April 20, 2004

Mrs. Margaret Harding, Manager
Nuclear Fuel Engineering
Global Nuclear Fuel
P. O. Box 780
Wilmington, NC 28402

SUBJECT: DRAFT SAFETY EVALUATION FOR GLOBAL NUCLEAR FUEL (GNF) LICENSING TOPICAL REPORT NEDC-33107P, "GEXL80 CORRELATION FOR SVEA96+ FUEL" (TAC NO. MC0666)

Dear Mrs. Harding:

By letter dated September 8, 2003, as supplemented by letters dated September 17, 2003, and March 17, 2004, Global Nuclear Fuel (GNF) submitted Licensing Topical Report (LTR) NEDC-33107P, "GEXL80 Correlation for SVEA96+ Fuel," to the staff for review. Enclosed for GNF's review and comment is a copy of the staff's draft safety evaluation (SE) for the LTR.

Pursuant to 10 CFR 2.390, we have determined that the enclosed draft SE does not contain proprietary information. However, we will delay placing the draft SE in the public document room for a period of ten working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects. If you believe that any information in the enclosure is proprietary, please identify such information line-by-line and define the basis pursuant to the criteria of 10 CFR 2.390. After ten working days, the draft SE will be made publicly available, and an additional ten working days are provided to you to comment on any factual errors or clarity concerns contained in the SE. The final SE will be issued after making any necessary changes and will be made publicly available. The staff's disposition of your comments on the draft SE will be discussed in the final SE.

To facilitate the staff's review of your comments, please provide a marked-up copy of the draft SE showing proposed changes and provide a summary table of the proposed changes.

If you have any questions, please contact Mel Fields at (301) 415-3062.

Sincerely,

/RA/

Stephen Dembek, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 712

Enclosure: Draft Safety Evaluation

cc w/encl: See next page

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DRAFT SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

LICENSING TOPICAL REPORT NEDC-33107P, "GEXL80 CORRELATION

FOR SVEA96+ FUEL"

GLOBAL NUCLEAR FUEL

PROJECT NO. 712

1.0 INTRODUCTION

By letters dated September 8, 2003 (Reference 1), and September 17, 2003 (Reference 2), Global Nuclear Fuel (GNF) submitted proprietary and non-proprietary Licensing Topical Reports (LTR) NEDC-33107P and NEDO-33107, "GEXL80 Correlation for SVEA96+ Fuel," for NRC review and approval. The LTR contained the proposed methodology, the correlation development, and a determination of the associated uncertainties derived for modeling the critical power performance of the Westinghouse Electric Company LLC (Westinghouse) SVEA96+ fuel design. This critical power correlation will be applied to the legacy (at least once-burned) SVEA96+ fuel that will co-reside in the Hope Creek Generating Station (Hope Creek) boiling water reactor (BWR), beginning with operating Cycle 13, when GNF first provides a fresh batch reload of the GNF GE-14 fuel design in November 2004.

The GNF submittal was supplemented by two supporting documents submitted by PSEG Nuclear LLC (PSEG) on September 8, 2003, one providing the Westinghouse proprietary Table 2-3, "SVEA96+ Modeling Dimensions," to be used in the NEDC-33107P LTR (Reference 3) and the second providing the PSEG document, "GE14 and SVEA96+ Thermal Hydraulic Compatibility Report," (Reference 4), containing both Westinghouse and GNF proprietary information.

The methodology utilized to develop the GEXL80 critical power correlation is consistent with that used for developing the General Electric critical quality (X_C), boiling length (L_B) correlation (GEXL) form of the critical power correlations for new GNF fuel designs, as defined in the approved General Electric BWR Thermal Analysis Basis (GETAB) LTR (Reference 5). The GEXL critical power form is required in the GNF standard reload design process, as outlined in the approved General Electric Standard Application for Reactor Fuel (GESTAR II) document (Reference 6).

The GNF submittal summarizes the development of the SVEA96+ GEXL80 critical power correlation. As stated, the SVEA96+ GEXL80 correlation will be used to determine the critical power performance of the Westinghouse SVEA96+ fuel design. The legacy Westinghouse SVEA96+ fuel, which is co-resident in a mixed core with fresh GNF GE-14 fuel, will be in at least its second cycle of irradiation. As such, the SVEA96+ GEXL80 correlation would not be applied to reload quantities of first cycle SVEA96+ fuel. The GNF submittal describes the process used in the development of the GEXL80 correlation for prediction of critical power for SVEA96+ fuel and presents the determination of the ECPR (ratio of the GEXL80 calculated critical power to the PSEG ABBD2.0 calculated critical power) mean value and the uncertainty of that correlation in the prediction of the SVEA96+ critical power performance. The final GEXL80 predicted to SVEA96+ measured critical power mean and uncertainty is presented, as determined by PSEG from comparison to the actual measured experimental critical power data.

2.0 REGULATORY EVALUATION

Title 10 of the Code of Federal Regulations (CFR), Section 50.34, "Contents of Applications; Technical Information," requires that safety analysis reports be submitted that analyze the design and performance of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents. As part of the core reload design process, licensees (or vendors) perform reload safety evaluations to ensure that their safety analyses remain bounding for the design cycle. To confirm that the analyses remain bounding, licensees confirm that key inputs to the safety analyses (such as the critical power ratio) are conservative with respect to the current design cycle. If key safety analysis parameters are not bounded, a re-analysis or reevaluation of the affected transients or accidents is performed to ensure that the applicable acceptance criteria are satisfied.

There are no specific regulatory requirements for the review of topical reports. NRC staff guidance for preparing the safety evaluation (SE) input is provided in NRR Office Instruction LIC-500, Revision 2, "Processing Requests for Reviews of Topical Reports." Following such guidance, the NRC staff review was based on the evaluation of the technical merit of the submittal and compliance with any applicable regulations.

3.0 TECHNICAL EVALUATION

The hypothetical critical power data base to be used for the development of the GEXL80 correlation was obtained from PSEG. This data base consisted of SVEA96+ sub-bundle and full bundle critical power data points generated by the NRC-approved Westinghouse BWR subchannel code "CONDOR" (Reference 7), incorporating the NRC-approved Westinghouse ABBD2.0 critical power correlation (Reference 8) for SVEA96+ fuel. The objective of this data generation and collection was to obtain SVEA96+ critical quality data appropriate for generating the GETAB GEXL form critical power ratio (CPR) values for use in the GNF standard reload safety analysis process (GESTAR II) from Reference 6.

The span of the hypothetical data generation and collection encompasses cosine, top peaked, bottom peaked, and double humped axial power shapes in order to cover the complete range of expected operation of the SVEA96+ fuel in the Hope Creek BWR core. The data was used to develop a new GEXL correlation for the SVEA96+ design. This new GEXL correlation for SVEA96+ fuel was designated as GEXL80. The GEXL80 correlation uses the same functional form as previous GEXL correlations with different values of the constants derived for the GEXL correlation coefficient parameters.

The GEXL form for the critical power correlation has been used in the safety analysis process for GE fueled BWRs since 1974, and is described in the GETAB LTR NEDO-10958-A. The GEXL correlation was developed to provide a best estimate prediction of the onset of boiling transition in BWR fuel assemblies. The GEXL correlation is based on the relationship of critical quality with boiling length. It expresses the bundle average critical quality as a function of boiling length, bundle thermal diameter, system pressure, lattice geometry, local intra-bundle power peaking patterns (R-factor), mass flux and annular flow length.

GEXL was developed to accurately predict the onset of boiling transition in BWR fuel assemblies during both steady-state and reactor transient conditions. The GEXL correlation is necessary for GNF to determine the minimum critical power ratio (MCPR) operating limits resulting from transient analysis, the MCPR safety limit analysis, and the core operating performance and design. The GEXL correlation is an integral part of the transient analysis methodology. It is used to confirm the adequacy of the MCPR operating limit, and it can be used to determine the time of onset of boiling transition in the analysis of other events.

The NRC staff's review considered the following: (1) the adequacy of the hypothetical database generated with the Westinghouse sub-channel code CONDOR, (2) the proper determination of the uncertainty in the GEXL80 correlation predictions for the SVEA96+ fuel design, (3) the applicability of the proposed operating application range of GEXL80 correlation for the SVEA96+ fuel, and (4) the comparison of the GEXL80 correlation critical power predictions to the raw critical power experimental data for the SVEA96+ fuel.

3.1 Validity of the Hypothetical Data Base and Associated Uncertainties.

PSEG used the approved Westinghouse ABBD2.0 critical power correlation for the SVEA96+ fuel (as encoded in the Westinghouse sub-channel code CONDOR) to generate a hypothetical database of predicted critical power values for a range of operating conditions corresponding to the range of the SVEA96+ correlation. This hypothetical database was then treated by GNF in the same way as an experimental database, using the approved methodology for GEXL correlation development. Utilizing this approach, GNF produced a new form of the GEXL correlation, namely GEXL80, intended for plant-specific application (Hope Creek) to the legacy SVEA96+fuel design, located in non-limiting locations with at least one cycle of irradiation.

The data for the GEXL80 development specific to SVEA96+ fuel was generated using the NRC- approved Westinghouse ABBD2.0 correlation encoded in the above stated sub-channel code. GNF specified the values of rod-to-rod power peaking, axial power shapes, pressure, mass flux and sub-cooling that were used with the Westinghouse ABBD2.0 correlation to determine the predicted critical power at dryout.

The SVEA-96+ fuel design is a 10x10 fuel lattice array consisting of four mini-bundles, which reside in a channel box. The channel structure has a central water cross that displaces four fuel rod positions, one from each mini-bundle, and four water wing structures that extend from the central water cross to the channel wall. The channel structure is attached to the lower tie plate. The composition of each of the mini-bundles includes upper and lower tie plates, spacer grids, and 24 full-length fuel rods. A handle attaches to the top of the channel box for lifting and transporting the fuel assembly.

As part of the previous Hope Creek fuel vendor transition, Westinghouse (formerly ABB-CE) supplied SVEA-96+ thermal hydraulic performance data, as well as local loss coefficients [PSEG File HCA.5-0020], at several power and flow conditions for the current licensed reactor power of 3293 mega-watts thermal (MWt), using the proprietary computer code CONDOR. The FIBWR2 model of Reference 9 was benchmarked against this data. Table 3.1 of Reference 3 displays the pressure loss coefficients that were provided for the upper and lower tie plate and the spacers. The inlet loss coefficients are the values traditionally used at Hope Creek to model the central and peripheral bundle orifices, relative to the reference flow area.

3.2 Determination of Correlation Uncertainties

The hypothetical database used in the development of the GEXL80 correlation for SVEA96+ fuel was summarized in Table 2-1 of Reference 1. This table shows the number of calculated critical power data points obtained using the Westinghouse critical power correlation for cosine, inlet, outlet, and double humped axial power distributions. It also shows the fuel pin dryout location that formed the basis for the 26 different sets of Westinghouse calculated critical power data. Table 2-2 of Reference 1 provides additional information by further dividing the calculated data points collected into subgroups by pressure, mass flux, and inlet sub-cooling.

Although the GEXL80 hypothetical database generated in this manner is artificial in construct, i.e., created with a computer code which has encoded in it the ABBD2.0 correlation, and which at best can only approximate the actual critical power raw data behavior of the SVEA96+ fuel, it can be expected with reasonable engineering practices, and proper statistical accountability, to predict critical power behavior with acceptable uncertainties. Testing the hypothetical database values as if it were real data in the regression analysis, however, introduces unavoidable error into the correlation being derived from it.

The local critical power values predicted with the approved ABBD2.0 correlation can be predicted to vary over the range of the hypothetical database. Since the GEXL80 correlation is fitted to this hypothetical database, the error in the critical power prediction of the GEXL80 correlation for a given set of conditions will have some additional error relative to the real critical power value for those conditions, over and above the uncertainty of the correlation’s fit to the hypothetical database. Therefore, the approach of the correlation procedure can be valid only if the overall uncertainty in the new GEXL80 correlation is appropriately characterized in terms of both the uncertainty in its fit to the hypothetical database and the uncertainty of the critical power values in the hypothetical database itself.

The treatment of the overall uncertainty of the GEXL80 correlation for SVEA96+ fuel, as presented in the GNF submittal, is complete in that GNF used standard statistical combination of uncertainty techniques to appropriately combine the uncertainty of the fit of GEXL80 correlation to the hypothetical database and the uncertainty of the database itself, which is a function of the uncertainty of ABBD2.0 correlation.

3.3 Generation of the GEXL80 Correlation and the Range of Applicability

In developing the GEXL80 correlation, GNF took steps to optimize the GEXL80 critical power predictions for the SVEA96+ fuel design, and to minimize the prediction uncertainty. This process is identical to that used by GNF when developing GEXL correlation coefficients for

GNF/GE fuel designs using raw test data, and has been used in past development of GEXL correlations applicable to other legacy fuel.

The procedure used for the development of the GEXL80 correlation is summarized below:

- First, a range of generated data covering all parameter(s) variations was selected to form a correlation development database. This database consists of the majority of the generated data. A separate data-set was set aside to form a correlation verification database.

- The GEXL80 correlation coefficients are then chosen (optimized) to minimize the bias and standard deviation in correlating the development database, and to minimize any trend errors in reference to flow, pressure, sub-cooling, and R-factor.

- Once the optimum coefficients were determined, the apparent R-factors are calculated for each assembly. The apparent R-factor is defined as that R-factor which yields an overall ECPR of 1.0 for a given assembly. ECPR is defined as the ratio of the GEXL80 calculated critical power to the PSEG ABBD2.0 calculated critical power.

- A final set of additive constants are determined by adjusting the preliminary additive constants, subject to minimizing the difference between the R-factors.

The range of application for the GEXL80 correlation as stated in the submittal is the same as the range of the hypothetical database over which the correlation is derived and is determined by PSEG to be within the Westinghouse SVEA 96+ experimental development database.

The stated application range covers the complete range of expected operation of the SVEA96+ fuel during normal steady-state and transient conditions in the Hope Creek BWR core, and this will be confirmed by GNF and monitored by PSEG during plant operation.

3.4 Comparison of GEXL80 Critical Power Results to SVEA96+ Raw Data

As part of the Cycle 13 reload design, PSEG had an agreement with GNF to compare the GEXL80 correlation critical power predictions with the SVEA96+ raw critical power data (Reference 10). This comparison was documented in Reference 11, in which PSEG communicated to GNF the final values of the bias and uncertainty to be used in the application of the GEXL80 correlation. On February 17, 2004, members of the NRC staff visited the Hope Creek site in Salem, New Jersey for an on-site review of the results of the above stated comparison and the participation of PSEG in the analyses. Both sub-bundle and full bundle comparisons were conducted by PSEG personnel. The NRC staff reviewed the comparisons for biases and uncertainties that may have been added to or subtracted from the GEXL80 pseudo database, and which might result in non-conservative predictions of critical power, resulting in delayed prediction of fuel going into boiling transition.

The thermal-hydraulic operational ranges of the GEXL80 correlation and the fundamental statistical basis were reviewed, in addition to the comparison to the raw data. The results of the comparisons showed excellent agreement of the GEXL80 correlation critical power predictions to the SVEA96+ critical power data base. The NRC staff concurs with the results and conclusions of the comparisons conducted by PSEG, and concludes that the use of the GEXL80 correlation with the stated bias and uncertainty conservatively predicts critical power values for the legacy fuel SVEA96+.

3.5 Sub-Bundle Mis-Match Factor

The SVEA96+ bundle is divided into four mini-bundles by the water cross as shown in Figure 2-1 of Reference 1. The four mini-bundles comprised four parallel flow channels that are all subject to the same overall lower template to upper template pressure drop. If the SVEA96+ bundle has a quadrant symmetric pin power distribution, the four mini-bundles have the same power and they will also have the same mass flux and critical power performance. If, on the other hand, the pin power distribution is not symmetric, the four mini-bundles will have different powers. The mini-bundle with the highest power will have the highest steam vapor generation and, therefore, its two-phase pressure drop will increase relative to the other three mini-bundles. Since the four mini-bundles all have the same overall pressure drop, the impact of the higher two-phase pressure drops in the hottest bundle must be offset by a reduced inlet flow and a corresponding lower single phase pressure drop. Similarly, the mini-bundle with the lowest power will have less vapor generation, less two-phase pressure drop and correspondingly must have a higher inlet flow and higher single phase pressure drop. Therefore, the impact of a power mis-match between the four mini-bundles in the SVEA96+ fuel bundle is that the mini-bundle with the highest power has a mass flux that is less than the average for the full bundle, and the mini-bundle with the lowest power has a mass flux that is higher than the average. For a mini-bundle, a reduction in the mass flux will produce a corresponding reduction in the mini-bundle critical power (critical power is a monotonically increasing function with mass flux).

The GEXL methodology calculates the critical power based on the bundle R-factor and the bundle average mass flux. Using this average mass flux, however, does not account for the lower mass flux in the hottest mini-bundle and the corresponding lower critical power. Therefore, an adjustment to the critical power must be developed to account for the impact of any power mis-match between the mini-bundles. The thermal/hydraulic model for the SVEA96+ bundle characterizes the pressure drop as a function of power and mass flux. A relationship between power and flow for a constant pressure drop can be derived from this thermal-hydraulic model. Therefore, the mismatch in mini-bundle mass flux can be determined for a given mini-bundle power mis-match and the average bundle thermal/hydraulic conditions. Since critical power is a monotonically increasing function with mass flux, the mini-bundle mass flux mis-match can be equated to a corresponding reduction in mini-bundle critical power. This reduction in the mini-bundle critical power is then incorporated as a penalty on the R-factor for the mini-bundle.

3.6 Thermal-Hydraulic Compatibility of the GE14 Fuel with the SVEA96+ Fuel

The September 8, 2003, submittal by PSEG (Reference 4), provided independent verification of the conclusion made by GNF that the GE14 and SVEA96+ fuels are thermal-hydraulically compatible.

Westinghouse provided the thermal-hydraulic modeling data for the legacy SVEA96+ fuel [PSEG File HCA.5-0020] and GNF for the GE14 fuel [PSEG File HCG.5-0004]. As part of the new fuel introduction (NFI) work scope, GNF provided PSEG a report containing several mixed core evaluations to support the conclusion that the two distinct fuel designs are thermal-hydraulically compatible [PSEG File NFVD-GE-2003-002-00]. PSEG has taken the data from each fuel vendor and modeled each fuel type using the industry computer code FIBWR2 (Reference 9) as an independent means of verifying the conclusions arrived at by GNF.

The September 8, 2003, PSEG submittal first summarized the FIBWR2 benchmark results of modeling the full cores of each fuel type at various power and flow conditions. The FIBWR2 model for each fuel type was benchmarked with the thermal-hydraulic analysis results provided by the respective fuel vendors. Included also in the September 8 submittal, is a summary of the core performance for a number of projected transition or mixed cores at the same power and flow conditions to verify the fuel vendor's conclusions regarding the thermal hydraulic compatibility of the SVEA96+ and GE14 fuel designs.

The GE14 fuel design consists of 92 fuel rods arranged in a 10x10 lattice array, with two water tubes displacing eight fuel rod positions. Fourteen of the 92 fuel rods are part-length. Additional components in a GE14 assembly include: upper and lower tie plates, spacer grids, a handle that attaches to the upper tie plate for lifting, and a channel box that slides over the fuel rods and has a spring loaded fit against the lower tie plate. As part of the current fuel vendor transition, GNF supplied GE14 thermal hydraulic performance data [PSEG File HCG.5-0004] at several power and flow conditions for a rated power of 3952 MWt, the future extended power uprate (EPU) power level, using the proprietary GNF computer code ISCOR (GESTAR II). The PSEG Hope Creek FIBWR2 model [PSEG File HCT.6-0042] was benchmarked against this data. Table 3.3 of Reference 3 displays the pressure loss coefficients that were provided for the upper and lower tie plate and the spacers. The inlet loss coefficients are the values traditionally used at Hope Creek to model the central and peripheral bundle orifices, relative to the reference flow area. Table 3.4 of the Reference 3 displays a sample comparison of the GE14 information and the FIBWR2 results using a 1.4 peak to average chopped cosine axial power shape.

With respect to the ranges of operability, GNF provided the results of analysis of the reference loading pattern for the Hope Creek Cycle 13 that has core characteristics that are representative of the mixed cores that will be encountered during the transition cycles. The CPR was extracted for all the SVEA96+ fuel throughout the entire cycle. Examination of the CPR data confirmed that the legacy SVEA96+ fuel will not be the limiting MCPR fuel in Cycle 13.

3.7 Mixed Core Evaluations

The next three cycles at Hope Creek will be designated as mixed cores, with core loadings comprised of SVEA96+ fuel and GE14 fuel. The first transition mixed core, Cycle 13 was modeled with approximately two-thirds SVEA96+ fuel and one-third GE14 fuel. Cycle 14 was modeled with approximately one-half SVEA96+ fuel and one-half GE14 fuel; and Cycle 15 was modeled with approximately one-third SVEA96+ fuel and two-thirds GE14 fuel. Subsequently, PSEG performed independent calculations to verify the mixed core calculation results as obtained by GNF, regarding the similarity in thermal-hydraulic performance of the GE14 and

SVEA96+ fuel designs. Proprietary data provided by Westinghouse and GNF was used by PSEG to develop FIBWR2 computer code models to perform the various evaluations.

Specifically, PSEG investigated the compatibility between GE14 and SVEA-96+ through a series of mixed cores, progressing from the current full core of SVEA96+ fuel to a projected full core of GE14 fuel. Tables 4.2 through 4.7 of Reference 4 display the FIBWR2 simulation results for each of the core loadings in Table 4.1 of Reference 4 at each of the reactor conditions. The mixed core simulation analyses projected the performance of both fuel types during transition cores, going from a full core of SVEA96+ fuel to a full core of GE14 fuel. During the mixed core transition cycles, only SVEA96+ assemblies are placed at the core periphery. Each of the mixed core loadings will have 92 SVEA96+ bundles placed at the periphery of the core. In the model, one of the SVEA96+ bundles is designated a "hot" SVEA96+ bundle with a 1.56 radial power peaking factor, and one "hot" GE14 bundle with a 1.56 radial power peaking factor, with the remainder of each fuel type allocated (loaded) to reach the respective bundle quantities listed in Table 4.1. The following trends were observed to occur in the mixed core evaluations:

- As discussed in Section 3.4 of Reference 4, the core pressure drop for a full core of GE14 fuel is higher than the core pressure drop for a full core of SVEA96+ fuel at all reactor conditions. As was demonstrated by GNF, the mixed core results showed that as the fraction of GE14 assemblies increases, the core pressure drop also increased to approach the GE14 full core value. The linearity of the core pressure drop increase as a function of GE14 assembly fraction, indicated that the introduction of GE14 fuel assemblies into the SVEA-96+ fuel core does not significantly affect the original SVEA96+ performance, while the GE14 fuels maintain their own performance as if they are in the full GE14 cores. This result was expected since the thermal-hydraulic performance of these two fuel types is similar.

- The core active flow (water through the active fuel zone) for the mixed core was found to be essentially the same for all reactor conditions.

- As discussed in Section 3.4 of Reference 4, the core bypass flow (excluding intra-bundle water tube flow) for a full core of GE14 fuel is higher than the core bypass flow for a full core of SVEA96+ fuel. The mixed core evaluations demonstrate a clear progression towards the full core GE14 values observed in Tables 3.7 through 3.12. This is due to differences in the construction of each fuel type as described in Section 3.4 of Reference 4. As the fraction of GE14 fuel increases, more flow paths are available from the fuel channel to the bypass region. Figure 4.3 displays the bypass flow as a function of core loading for each of the reactor conditions evaluated. The differences in fuel design, though, do not adversely affect the performance of a neighboring fuel assembly.

- Due to the differences in the pressure drop of the two fuel designs, the hot bundle active flows in the mixed core evaluations are affected in the following ways: the GE14 hot bundle active flow in the 573 SVEA96+ and 191 GE14 core is less than the full core GE14 evaluations. As the number of GE14 assemblies increases, the GE14 hot bundle flow increases towards the full core value. Since the GE14 fuel design has a slightly higher pressure drop, the SVEA96+ hot bundle active flow is more than the full core SVEA96+, in the 573 SVEA96+, 191 GE14 core loading.

As the number of GE14 bundles increases, the SVEA96+ hot bundle active flow increases to become higher than the full core SVEA96+ results.

3.8 GNF Response to NRC Staff's Request for Additional Information (RAI)

During the course of the NRC staff's review of LTR NEDC-33107P, a number of requests for additional information were communicated to both the licensee and GNF. The licensee's questions were resolved by the February 17, 2004 on-site review at Hope Creek, as discussed in Section 3.4 of this SE. GNF submitted a formal response to the remaining questions by a letter dated March 17, 2004 (Reference 12).

The responses provided clarification of data collection and treatment and conclusions stated in the LTR. Included were:

- Additions to the statistical summary Tables 3-2 and 3-3, providing the 95/95 upper tolerance limits for the GEXL80 correlation,
- An explanation of the treatment of the "mini-bundle variation term" in the R-factor calculation,
- Clarification of justification of the GEXL80 correlation “range of applicability” based on the number and span of the points in the hypothetical data base and the actual experimental data range, and
- Clarification of the PSEG role and responsibility in comparing the GEXL80 correlation to the actual experimental test data base.

Based on these responses, the staff concluded that all outstanding issues had been satisfactorily addressed.

4.0 <u>CONCLUSION</u>

The NRC staff reviewed the analyses and results presented in LTR NEDC-33107P, "GEXL80 Correlation for SVEA96+ Fuel," and the GE14 and SVEA96+ Thermal-Hydraulic Compatibility Report, and has determined that the analyses and results are in accordance with 10 CFR 50.34. In addition, the staff concludes that the analysis presented in the two reports, are acceptable because: (1) the total uncertainty in the correlation’s critical power predictions appropriately takes into account the fact that the uncertainty in the new correlation’s fit to the hypothetical database and the uncertainty in the hypothetical database with respect to the underlying experimental data are appropriately treated; (2) generating the hypothetical databases using the ABBD2.0 correlation encoded in the subchannel code CONDOR is a reasonable engineering approach to dealing with mixed core fuel, where the experimental database and critical power correlation for the previous vendor’s fuel are not available to the new vendor; (3) GNF intends to utilize the new GEXL80 correlation within the limits of the hypothetical data base, further bounded by the experimental limits of the SVEA96+ database; and (4) GNF confirmed that the CPR analyses remain bounding, and that key inputs to the safety analyses (such as the CPR) are conservative with respect to the current design cycle.

In addition, the staff also finds acceptable the full core and mixed core evaluations and the results of analysis performed by PSEG to independently verify the conclusions reached by GNF that the introduction of the GE14 fuel will not adversely impact the performance of the SVEA-96+ fuel, and that the two distinct fuel designs are thermal-hydraulically compatible.

As stated above, the GNF GEXL80 correlation is limited to application to the legacy (at least once-burned) Westinghouse SVEA96+ fuel, loaded in non-limiting locations, that will co-reside in the Hope Creek BWR during the mixed vendor transition cores, beginning with the reload scheduled for operating Cycle 13 in November 2004. The use of the GEXL80 correlation has not been justified for application to fresh (unburned) SVEA96+ fuel or for other than Hope Creek reload cores.

Therefore, on the basis of the above review and justification, the NRC staff concludes that the proposed GEXL80 correlation methodology and results are acceptable.

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