March 28, 2002

Mr. G. A. Kuehn, Jr.
Vice President SNEC and
Program Director SNEC Facility
GPU Nuclear, Inc.
Route 441 South
P.O. Box 480
Middletown, PA 17057-0480

SUBJECT: SAXTON NUCLEAR EXPERIMENTAL FACILITY - DISCUSSION TOPICS FOR APRIL 8, 2002, MEETING (TAC NO. MA8076)

Dear Mr. Kuehn:

We are continuing our review of your amendment request for Amended Facility License No. DPR-4 for the Saxton Nuclear Experimental Corporation Facility which you submitted on February 2, 2000, as supplemented. As part of our review, we have arranged a meeting with you that is open to public observation on April 8, 2002, to discuss details of our review of your application. The details of the meeting were sent to you under separate cover.

To facilitate our discussions on April 8, 2002, please find enclosed comments and issues that were identified during our review of your License Termination Plan, response to requests for additional information, characterization information, and observations during a recent site visit. The enclosure is not a request for additional information and may not contain all technical issues identified by the staff. Following our meeting, we may issue a request for additional information based on the outcome of the meeting.

If you have any questions regarding this review, please contact me at (301) 415-1127.

Sincerely,

/RA/

Alexander Adams, Jr., Senior Project Manager
Research and Test Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-146

Enclosure: As stated

cc w/enclosure: Please see next page

Saxton Nuclear
Experimental Corporation

Docket No. 50-146

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DISCUSSION ISSUES FOR MEETING BETWEEN THE NRC AND SNEC STAFFS
APRIL 8, 2002

Comments 1 to 6 are on the SNEC response to the NRC Request for Additional Information (RAI2) dated November 8, 2000.

1. Comments on RAI2 Question 3

SNEC's response states that embedded piping and other components will be removed to the extent practical. However, Table 5-2 indicates that building surface DCGL values will be used for any remaining embedded piping. Given that screening DCGL values will be used for building surfaces and these screening DCGL values were not developed for this purpose, the licensee needs to justify extending the application of screening DCGL values for this purpose. Table 5-2 also indicates that surface and volumetric concrete DCGL values will be applied in some survey units (e.g., the containment vessel). SNEC needs to clearly identify which set of DCGL values will be used. Because exposure from the concrete can occur from both surface and volumetric contamination, the more restrictive of the two sets of DCGL values should be used. It should be also noted that no DCGL values are provided for volumetric concrete.

Staff was unable to derive the area factors (specifically for Cs-137 and Co-60) included in Table 1. To facilitate the staff review, the SNEC needs to provide *SNEC Calculation Report # E900-01-005*. Further, area factors previously developed for soils (i.e., volumetric contamination) need to be updated based upon the revised modeling done in support of responses #4 and #8.

2. Comments on RAI2 Question 4

Table 1 provides both a "basic" set of input parameters and a range of parameter values. It is not clear which was used to develop the set of surface soil (upper ~1 m) DCGL values listed in Table 2. Staff was unable to duplicate the DCGL values by using the "basic" set of input parameters (see the table below). However, it is not clear from the information provided if this is what the "basic" set was used for.

It should be also noted that not all parameters are included in Table 1 and/or Section II of the write-up. For example, distribution coefficients (K_d) for some isotopes and the outdoor time fraction are not included. To facilitate the staff review and to allow an appropriate evaluation of the development of DCGL values, SNEC needs to provide electronic copies of the input and output files for their RESRAD analyses.

Radionuclide	SNEC DCGL (pCi/g)	NRC (pCi/g)
Co-60	3.9	2.62
Cs-134	5.1	3.94
Cs-137	8.7	7.48
Fe-55	2.3E+04	1.7E+04
Ni-59	3216	7640
Ni-63	1175	2791

While the treatment of parameters stochastically may be appropriate for sensitivity analyses, it may not be suitable for actually developing DCGL values. SNEC needs to clearly describe how the DCGL values were developed, how the sensitivity analysis was carried out, and how the results of the sensitivity analysis are being used. The primary purpose for performing a sensitivity analysis is to identify the key parameters; that is, those parameters that are expected to have the greatest effect on the calculated dose. Because these parameters are expected to have the most effect on calculating potential doses, it is very important that the value selected for these parameters be justified based upon either site-specific information or demonstration that the selected value is conservative. Using this criterion, SNEC has not justified the value used for all the key parameters listed in Table 4. In fact, no justification is provided at all for the selected value for several of the key parameters, such as: indoor time fraction, external gamma shielding factor, contaminated fraction of plant food, contaminated fraction of meat, depth of roots, and livestock fodder intake for meat. It should be noted that staff does not consider simply listing the parameter value used in the analysis as adequate justification for its use. Also, use of the central tendency of a range of values based on national data is generally not considered to be conservative when applied in a site-specific analysis. Such values may be appropriate for parameters for which the results are shown to be insensitive. SNEC's justification for the contaminated zone thickness may be also inadequate (see staff comment, below).

Overall, very little detail is provided on how the sensitivity analysis was conducted; therefore, staff cannot confirm that the 20 parameters listed in Table 4 (22 parameters are listed in the table, but several are listed twice) are indeed the key parameters. For example, no information is provided on the cutoff criteria that was used in the sensitivity analysis, which parameters were correlated (note: some of the parameters, such as porosity and density, should be correlated), and how the results are affected by the parameter (e.g., positively or negatively). It is also not clear whether a separate sensitivity analysis was performed for each radionuclide or whether the sensitivity analysis included all radionuclides jointly. It should be noted that analyzing the radionuclides jointly could give misleading results. Based on the radionuclide mix, several parameters such as plant, meat, and milk transfer factors, saturated zone hydraulic conductivity, depth of soil mixing, and wind velocity are expected to be important, but are not included in the list in Table 4. To facilitate the staff review of the sensitivity analysis, SNEC needs to clearly describe the approach used to conduct their sensitivity analysis. In addition, SNEC needs to provide the RESRAD output report(s) from their sensitivity analysis.

SNEC provides no basis for why it is appropriate to assume that all contaminants within the shallow system will be limited to 1.0 meter. Why is it appropriate to separate the potential impacts from exposure to contaminants in the shallow system from those in the deeper system, especially if the contamination extends from the surface down to some deeper zone? SNEC needs to explain, why it is appropriate to assume that exposure to contamination at these different zones will be independent and mutually exclusive.

In addition to these general comments, staff has the following specific comments with the analysis conducted in response to RAI #4:

- SNEC needs to show that use of the lowest K_d values will provide a conservative assessment of the dose. It is not certain that use of the lowest K_d value will be conservative for radionuclides where the ground-water pathway is not important. In fact,

use of the lowest K_d value could be non-conservative for radionuclides where the surface exposure pathways are important. In general, K_d should be treated as a stochastic parameter in the sensitivity analysis to determine what effect it has on the calculated dose. For isotopes where K_d is shown to be sensitive, and negatively correlated with the dose, it would be appropriate to assume that use of the minimum derived K_d value is conservative. On the other hand, where K_d is shown to be sensitive, and positively correlated with the dose, use of the minimum derived K_d value would be non-conservative.

- If the slope of the ground-water ranges between 10 to 15 feet over a distance of 600 to 800 feet, the hydraulic gradient should range between 0.0125 to 0.025, instead of 0.017 to 0.019.

- In order to assess the sensitivity analysis, the statistical parameters used in the analysis should be provided. The minimum and maximum values, as reported in Table 1, are only useful for the uniform, normal-b, and lognormal-b distributions.

- SNEC needs to justify the assumption that 75% of the livestock and irrigation water is derived from on-site sources. SNEC needs to explain why this is considered to be either a conservative or acceptable assumption.

- SNEC needs to explain why (how) the contaminated fraction of plant food and meat parameters are identified as sensitive parameters (in Table 4); however, Table 1 indicates that these parameters were not included in the probabilistic analysis.

- It is not clear why SNEC chose to use a range of values for some behavioral parameters and then elected to go with the DandD default for the “basic” set. Given that the DandD default is usually at the lower end of the range, this has the appearance that a non-conservative value is being used, especially if the results are sensitive to the parameter (e.g., leafy vegetable consumption). If the DandD default values are considered acceptable, they should be assigned as a constant in the probabilistic analysis. On the other hand, if the assigned range and statistical distributions are considered appropriate, the selected value should be based upon that range and distribution, in which case, selection of a value at the lower end of the range cannot be considered as conservative.

- SNEC needs to justify the use of a contaminated zone area of 10,000 m^2; i.e., SNEC needs to indicate that this bounds the area of contamination at the site and is consistent with the assumptions made in developing survey units.

3. Comments on to RAI2 Question 5

As reflected in the response, DCGL values developed for contaminated soil will be applied to a range of different media, including fill material and construction debris. SNEC needs to indicate why K_d is the only factor that should be considered in determining the application of these DCGL values to a wide range of different contaminated media. In addition, SNEC needs to show that use of the lowest K_d values will provide a conservative assessment of the dose (see previous comment, above).

4. Comments on RAI2 Question 6

Because there are different versions of the MARSSIM manual, the specific equation that will be used should be included in the LTP. Simply referring to a page number in the manual is inadequate. Further, it is not clear what is meant by "or an equivalent form." This needs to be clarified. The licensee needs to also explain when and how gross activity DCGL values will be provided.

5. Comments on RAI2 Question 8

SNEC's basis for characterizing the reported DCGL values as conservative is not clear. Tables 4-5, 4-6, and 4-8 of Appendix 2 lists minimum, maximum, and mean DCGL values. Apparently the smallest mean values are used to develop the minimum site subsurface values reported in Table 5-1. No information is provided on what the mean represents and how it was derived (i.e., is it based on the mean of the distribution of outputs or a deterministic analysis using mean input parameter values?). To facilitate the staff review, SNEC needs to provide electronic copies of their input and output files for analyses used to develop these DCGL values. In addition, SNEC needs to clearly explain how these mean DCGL values were derived and why they are appropriate for determining compliance. It should be noted that the mean DCGL may not necessarily equate to a mean dose of 25 mrem/year.

SNEC needs to explain how their analysis of subsurface material appropriately represents the material being located in the saturated zone. To model this material under saturated conditions, no ground-water dilution should be assumed and all contaminants should be assumed to be available for withdrawal from the hypothetical well. Accordingly, it seems that the mass balance (MB) approach should have been used in the RESRAD analysis for modeling the bedrock layer instead of the non-dispersion (ND) approach. No information is provided on which approach was used for the recreation exposure scenario; however, the MB approach should be used for that scenario as well.

In addition to these general concerns, staff has the following specific concerns with the analysis conducted in response to RAI #8:

- SNEC needs to show that use of the lowest K_d values will provide a conservative assessment of the dose (see previous comment, above). In addition, SNEC needs to justify the use of RESRAD default K_d values for Ac, Pa, Po, Ra, and Th. Further, SNEC needs to justify the use of an upper-end K_d value of 5 for C and H given that a recommended K_d value of 1 is listed in Table 3.

- In order to assess the sensitivity analysis, the statistical parameters used in the analysis should be provided. The minimum and maximum values, as reported in Table 4-1, are only useful for the uniform, normal-b, and lognormal-b distributions.

- No basis is provided for assuming a dilution factor of 1/5 for contaminants in overburden material assumed to be brought to the surface.

- The assumption that irrigation water will be derived from the shallow zone, where the contaminants are assumed to be diluted, as opposed to the deeper zone where the drinking water is assumed to be derived is not conservative and needs to be justified.

- SNEC needs to provide information that was supposed to be included in Attachment A of the URS Corp. report.

- As stated in the comments on the analysis provided in response to RAI #4, SNEC needs to clearly describe the approach used to conduct their sensitivity analysis. In addition, SNEC needs to provide the RESRAD output report(s) from their sensitivity analysis. The fact that the external gamma shielding factor is not identified as a key parameter for Co-60, Cs-137, Eu-152, Eu-154, Eu-155, and Nb-94 in Table 4-2 raise concerns about the validity of the sensitivity results. It is not clear why a table similar to Table 4-2 was not included for the sensitivity analyses conducted for bedrock and sediment exposures.

6. Summary of Key Concerns

SNEC responses to RAI2 Questions 3, 4, 5, 6, and 8 are insufficient to close out these RAIs. Staff has significant concerns primarily with the responses for RAI numbers 4 and 8:

- Staff has key concerns with the analyses used to develop and support the development of DCGL values that will be used for soils, concrete debris, and sediments. In particular, staff does not believe that SNEC has provided a sufficient basis to support the approach used for conducting the sensitivity analyses to identify key parameter and for analyzing subsurface material.

- The documentation and information provided is not sufficient to allow a clear understanding of how the analysis was done, how to interpret the results, and an independent assessment of the results. Accordingly, staff has concerns with the transparency and reproducibility of the analysis.

7. Site Visit of March 11, 2002

Removal of all Concrete from Inside the Containment Vessel (CV) Liner: Although NRC agrees that radiological characterization leads into, and may continue until the final status survey (FSS) is conducted, the licensee's decision to remove all concrete from inside the containment vessel is a significant departure from surface scabbling and removal of limited volumes of contaminated concrete that is now presented in the license termination plan (LTP), Section 2, "Site Characterization". The decision by the licensee during late fall 2001 to progress from limited to complete removal of the internal concrete structure warrants a major revision to the LTP (i.e., Section 2, "Site Characterization" and Section 5, "Final Radiation Survey Plan") for the following reasons.

- All of the survey units specific to the interior rooms (i.e., floors, walls, ceilings) of the CV, that are currently described in the LTP, will no longer exist. This accounts for about 50 percent of the survey units for the entire site in Table 5-2, Initial Classification of Site Areas" of the LTP.

- New survey units will need to be created once all of the concrete is removed from inside of the CV liner. These new survey units will be comprised of the exposed steel liner . Once exposed, the CV liner will require complete characterization for surface contamination and activation products. No such characterization has been done to date since the entire CV liner is now covered with several feet of structural support concrete.

- The design of the FSS for the inside of the CV liner will require revision. Removal of all concrete from the CV liner poses some new technical challenges to the design and conduct of the FSS. First, all of the support concrete cannot be removed, and thus expose all off the CV liner, since the CV liner would collapse from the outside groundwater pressure. Instead, as concrete is removed from the CV liner, steel reinforcement must be welded into place to prevent the walls from collapsing. Specifically, sections of steel reinforcement rings will be welded to the liner when only a few square meters of concrete are removed to avoid CV structural collapse. Placement of the steel reinforcement rings will obscure significant areas of the CV liner once they are installed. This will interfere with the taking of surficial radiological measurements during the FSS. Also, the procedure by which the licensee intends to characterize surfaces covered by the steel reinforcement rings needs to be established. As there is significant potential for the presence of activated steel in the CV liner, the nature and extent of this and other radiological contamination will need to be characterized.

- Figures describing the new survey units and tables indicating the nature and extent of contamination will need to be provided for NRC staff review. Also, a description of the survey/sampling techniques to be used to conduct the FSS needs to be provided. The licensee has indicated that automated advanced technology devices may be used to acquire data for characterization and the FSS. DQOs for such devices will need to be developed and then reviewed by the NRC staff to determine adequacy for the FSS.

- In the LTP, the licensee included the CV dome as part of the FSS and designated the survey units for which a FSS would be done. However, upon completion of the lower CV FSS, the licensee now intends to install a temporary floor (about 10 feet below grade) and then remove the entire CV dome structure. Issues regarding radiological controls to avoid recontamination of the lower CV structure need to be addressed. Also, the lower half of the CV will now be re-filled prior to the termination of the license, and therefore, protocols that ensure clean fill is used need to be provided (so that regulatory compliance with the release criteria is maintained post FSS).

- Additionally, LTP Section 3, “Identification of Remaining Dismantlement Activities” and Section 4, “Remediation Plans” will need to be revised to include information specific to this significant change in the site decommissioning process.

8. Review of Phase 1, 2, and 3 Characterization Data

Some of the more significant issues concerning the additional site characterization data provided by the licensee are presented below:

- Minimal or no TRU/HTD radionuclide data was provided for the structures and land/water areas characterized. Since the site used failed fuel assemblies containing

MOX, such information is critical to understanding the nature and extent of such site contamination, as well as the design and conduct of the final status survey.

- The sample/measurement data needs to be clarified. In some cases, sample activities for sediments are provided with no radionuclides identified. Confidence intervals for the data provided is rarely given. Analytical techniques used for identifying TRU has not been stated. The overwhelming majority of data is specific to Cs-137 only. The purpose for providing additional characterization data was to determine the nature and extent of those radionuclides specific to the suite identified in the LTP. The licensee has not adequately addressed this issue.

  Figures need to be provided for the SSGS structure that clearly depict survey units for floors and walls. The license needs to show that they understand how to conduct an adequate FSS according to the MARSSIM since the walls are not flat. In general, additional figures and tables need to be provided that are legible and indicate the location of samples of significant activity.

- Classification of the impacted section of the intake tunnel needs further justification. Currently, the licensee is assigning this as a Class 3, additional data and/or rational for not making this a Class 2 needs to be given.

- Based on the results of the supplemental characterization, the licensee has changed the classification of the weir outfall from Class 1 to Class 2. This needs to be reflected in a revision to Table 5.2. In addition, the size of the survey unit needs to be clarified.

9. Key Additional Issues from Current LTP

Continued review of the LTP has raised other significant issues that requiring addressing. Some of these concerns are presented below:

- Figures need to indicate specific survey units with appropriate sampling and measurement locations depicted, and correlated to the appropriate data and survey unit classification tables. A generic block diagram showing general area classifications is not adequate. Specifically, Figure 5-1, “SNEC Facility Site Area Grid Map, indicates that the entire licensed site is designated as Class 1, when in fact, there exist many survey units inside this area that are Class 2 or 3. Also, survey areas are often designated as containing multiple survey units, yet no information is provided (map or figure) to denote the boundaries of each survey unit within a specific survey area.

- Section 5.7.2, Final Survey Report - The content of the final status report as explained in the LTP is not adequate. Specifically, the LTP indicates that the level of detail to be provided for much of the results and related information will be submitted in summary form. Provision of such summaries will not be adequate. The final status survey report must be a stand-alone document that is all inclusive of the information and data specific to that survey unit. Such is necessary for the NRC staff to make the determination that the licensee has adequately demonstrated compliance with the release criteria.

The remaining portion of the CV tunnel that currently supports the Materials Handling Bay (MHB) has not been classified; the tunnel is an impacted area. As this portion of the CV tunnel cannot be demolished, unless the MHB is removed first, the licensee needs to clarify the decommissioning sequence of events to justify not classifying the CV tunnel.