or pCi/l (if water) or pCi (if smears)
On-site Analysis for Cs-137	—
On-site Analysis for Co-60	—
On-site Analysis for H-3	—
I-129	< 5
Gross Alpha	—
Gross Beta	—
K-40	< 50 (39.8)
Ra-226	< 70
Th-232	—
Cm-242	< 0.4
Th-228	< 7
Np-237	—
Ce-144	—

ATTACHMENT 4-3

SNEC CV STEEL SHELL MODEL

All Dimensions are in Feet



ATTACHMENT 5.1

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B. Drum
10/6/02
6900-02-025

MicroShield v5.05 (5.05-00121)
GPU Nuclear

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Page : 1
DOS File : CVSHELL.MS5
Run Date : October 5, 2002
Run Time : 4:52:16 PM
Duration : 00:00:15

B. Brown
10/6/02
6900-02-025

File Ref: ________
Date: ________
By: ________
Checked: ________

Case Title: CV Shell
Description: Y Sector of CV Shell Model
Geometry: 13 - Rectangular Volume

Source Dimensions

Length	1.746 cm	0.7 in
Width	399.254 cm	13 ft 1.2 in
Height	609.6 cm	20 ft 0.0 in

Dose Points

	X	Y	Z
# 1	51.74625 cm	304.8 cm	1.99e+02 cm
	1 ft 8.4 in	10 ft 0.0 in	6 ft 6.5 in

Shields

Shield Name	Dimension	Material	Density
Source	15.009 ft^3	Iron	7.86
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	$\mu Ci/cm^3$	Bq/cm^3
Co-60	6.5141e-006	2.4102e+005	1.5327e-005	5.6710e-001

Buildup
The material reference is : Source

Integration Parameters

X Direction	40
Y Direction	40
Z Direction	40

Results

Energy MeV	Activity photons/sec	Fluence Rate $MeV/cm^2/sec$ No Buildup	Fluence Rate $MeV/cm^2/sec$ With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	3.932e+01	3.742e-05	6.093e-05	7.224e-08	1.176e-07
1.1732	2.410e+05	4.559e-01	6.715e-01	8.147e-04	1.200e-03

ATTACHMENT 5 - 2

Page : 2
DOS File : CVSHELL.MS5
Run Date: October 5, 2002
Run Time: 4:52:16 PM
Duration : 00:00:15

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Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
1.3325	2.410e+05	5.372e-01	7.726e-01	9.321e-04	1.340e-03
TOTALS:	4.821e+05	9.932e-01	1.444e+00	1.747e-03	2.541e-03

ATTACHMENT 5 - 3

MicroShield v5.05 (5.05-00121)
GPU Nuclear

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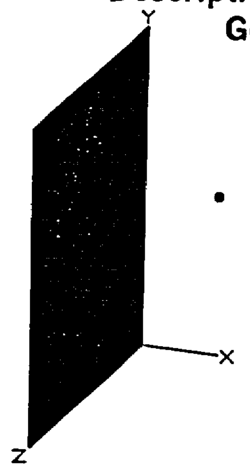
Page : 1
DOS File : CVXPLUS.MS5
Run Date : October 5, 2002
Run Time : 4:58:39 PM
Duration : 00:00:15

B. B[illegible]
10/6/02
6900-02-025

File Ref: ______
Date: ______
By: ______
Checked: ______

Case Title: CV Shell
Description: X and Z Plus Sector of CV Shell Model
Geometry: 13 - Rectangular Volume



Source Dimensions

Length	1.746 cm	0.7 in
Width	561.2 cm	18 ft 4.9 in
Height	609.6 cm	20 ft 0.0 in

Dose Points

	X	Y	Z
# 1	148.7424 cm	304.8 cm	0 cm
	4 ft 10.6 in	10 ft 0.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	5.97e+05 cm³	Iron	7.86
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Co-60	9.1564e-006	3.3879e+005	1.5327e-005	5.6710e-001

Buildup
The material reference is : Source

Integration Parameters

X Direction	40
Y Direction	40
Z Direction	40

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	5.526e+01	1.467e-05	2.314e-05	2.833e-08	4.468e-08
1.1732	3.388e+05	1.765e-01	2.509e-01	3.154e-04	4.484e-04
[illegible]325	3.388e+05	2.072e-01	2.876e-01	3.595e-04	4.990e-04

ATTACHMENT 5-4

Page : 2
DOS File : CVXPLUS.MS5
Run Date : October 5, 2002
Run Time: 4:58:39 PM
Duration : 00:00:15

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Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	6.776e+05	3.837e-01	5.385e-01	6.749e-04	9.474e-04

ATTACHMENT 5 - 5

MicroShield v5.05 (5.05-00121)
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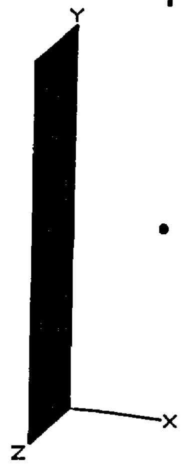
Page : 1
DOS File : CVMINUS.MS5
Run Date : October 5, 2002
Run Time : 5:01:03 PM
Duration : 00:00:15

File Ref: ________
Date: ________
By: ________
Checked: ________

Case Title: CV Shell
Description: X and Z Minus Sector of CV Shell Model
Geometry: 13 - Rectangular Volume



Source Dimensions

Length	1.746 cm	0.7 in
Width	162.218 cm	5 ft 3.9 in
Height	609.6 cm	20 ft 0.0 in

Dose Points

	X	Y	Z
# 1	148.7424 cm	304.8 cm	0 cm
	4 ft 10.6 in	10 ft 0.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	1.73e+05 cm³	Iron	7.86
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm³	Bq/cm³
Co-60	2.6467e-006	9.7929e+004	1.5327e-005	5.6710e-001

Buildup
The material reference is : Source

Integration Parameters

X Direction	40
Y Direction	40
Z Direction	40

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	1.597e+01	9.526e-06	1.424e-05	1.839e-08	2.749e-08
1.1732	9.793e+04	1.122e-01	1.518e-01	2.006e-04	2.714e-04
1.3325	9.793e+04	1.311e-01	1.735e-01	2.275e-04	3.010e-04

ATTACHMENT 5.6

Page : 2
DOS File : CVMINUS.MS5
Run Date : October 5, 2002
Run Time: 5:01:03 PM
Duration : 00:00:15

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Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
TOTALS:	1.959e+05	2.434e-01	3.254e-01	4.281e-04	5.724e-04

ATTACHMENT 5.7

MicroShield v5.05 (5.05-00121)
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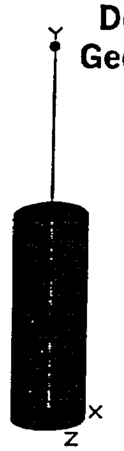
Page	: 1
DOS File	: DTMODEL.MS5
File Date	: October 5, 2002
Run Time	: 8:22:10 PM
Duration	: 00:00:02

File Ref: ________
Date: ________
By: ________
Checked: ________

Case Title: 8" Pipe End
Description: Discharge Tunnel Pipe Model
Geometry: 8 - Cylinder Volume - End Shields



Source Dimensions

Height	60.96 cm	2 ft
Radius	10.16 cm	4.0 in

Dose Points

	X	Y	Z
# 1	0 cm	110.998 cm	0 cm
	0.0 in	3 ft 7.7 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	1206.372 in³	Concrete	1.4
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm³	Bq/cm³
Ba-137m	1.6704e-007	6.1805e+003	8.4497e-006	3.1264e-001
Co-60	1.1071e-009	4.0961e+001	5.6000e-008	2.0720e-003
Cs-137	1.7658e-007	6.5333e+003	8.9320e-006	3.3048e-001

Buildup
The material reference is : Source

Integration Parameters

Radial	40
Circumferential	40
Y Direction (axial)	40

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0318	1.280e+02	1.432e-06	1.735e-06	1.193e-08	1.445e-08

ATTACHMENT 6.1

Page : 2
DOS File : DTMODEL.MS5
Run Date : October 5, 2002
Run Time: 8:22:10 PM
Duration : 00:00:02

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Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0322	2.361e+02	2.754e-06	3.355e-06	2.216e-08	2.700e-08
0.0364	8.591e+01	1.520e-06	1.984e-06	8.638e-09	1.127e-08
0.6616	5.561e+03	1.301e-02	2.562e-02	2.522e-05	4.967e-05
0.6938	6.682e-03	1.667e-08	3.241e-08	3.218e-11	6.258e-11
1.1732	4.096e+01	2.089e-04	3.566e-04	3.734e-07	6.372e-07
1.3325	4.096e+01	2.487e-04	4.117e-04	4.315e-07	7.143e-07
TOTALS:	6.093e+03	1.347e-02	2.640e-02	2.607e-05	5.107e-05

ATTACHMENT 6 - 2

MicroShield v5.05 (5.05-00121)
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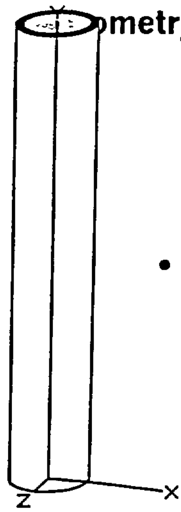
Page : 1
DOS File : 18LINE.MS5
R Date : October 6, 2002
R Time : 9:22:01 PM
Duration : 00:00:44

File Ref: ________
Date: ________
By: ________
Checked: ________

Case Title: Tie Line
Description: 18" Line Between Intake & DT
Geometry: 12 - Annular Cylinder - External Dose Point



Source Dimensions

Height	304.8 cm	10 ft 0.0 in
Radius	20.32 cm	8.0 in

Dose Points

	X	Y	Z
# 1	74.168 cm	152.4 cm	0 cm
	2 ft 5.2 in	5 ft 0.0 in	0.0 in

Shields

Shield Name	Dimension	Material	Density
Cyl. Core	20.32 m³	Air	0.00122
Source	.025 m	Concrete	1.4
Shield 3	.014 m	Iron	7.86
Transition		Air	0.00122
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm³	Bq/cm³
Ba-137m	8.8740e-007	3.2834e+004	8.4497e-006	3.1264e-001
Co-60	5.8812e-009	2.1761e+002	5.6000e-008	2.0720e-003
Cs-137	9.3806e-007	3.4708e+004	8.9320e-006	3.3048e-001

Buildup
The material reference is : Shield 3

Integration Parameters

Radial	40
Circumferential	40
Y Direction (axial)	40

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0318	6.798e+02	6.912e-40	1.700e-30	5.758e-42	1.416e-32

ATTACHMENT 6-3

Page : 2
DOS File : 18LINE.MS5
Run Date : October 6, 2002
Run Time : 9:22:01 PM
Duration : 00:00:44

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Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0322	1.254e+03	1.671e-38	3.187e-30	1.345e-40	2.565e-32
0.0364	4.564e+02	3.005e-29	3.653e-29	1.707e-31	2.075e-31
0.6616	2.954e+04	2.394e-02	6.275e-02	4.642e-05	1.217e-04
0.6938	3.550e-02	3.125e-08	8.044e-08	6.033e-11	1.553e-10
1.1732	2.176e+02	4.670e-04	9.774e-04	8.346e-07	1.747e-06
1.3325	2.176e+02	5.751e-04	1.146e-03	9.978e-07	1.989e-06
TOTALS:	3.237e+04	2.499e-02	6.488e-02	4.825e-05	1.254e-04

ATTACHMENT 6-4