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OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

September 25, 2003

Mr. Thomas Dragoun
NRR/DRIP
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

SUBJECT: FINAL SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT NO. 2 FOR THE SAXTON NUCLEAR EXPERIMENTAL CORPORATION, SAXTON, PENNSYLVANIA (DOCKET NO. 50-146; TASK 3)

Dear Mr. Dragoun:

Enclosed is the final Site-Specific Decommissioning Inspection Report for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania, for Task 3 activities performed on-site during the period August 4 through 6, 2003.

Please contact me at (865) 576-3356 or Timothy J. Vitkus at (865) 576-5073 should you require any additional information.

Sincerely,

Timothy J. Bauer

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Health Physicist
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Enclosure

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FINAL
SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT NO. 2
FOR THE SAXTON NUCLEAR EXPERIMENTAL CORPORATION
SAXTON, PENNSYLVANIA

At the request of the Nuclear Regulatory Commission's Office of Nuclear Reactor Regulation, the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed site-specific decommissioning inspection activities at the Saxton Nuclear Experimental Corporation (SNEC) in Saxton, Pennsylvania. This report describes the in-process inspection activities for the intake and discharge tunnels of the Saxton Steam Generating Station (SSGS) performed on-site during the period August 4 through 6, 2003, as requested for Task 3.

The following applicable checklist items were taken from the Site-Specific Decommissioning Inspection Plan (ORISE 2003a). Bulleted observations and recommendations are noted under each checklist item. Some items not included from the Site-Specific Decommissioning Inspection Plan have been addressed in a previous inspection report (ORISE 2003b).

1.0 GENERAL

1.1 Review past records of spills or other releases of radioactive material and documentation of cleanup.

- **Observations:** SNEC calculation E900-03-016 was reviewed and historical knowledge of past releases of radioactive material was discussed with SNEC staff. Water was drawn from the Raystown Branch of the Juniata River for the SSGS through the intake tunnel. During winter months, warmed water from the discharge tunnel was mixed into the intake tunnel using the Spray Pond supply piping to keep the intake tunnel screen wash and filtration system components from freezing. Radioactive effluent released into the discharge tunnel caused low-level contamination in portions of the intake tunnel between the entry point and the SSGS itself. Characterization surveys of the intake tunnel indicated no remediation was required due to this cross contamination. Characterization surveys identified elevated sludge and one elevated wall area in the discharge tunnel across from a seal chamber due to the radioactive effluent release. The sludge was removed and post remediation surveys did not identify contamination on the underlying concrete. Contamination embedded into the concrete wall across from the seal chamber, potentially caused by the water impinging on the concrete surface, was also remediated. No concerns were identified.

2.0 IDENTIFICATION OF CONTAMINANTS AND DCGLS

2.1 Review previous measurement and analytical results to confirm the nature of the site information and contaminants at the site. In particular, review the data that relate to the licensee's determination of radionuclide ratios, fractional contributions to total activity and variability.

- **Recommendations:** SNEC calculation E900-03-016 was reviewed. Attachment 2 provided analytical results from samples collected from the tunnels. The prominent contaminant calculated on Attachment 2 was Cs-137 at approximately 92% of the total contamination. Other contaminants identified were Sr-90, Co-60, Am-241, Pu-238, Pu-239, and Ni-63, with Ni-63 being the second-most prominent contaminant. The results of the samples were tabulated and the mean concentration and the standard deviation for each contaminant were calculated.

  The "2 Sigma + Mean" values from Attachment 2 were used on Attachment 3 to calculate an "Effective [surrogate] Area DCGL for Cs-137." There are two concerns with the use of this value. First, using the mean plus 2-sigma rather than the mean value is not conservative from a detection standpoint, i.e., the fraction of Cs-137 calculated by using the mean plus 2-sigma will increase the efficiency relative to the fraction of Cs-137 calculated using only the mean. Using the mean minus the 2-sigma would have been the most conservative in this case, but that value would have been negative and leads to the second point. Radionuclide fractions are generally calculated individually for each sample rather than as a population. For five samples listed on Attachment 2 where results are presented for all listed radionuclides, the fractions of Cs-137, Ni-63, and the sum of Cs-137 and Ni-63 fractions are shown below.

SNEC Sample No.	%Cs-137	%Ni-63	%Cs-137 + %Ni-63
SXCF971	11.5%	85.6%	97.0%
SXCW3539	29.9%	56.0%	85.9%
SX10SD990022	33.0%	49.8%	82.9%
SXCW3538	90.7%	8.2%	98.9%
SX10SD990033	98.0%	1.2%	99.2%
Average:	**52.6%**	**40.2%**	**92.8%**
Standard Deviation:	**39.1%**	**35.2%**	**7.8%**

From the results in the above table, it is apparent that assuming 96.364% Cs-137 (calculated on Attachment 3 using the mean plus 2-sigma values) is inappropriate. In fact, both the Cs-137 and Ni-63 fractions widely vary between samples with Cs-137 fractions ranging from 11.5% to 98% while Ni-63 fractions mirror the Cs-137 fractions. ESSAP recommends that SNEC re-evaluate the technical justification for their DCGL calculation. See MARSSIM (NRC 2000) section I.11 for more information on evaluating radionuclide fractions.

Additionally, the Sr-90 results for sample SX10SD990022 and SX10S990033 are both listed as 7.264 pCi/g, decay corrected to July 15, 2003. It is unlikely that two samples would be identically measured to the stated accuracy. ESSAP recommends that SNEC confirm these results.

2.2 Review the derived concentration guideline levels (DCGLs) that the licensee will use for outdoor soil areas, structure surfaces, and/or rubblized structures. Verify that the licensee has accounted for all media for which final status surveys will be designed.

- **Recommendations:** SNEC calculation E900-03-016 was reviewed. A gross activity $DCGL_W$ listed of 8,543 dpm/100 cm^2 was validated (within rounding error) using MARSSIM equation 4-4 with the data provided from the "% of Total" and "Individual Limits (dpm/100 cm^2)" columns. This value was multiplied by the Cs-137 fraction (96.364%) then further reduced by 75%—the SNEC action level to account for de-listed contaminants—to 6,174 dpm/100 cm^2. A similar calculation was performed to determine an effective volumetric $DCGL_W$ for Cs-137. These values were used to design the final status survey. Calculations are included where the SNEC action level has been applied to the gross activity calculation of 8,543 dpm/100 cm^2 to determine an administrative limit of 6,407 dpm/100 cm^2. This administrative limit is the appropriate limit to apply because the survey methodology of using gas proportional detectors is not radionuclide specific to Cs-137. The fractions of each radionuclide would then be used to weight the efficiencies of the detector (see Recommendations for 4.2.1). While the net effect of using the "Effective Area DCGL for Cs-137" is conservative, it is not consistent with guidance.

2.3 Evaluate how the DCGLs will be implemented—e.g., use of surrogate measurements and modified DCGLs, gross activity DCGLs, $DCGL_{EMC}$s—to determine how samples/measurements will be compared, implementation of the unity rule, and how radionuclide variabilities—specifically modification of σ—will be integrated in DCGL implementation.

- **Recommendations:** SNEC calculation E900-03-016 was reviewed. Section 2.1.9 states that the Cs-137 area factor of 11 for a 1-m^2 area was used to calculate a $DCGL_{EMC}$ of 67,914 dpm/100 cm^2. During the in-process inspection, clarification of this statement was given by SNEC staff—if an elevated area was found to be less than 1-m^2 in area, the elevated area would be averaged over a contiguous 1-m^2 area which included the elevated area, then compared to the $DCGL_{EMC}$. SNEC took this approach because the area factor tables in the approved License Termination Plan (LTP) (GPU 2002) did not model areas smaller than 1-m^2 and that this approach was more consistent with dose modeling. However, other NRC sites have taken the approach to cap the use of area factors. If SNEC took this approach, which is conservative, then the area factor of 11 would be applied to any elevated areas less than or equal to 1-m^2 in area without performing averaging.

determine the $DCGL_{EMC}$. An alternative approach would be to calculate a gross activity $DCGL_{EMC}$ using MARSSIM equation 4-4.

At the time of the in-process inspection, SNEC had not included static measurements into the survey design. Per the approved LTP, if the scan MDC is less than 10% of the $DCGL_W$, static measurements are not required. The actual sensitivity of the Shonka Research Associates (SRA) Surface Contamination Monitor (SCM) will be calculated when processing the data. If the sensitivity is not adequate, SNEC will need to draft an appropriate MARSSIM measurement plan.

4.0 FINAL STATUS SURVEY PROCEDURES AND INSTRUMENTATION

4.2 Building Surface Survey Instrumentation

4.2.1 Review the calibration and performance check procedures. Ensure calibrations will account for any environmental or other factors that could potentially impact performance. Evaluate the appropriateness of the calibration source energies in determining instrument efficiencies and any applied weighting factors relative to the radionuclides of concern. Evaluate the licensee's selection of surface efficiency value(s). Review the survey instrumentation operational checkout procedures and acceptance parameters.

- **Recommendations:** Specific calculations for the SCM efficiency were not available at the time of the in-process inspection. It is expected details of the SCM calibration will be included with the final status survey report for the tunnels. The performance check procedures for the SCM were demonstrated during the in-process inspection. The SRA procedures exceed industry standards (ANSI 1997); the SRA procedures implement a trending analysis system similar to that used by a laboratory.

  ESSAP recommends that information regarding weighting the instrument efficiencies by the fractions used to calculate the gross activity $DCGL_W$ be included in the final status survey report (see Recommendations for 2.1).

4.2.2 Review both the scanning and static measurement MDC determinations.

- **Observations:** SRA did not calculate *a priori* sensitivities for the SCM, but used operational knowledge to set the scan speed (sensitivity) of the motorized system. Details of actual sensitivities are to be included in the final status survey report.

4.2.3 Review the procedures for field use of instrumentation and evaluate that any *a priori* factors that may impact use in the field have been accounted for, such as scan speed and background variability. Review training records of personnel who will operate survey instrumentation.

- **Observations:** SRA did not calculate *a priori* sensitivities for the SCM (see Observations for 4.2.2). Training records were reviewed for SRA staff performing surveys in the tunnels. Training was confirmed for SNEC site access, final status survey, confined space, and post-remediation isolation and SRA SCM procedures.

4.3 Final Status Survey Procedures

Review final status survey procedures and planning documents for the following:

4.3.1 Verify the adequacy of reference areas selected by the licensee for assessing background contributions to surface activity levels and radionuclides in soils or other volumetric media.

- **Observations:** The background reference area that SNEC identified for the SSGS and tunnels was sold and no longer accessible. SRA was unable to perform background measurements using the SCM. Several possible solutions were discussed during the in-process inspection. SRA suggested 1) ignoring background because the radioactivity levels in the tunnels were near background, 2) locating a new background reference area for performing background measurements, 3) subtracting shielding measurements from unshielded measurements, and 4) infer the background from the collected data using statistical analysis. The final status survey report will contain details as to what approach or approaches were used.

4.3.2 Review procedures for establishing survey unit boundaries. Review maps showing preliminary survey unit designations.

- **Observations:** Survey unit boundaries were determined based on characterization surveys and physical features, e.g. floors of the tunnels were separate from the ceilings. No concerns were identified.

4.3.3 Review available radionuclide variability (σ) data that will be used for calculating required sample size. Additionally, determine whether the analytical methods and instrumentation used for the initial σ calculations are comparable to those that will be used during final status surveys.

- **Observations:** At the time of the in-process inspection, required sample size was not calculated (see Recommendations for 2.3).

4.3.4 Review procedures for required scan coverage based on survey unit classification.

- **Observations:** SNEC calculations E900-03-016 was reviewed. Per the approved LTP, all areas were scanned by the appropriate percentage.

4.3.7 Review selection process for sample locations in survey units.

- **Observations:** At the time of the in-process inspection, required sample size was not calculated (see Recommendations for 2.3).

6.0 IN-PROCESS AUDIT OF RADIOLOGICAL SURVEY TECHNICIANS

Review the licensee's radiological survey technician's implementation of the final status survey. Specifically:

6.2 Adherence to the specification of the Survey Requests (SR) generated by the licensee for final status survey field implementation.

- **Recommendations:** SR-0082 and SR-0083 pertaining to final status survey of the intake and discharge tunnels were reviewed. As part of the SRs, the attached SRA procedures for the SCM were also reviewed. It was noted that the wheel encoder confirmation was performed on 7/22/2003 when the SCM arrived on site per the procedures. It was noted that the survey logbooks did not have the P-10 gas level noted as required by the procedure. ESSAP recommends SRA add a procedure deviation entry to the survey logbooks. It was also noted that a date was missing from a page for 7/29/2003 in logbook #2.

  ESSAP also reviewed SRA staff performing final status surveys in portions of the discharge tunnel. Per the procedures, surveyed areas where marked with chalk and identified with a numerical code. A sketch of the area was noted in a survey logbook so that the various measurements could be "stitched" back together in the software during the data processing phase. The procedures also discuss laying down lane lines, for example with a chalk line, to guide the operator during SCM surveys. However, due to the width of the detector compared to the tunnel dimensions, lane lines were not required.

6.3 Performance of surface scans using the audible output—in particular, that the radiological survey technician passing the detector over the surface being measured is the individual listening to the audible output.

- **Observations:** The SCM did not have audible output. Instead, the SRA survey technician could watch the screen to see a visual representation of the SCM readings, but was not required because the data are processed post-survey with the location of each measurement captured.

7.0 CONFIRMATORY SURVEY MEASUREMENTS

7.2 Building Surface Surveys

Perform alpha+beta surface scans using gas proportional detectors coupled to ratemeter-scalers with audible indicators. Scans should be performed over 50 to 100% of selected survey units. Areas of elevated radiation will be marked for further investigation. Direct measurements will be performed in each survey unit—the number performed will be dependent on the licensee's modified guideline levels and surface scan results. Direct measurements will also be performed at locations corresponding to licensee measurements for direct data comparison.

- **Observations:** ESSAP performed alpha+beta surface scans using gas proportional detectors coupled to ratemeter-scalers with audible indicators over approximately 10% of lower walls in survey units SS6-1 and SS6-2 and approximately 25% of the first 150 feet of the discharge tunnel. Scan coverage was reduced from the inspection plan percentages due to results as the survey progressed and time constraints due to water leakage hampering survey efforts. Two low level elevated areas were noted during the scans. Direct measurements were performed at five locations, with two performed at the elevated areas noted during the scan survey. Because of the results of the in-process inspection (see Recommendations for 2.1 and 4.2.1 where further radionuclide fraction evaluation is required), ESSAP did not calculate an efficiency for calculating surface activity at this time. Survey activities were conducted in accordance with procedures from the ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 2003b and c).

8.0 QA/QC AND DATA MANAGEMENT PROCEDURES

ESSAP performed an inspection of the SNEC QA/QC and data management procedures during the period March 27 through 29, 2001. The following items will be reviewed for additions and/or modifications that have been incorporated since the 2001 inspection.

8.2 Review the licensee's data management system that will be used to track field and analytical results.

- **Observations:** SCM data were collected in strips. The arrangement of these strips were noted in survey logbooks using rough sketches. These sketches were used to digitally "stitch" the data back together in the SCM data management software called SIMS. Survey data were backed-up to CD-R. No concerns were identified.

REFERENCES

American National Standards Institute (ANSI). Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments. ANSI N323A-1997. New York, New York; 1997.

GPU Nuclear, Inc. (GPU). Saxton Nuclear Experimental Corporation Facility, License Termination Plan, Rev. 2. Saxton, PA; December 16, 2002.

Oak Ridge Institute for Science and Education (ORISE). Final Site-Specific Decommissioning Inspection Plan for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania (Docket No. 50-146, Task 1). Oak Ridge, TN; March 13, 2003a.

Oak Ridge Institute for Science and Education. Final Site-Specific Decommissioning Inspection Report No. 1 for the Saxton Nuclear Experimental Corporation, Saxton, Pennsylvania (Docket No. 50-146, Task 2). Oak Ridge, TN; May 15, 2003b.

Oak Ridge Institute for Science and Education. Survey Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, TN; February 2003c.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, TN; April 2003d.

U.S. Nuclear Regulatory Commission (NRC). Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Washington, DC; NUREG-1575; Revision 1, August 2000.