September 8, 2010

Mr. Jerald G. Head
Senior Vice President, Regulatory Affairs
GE Hitachi Nuclear Energy
3901 Castle Hayne Road MC A-18
Wilmington, NC 28401

SUBJECT: FINAL SAFETY EVALUATION FOR GE-HITACHI NUCLEAR ENERGY AMERICAS LLC LICENSING TOPICAL REPORTS NEDC-33237P, REVISION 4, "GE14 FOR THE ECONOMIC SIMPLIFIED BOILING-WATER REACTOR CRITICAL POWER CORRELATION, UNCERTAINTY, AND OLMCPR DEVELOPMENT," AND NEDC-33413P, REVISION 2, "FULL SCALE CRITICAL POWER TESTING OF GEXL14"

Dear Mr. Head:

On August 24, 2005, GE Hitachi (GEH) Nuclear Energy submitted the Economic Simplified Boiling Water Reactor (ESBWR) design certification application to the staff of the U.S. Nuclear Regulatory Commission. Subsequently, in support of the design certification, GEH submitted the license topical reports (LTRs) NEDC-33237P, "GE14 for ESBWR Critical Power Correlation, Uncertainty, and OLMCPR Development," and NEDC-33413P, "Full Scale Critical Power Testing of GEXL14." The staff has now completed its review of NEDC-33237P and NEDC-33413P.

The staff finds NEDC-33237P, "GE14 for ESBWR Critical Power Correlation, Uncertainty, and OLMCPR Development," and NEDC-33413P, "Full Scale Critical Power Testing of GEXL14," acceptable for referencing for the ESBWR design certification to the extent specified and under the limitations delineated in the LTRs and in the associated safety evaluation (SE). The SER, which is enclosed, defines the basis for acceptance of the LTR.

The staff requests that GEH publish the revised version of the LTRs listed above within 1 month of receipt of this letter. The accepted version of NEDC-33237P and NEDC-33413P, shall incorporate this letter and the enclosed SE and add an "-A" (designated accepted) following the report identification number.

If NRC's criteria or regulations change, so that its conclusion that the LTR is acceptable is invalidated, GEH and/or the applicant referencing the LTR will be expected to revise and resubmit its respective documentation, or submit justification for continued applicability of the LTR without revision of the respective documentation.

Document transmitted herewith contains sensitive unclassified information. When separated from the enclosures, this document is "DECONTROLLED."

Pursuant to 10 CFR 2.390, we have determined that the enclosed SE contains proprietary information. We will delay placing the non-proprietary version of this document in the public document room for a period of 10 working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects only. If you believe that any additional information in Enclosure 1 is proprietary, please identify such information line by line and define the basis pursuant to the criteria of 10 CFR 2.390.

The Advisory Committee on Reactor Safeguards (ACRS) subcommittee, having reviewed the subject LTR and supporting documentation, agreed with the staff's recommendation for approval following the May 18, 2010 ACRS subcommittee meeting.

Sincerely,

/RA Frank Akstulewicz for:/

David B. Matthews, Director
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
1. Safety Evaluation (Non-Proprietary)
2. Safety Evaluation (Proprietary)

cc: See next page (w/o enclosure)

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ADAMS ACCESSION NO. - ML101740163-Package

OFFICE	BWR:PM	BC:SRSB	BWR:LPM	BWR:BC	OGC/NLO	DNRL:D
NAME	BBavol	JDonoghue	ACubbage	MTonacci		DMatthews
DATE	06/28/10	08/26/10	09/02/10	09/07/10	08/05/10	09/08/10

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SUBJECT: FINAL SAFETY EVALUATION REPORT FOR GE-HITACHI NUCLEAR ENERGY AMERICAS LLC LICENSING TOPICAL REPORTS NEDC-33237P, REVISION 4, "GE14 FOR THE ECONOMIC SIMPLIFIED BOILING-WATER REACTOR CRITICAL POWER CORRELATION, UNCERTAINTY, AND OLMCPR DEVELOPMENT," AND NEDC-33413P, REVISION 2, "FULL SCALE CRITICAL POWER TESTING OF GEXL14" DATED SEPTEMBER 8, 2010

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SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS
NEDC-33237P, REVISION 4, "GE14 FOR ESBWR CRITICAL POWER CORRELATION, UNCERTAINTY, AND OLMCPR DEVELOPMENT," AND NEDC-33413P, REVISION 2, "FULL SCALE CRITICAL POWER TESTING OF GEXL14," LICENSING TOPICAL REPORTS FOR REFERENCE IN THE ECONOMIC SIMPLIFIED BOILING-WATER REACTOR DESIGN CERTIFICATION APPLICATION

1.0 Introduction

In support of its application for design certification of the economic simplified boiling-water reactor (ESBWR), GE-Hitachi Nuclear Energy Americas LLC, in conjunction with its affiliate company Global Nuclear Fuels (GNF), submitted Licensing Topical Report (LTR) NEDC-33237P, "GE14 for ESBWR—Critical Power Correlation, Uncertainty, and OLMCPR Development," issued March 2006 (Reference 1), for review by the staff of the U.S. Nuclear Regulatory Commission (NRC). The "ESBWR Design Certification Document" (DCD), Tier 2, Section 4.4, "Reactor Thermal and Hydraulic Design," refers to this LTR (Reference 2). Revisions 1 through 4 of the LTR incorporate additional information requested by the NRC during its review of the DCD and supporting LTRs (References 3 through 17). Additionally, in response to an NRC request, GEH and GNF submitted test report NEDC-33413P, "Full Scale Critical Power Testing of GE14E and Validation of GEXL14" (Reference 18), as a confirmatory assessment of the GEXL14 correlation's applicability to the ESBWR.

This safety evaluation documents the NRC staff's review of NEDC-33237P and supporting test report NEDC-33413P.

1.1 Background

The GE critical quality - boiling length (GEXL) correlation was developed for conventional boiling-water reactors (BWRs) to determine the critical quality relationship to bundle elevation for BWR fuel assemblies. GEXL is designed to predict the onset of boiling transition as a function of boiling length, thermal diameter, mass flux, pressure, annular flow length, and local peaking pattern (R-factor). The GEXL correlation is based on test data and computer simulations of 7x7, 8x8, 9x9, and 10x10 fuel assemblies. The test database for the overall GEXL correlation evolution includes over 20,000 full-scale boiling transition measurements obtained at the ATLAS and STERN critical power test facilities. For steady-state reactor operations, the GEXL correlation is used to establish an operating limit minimum critical power ratio (OLMCPR). During transients, the GEXL correlation is used to calculate the ratio of change in the critical power ratio to the initial critical power ratio, which is then compared to an established minimum critical power ratio (MCPR).

The GEXL14 correlation evolved from earlier versions and is specifically intended for application to the GNF 12-foot, 10x10 array, BWR fuel assembly (GE14). The NRC staff's safety evaluation for GEXL14 is documented in the final safety evaluation report for NEDC-32851P, "GEXL14 Correlation for GE14 Fuel," dated August 3, 2007 (Reference 19). The ESBWR fuel, referred to as GE14E, is based on the GE14 design. Components such as upper and lower tie plates, grid spacers, part-length rods, and channel boxes are identical in design to the conventional GE14 fuel components, except that the rods and channel boxes are approximately

2 feet shorter in length to enhance the ESBWR natural circulation cooling flow. Because of the similarities in design, GEH proposed to apply the GEXL14 correlation to the ESBWR fuel version. LTR NEDC-33237P describes the methodology and uncertainties applicable to the ESBWR design and the methodology for determination of the OLMCPR. LTR NEDC-33413P provides confirmation by test that the proposed application is appropriate for prediction of boiling transition for a GE14E fuel assembly.

2.0 REGULATORY BASIS

The regulations of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," (Reference 20) Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 10, "Reactor Design," require that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to ensure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs).

To ensure compliance with GDC 10, the staff confirms that the thermal and hydraulic design of the core and the reactor coolant system has been accomplished using acceptable analytical methods; is equivalent to, or is a justified extrapolation from, proven designs; provides acceptable margins of safety from conditions that would lead to fuel damage during normal reactor operation and AOOs; and is not susceptible to thermal-hydraulic instability. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (hereafter referred to as the SRP) (Reference 21), Section 4.4, "Thermal and Hydraulic Design," describes the staff review process for thermal and hydraulic design applications and requires that additional independent audit analyses be performed for new critical power ratio (CPR) correlations.

Specific acceptance criteria in SRP Section 4.4 for evaluation of fuel design limits necessary to meet the requirements of GDC 10 include the following:

- Uncertainties in the values of process parameters, core design parameters, and calculational methods used in the assessment of thermal margin should be treated with at least a 95-percent probability at a 95-percent confidence level.

- For CPR correlations, the limiting (minimum) value of CPR is to be established such that at least 99.9 percent of the fuel rods in the core would not be expected to experience departure from nucleate boiling or boiling transition during normal operation or AOOs.

The staff's safety evaluation review assesses the LTR's technical and statistical analyses using the acceptance criteria provided in SRP Section 4.4. The GEXL14 correlation is used to establish thermal margins for fuel and clad integrity, and therefore, GDC 10 is relevant to this review.

The MCPR is needed to ensure that the SAFDLs are not exceeded as the result of thermal stresses on the fuel rods. Additional requirements in the SRP are that the uncertainties for process parameters (e.g., reactor power, coolant flow rate, core bypass flow, inlet temperature, pressure, and nuclear and engineering hot channel factors), core design parameters, calculational methods, and instrumentation be used in determining the thermal margins. The identification of the uncertainties, as well as uncertainties for simulations, must also be addressed.

3.0 Technical Evaluation

The NRC staff's evaluation of the GEXL14 correlation for GE14E considers the correlation's applicability to ESBWR steady-state operation and AOO range, acceptable calculations and methodology, values of uncertainties, and test database criteria. The staff's review of NEDC-33237P and NEDC-33413P is summarized below:

3.1 Axial Power Profile Evaluation

LTR NEDC-33237P summarizes the original database that was the basis for the GEXL14 correlation. The data were acquired at the ATLAS critical power test facility in San Jose, CA. An electrically heated mockup of a conventional (12.5-foot) GE14 fuel assembly was subjected to a range of pressure, flow, R-factor (representative of pin power distribution), and inlet subcooling conditions that simulate the expected normal operating conditions and anticipated transient conditions. GEH proposed a methodology to adjust the correlation additive constants to account for differences in bundle length and associated part-length rod height and closer grid spacer separation of the ESBWR GE14E fuel. The subchannel computer code COBRAG (Reference 22) was used to evaluate the effect of these differences. The original ATLAS tests considered only a cosine axial power profile. Further testing included inlet-peaked power distribution. In Request for Additional Information (RAI) 4.4-1 (Reference 10), the staff questioned the applicability of critical power test data based on 12-foot fuel, considering the differences in power shape and thermal-hydraulic behavior. Additionally, computer code (COBRAG) assessment alone may not accurately determine the critical power correlation uncertainties. GEH responded to RAI 4.4-1 by stating that no additional fuel testing is necessary to confirm the thermal-hydraulic behavior of the GE14E fuel design. GEH maintained that computer calculations using COBRAG support their position and that the GEXL14 correlation prediction results show the GE14E fuel critical power values are within the range of acceptable uncertainties. The NRC staff challenged the applicant's position and suggested that the COBRAG predictions need to be validated by conducting critical heat flux tests. Consequently, the staff issued Supplement 1 to RAI 4.4-1. In this supplement, the staff requested that the applicant submit a proposed critical heat flux (critical power performance) test matrix for the GE14E fuel, with test conditions representative of expected ESBWR operating conditions.

The applicant's response to RAI 4.4-1, Supplement 1 (Reference 11), refers to the full-scale GE14E testing that had been performed. The response provided LTR NEDC-33413P. At the time the response was transmitted, the results of the GE14E testing were still being analyzed.

In the test report NEDC-33413P, [[ ]] was conducted on the GE14E test assembly at the STERN critical power test facility in Ontario, Canada. The test database consisted of [[ ]]. The purpose of the testing at the Stern laboratory was to validate the GEXL14 correlation's applicability to the GE14E fuel design. The staff questioned the appropriateness of testing a [[ ]] and asked GEH to provide the technical bases for [[ ]] in the test matrix. In its response (Reference 14), GEH stated that, since the GE14E fuel design is identical to the GE14 fuel design, aside from the obvious differences in length and spacer location, GEH asserted that axial power behavior should therefore be identical to that of GE14 fuel.

The staff reviewed the test data and graphical comparisons of the GEXL14 correlation calculation trends (i.e., inlet-peaked, cosine, and outlet-peaked power profiles) for both GE14E and GE14 fuel and concluded that the GEXL14 correlation predictions are well within the bounds of statistical uncertainties. Based on the applicant's response, the staff considers RAI 4.4-1 to be resolved.

GEH's response to applicable RAIs (Reference 14) also summarized the statistics on the GEXL correlation for various GNF fuel designs: 9x9 (GE11 and GE13) and 10x10 (GE12, GE14, GNF2, and GE14E). The statistical analyses of the critical power tests showed little variation with respect to axial power shape, part-length rod design, spacer design, spacer material, and/or bundle height within the GEXL correlation prediction range. The uncertainties for all tests were under [[ ]], which is typical for empirical correlations. The GEXL14 correlation critical power prediction capability for the ESBWR fuel assembly has therefore been demonstrated to the satisfaction of the staff, with respect to the axial power profile, including variations in assembly design.

3.2 Uncertainties and Statistical Evaluation

The GEXL14 correlation indirectly evaluates the critical power by predicting the critical quality or the quality where boiling transition or dryout occurs. To evaluate the statistical validity of the GEXL14 correlation, the ratio of predicted critical power to measured critical power (ECPR) is used. Table 1 provides the mean ECPRs and corresponding uncertainties. To be consistent with the ESBWR licensing basis, GEH omitted all data points with mass fluxes greater than [[ ]] from the application of GEXL14 for GE14E (because of the reduced operating flow velocity compared to that of a conventional BWR). The uncertainty of the GEXL14 correlation in predictions for GE14 is [[ ]]. For the GE14E assembly, the uncertainty is [[ ]]. This small increase in the licensing-basis statistical uncertainty yields a slightly larger MCPR for plants using GE14E. The test database from the GE14E STERN facility has a higher uncertainty, but it has fewer data points, and the mean ECPR is smaller than the predicted mean ECPR. A smaller ECPR would yield a smaller MCPR.

Table 1 GEXL14 Statistics

	GE14	Predicted GE14E (licensing basis)	STERN Facility (GE14E database)
Number of Data Points	[[ ]]	[[ ]]	[[ ]]
Mean ECPR	[[ ]]	[[ ]]	[[ ]]
% Standard Deviation	[[ ]]	[[ ]]	[[ ]]

The staff reviewed the GEH statistical evaluation and performed an independent assessment, which resulted in a similar conclusion—the use of GEXL14 for GE14E fuel is appropriately conservative.

3.3 Spacer and Part-Length Rod Effects

The differences between GE14 and GE14E fuel include active fuel length, number and spacer pitch, and part-length rod height. The sensitivity analysis in Section 4.2 of LTR NEDC-33237P was conducted to determine the effect of these differences on the GEXL14 prediction capabilities. For the sensitivity study of axial height and power shape effects, conservatism was input into the model by truncating the power profile of the GE14 fuel bundle to [[ ]] and applying that modified profile to GE14E. The axial power distribution exhibited a [[ ]] difference between a cosine and inlet peak.

The staff performed an independent parametric study for spacer and part-length rod effects using the subchannel computer code COBRAG (Reference 22). This study was performed to determine if the GEXL14 correlation could exhibit unbiased behavior for differences in construction between the fuel assembly, which was developed for (GE14) and the fuel assembly to which it is being extrapolated (GE14E). Separate analyses were performed to study each effect. Combining the effects, COBRAG resulted in a [[ ]] total increase in critical power, while the GEXL14 predicted a [[ ]] percent decrease in critical power for GE14E compared to that for GE14.

The results of the three separate studies on axial power distribution, spacer, and part-length rod effects demonstrate a small variation in GEXL14 predictions when applied to the ESBWR GE14E fuel. Therefore, the GEXL14 correlation for GE14E appropriately accounts for these effects.

3.4 STERN Facility Test Database

To validate the GEXL14 correlation critical power ratio (CPR) predictions for the GEXL14E fuel design, GEH was requested by the staff to conduct full scale validation tests of the GEXL14 CPR predictions. Documentation of the tests was provided to the staff in topical report NEDC-33413P (Reference 18). NEDC-33413P discusses the full-scale testing of GE14E fuel and validation of the GEXL14 correlation. The staff reviewed the topical report NEDC-33413P to ensure that sufficient test data was collected and that the appropriate operational range of the GEXL14E fuel was documented. The staff also evaluated the test matrix developed specifically by GEH for the ESBWR to determine if it contained sufficient power peaking patterns and varying core conditions (pressure, mass flux, inlet subcooling, and R-factor), to represent the operational domain of the GE14E fuel. The NRC staff questioned GEH regarding the test point selection criteria used for the test matrix in RAI 4.4-71 and RAI 4.4-72. In the response to RAIs 4.4-71 and 4.4-72 (Reference 14), GEH stated that it used no specific criteria, but the number of permutations was based on knowledge and experience from previous critical power tests. [[

]] Based on its assessment of the technical merits and its independent statistical evaluation of the test report and responses to NRC concerns, as detailed in Reference 14, the staff determined that the

GE14E test matrix has been adequately validated. Therefore, the staff considers RAIs 4.4-71 and 4.4-72 resolved.

The statistics of the STERN facility test data were compared to the ESBWR licensing-basis GEXL14 correlation. An average ECPR of [[ ]] percent was calculated. This demonstrates good agreement between the measured data and calculated values. It also demonstrates the correlation's reliability in predicting critical power for the GE14E assembly. Thus, the staff accepts the GE14E critical power database for GEXL14 statistical analysis.

3.5 Transient Methodology Evaluation

The staff reviewed the results of the transient critical power tests on the GE14E assembly. The tests were performed as directed by GEH at the STERN test facility. The tests simulated a number of transient types by varying the coolant flow, bundle pressure, inlet subcooling, and power. The results of the GE14E transient tests were compared to the GEXL14 correlation predictions.

The variation in these thermal hydraulic parameters leads to a transient in critical power. Five GE14E transient critical power tests were performed by GEH at the STERN laboratory facility. The NRC staff reviewed the results of these transient tests and the comparisons to the GEXL14 correlation predictions. The data of the comparison indicates that the GEXL14 correlation predictions are well within the GEXL14 statistical uncertainty as provided in Reference 1.

The staff assessed the GEH transient test data base, the results of the transient tests, and the comparisons as presented in GEH Letter, MFN 09-188, dated March 24, 2009. The results of the tests and review of the graphical comparisons presented in NEDC-33413P, do confirm that the GEXL14 correlation predictions regarding a change in critical power due to a transient, are within the statistical uncertainty of the GEXL correlation as presented in Reference 1. Thus, the staff finds GEXL14 correlation predictions of the GE14E transients acceptable.

In addition to the confirmation of the GEXL14 correlation transient predictions relative to the GE14E transient data, the transient tests were also used to qualify the OLMCPR calculated by the GEXL14. The OLMCPR is used to assess the thermal margins for AOO events. Section 5.13 of NEDC-33237P discusses the evaluation of the methodology of the OLMCPR for the ESBWR AOOs. The methodology follows the approved General Electric BWR Thermal Analysis Basis (GETAB) method described in Reference 23. To calculate the OLMCPR, the potentially limiting AOO events described in Section 15.2 of Reference 24 were analyzed to establish the bounding value to conform to the SRP acceptance criterion (Reference 21).

The criterion states, "the limiting (minimum) value of DNBR, CHFR, or CPR correlations is to be established such that at least 99.9% of the fuel rods in the core will not experience a DNB or boiling transition during normal operation or AOOs." The GEXL14 correlation is used to calculate a transient ratio, which is the change in the critical power ratio to the initial critical power ratio. The TRACG computer code (Reference 25) was used to determine the uncertainties for this transient ratio for all potentially limiting AOO events. Section 5.13 of NEDC-33237P outlines how the number of rods subject to boiling transition (NRSBT) is calculated from the transient ratio and how the 0.1-percent NRSBT bounding limit on the OLMCPR is determined.

In-house staff calculations using the COBRAG computer code also confirmed that the values of the OLMCPR as predicted by the GEXL14 correlation are acceptable. The GEXL14 correlation results predicted the change in the delta CPR relative to the initial CPR for all potentially limiting AOOs within the statistical uncertainties of the GEXL14 correlation, and thus, the use of the GEXL14 correlation to calculate OLMCPR is acceptable.

3.6 [[ ]]

In RAI 4.4-39, the staff requested that the applicant evaluate the [[ ]] as modeled in the computer code PANAC11. The staff's concern was that the chimney above the core [[ ]]. The applicant provided analysis using the TRACG computer code to demonstrate [[ ]]. The staff considered the applicant response as incomplete, and that additional calculations were needed to demonstrate the applicant's position. Consequently, the staff requested additional information through RAI 4.4-39, Supplement 1, to further support the original request. In response to RAI 4.4-39 Supplement 1, the applicant conducted additional calculations to demonstrate that the TRACG calculations are indeed adequate, and that the assumptions used in the calculations were valid. The staff disagreed with the applicant's conclusion and issued RAI 4.4-39, Supplement 2 to the applicant. In RAI 4.4-39 Supplement 2, the staff requested that GEH modify the TRACG initialization to allow for an independent analysis of [[ ]]. In response to RAI 4.4-39, Supplement 2, the applicant developed an approach for independently assessing the [[ ]] (Reference 28). The staff reviewed this response and the graphical data provided and concluded that the response to RAI 4.4-39, Supplement 2, provides the staff with reasonable assurance that the TRACG/PANAC11 results are accurate. Based on the applicant's response to RAI 4.4-39, Supplement 2, the staff finds that RAI 4.4-39 is resolved.

4.0 <u>Conditions and Limitations</u>

Licensees referencing NEDC-33237P and NEDC-33413P must ensure compliance with the conditions and limitations described below.

4.1 Approved ESBWR Operating Range

Table 2 below specifies the GEXL14 correlation and ESBWR operating ranges. As a function of core variables, GE14E steady-state operating conditions are within the bounds of the ESBWR licensing-basis statistics, which are further bounded by the GEXL14 correlation. All the AOO events listed in Section 15.2 of Reference 24 are also within these bounding conditions.

Table 2 GEXL14 Applicability Range and GE14E Range

Variables	GEXL14 Application Range	GE14E Estimated Range*	GE14E Database for Licensing-Basis Statistics/ ESBWR Operating Range
Pressure MPa (psia)	[[ ]]	[[ ]]	[[ ]]
Mass Flux* kg/sec-m^2 (Mlb/hr-ft^2)	[[ ]]	[[ ]]	[[ ]]
Inlet Subcooling kJ/kg (Btu/lb)	[[ ]]	[[ ]]	[[ ]]
R-Factor	[[ ]]	[[ ]]	[[ ]]

* The pressure, mass flux, and inlet subcooling ranges cover the nominal operating conditions and the AOOs, which are presented in Section 15.2 of the ESBWR DCD, Tier 2, Revision 5, and in Sections 15.2-4 and 15.2-5 of Final Safety Evaluation by the Office of Nuclear Reactor Regulation, Topical Report NEDC-32851P, Revision 2, 'GEXL14 Correlation for GE14 Fuel.

4.2 Correlation Applicability

Since the GEXL14 correlation is the only critical power correlation that has been demonstrated to predict the critical power performance of GE14E fuel, no other critical power correlation may be used to simulate the thermal-hydraulic performance of GE14E fuel without further justification and approval by the NRC staff.

4.3 Operating Limit Minimum Critical Power Ratio—Void Fraction Uncertainty Adder

In assessing the OLMCPR methodology, the NRC staff determined that GEH provided limited void fraction data to support the use of the Findlay-Dix void fraction correlation and associated uncertainty for the high void conditions in which the ESBWR is expected to operate. The uncertainty is a component required in calculating the technical specification safety limit MCPR (SLMCPR). The uncertainty must be well established to accurately determine the SLMCPR. The staff determined that the database on which the Findlay-Dix correlation was based lacks a statistically significant number of high void test data points. Consequently, until GEH acquires additional high void data, determines the Findlay-Dix correlation uncertainty, and obtains NRC staff approval, a thermal margin adder of 0.01 must be applied to the calculated OLMCPR.

An identical approach using a thermal margin adder of 0.01 is being applied to operating BWRs approved for extended power uprate (EPU) or maximum extended load line limit analysis plus (MELLLA+) operation (References 26 and 27). Expected in-core void fraction conditions for ESBWR operation are similar to those for EPU and MELLLA+ plants. Additionally, the analytical methods used for plant safety analyses are comparable, as demonstrated in the response to RAI 4.4-39, Supplement 2 (Reference 28).

5.0 <u>Conclusions</u>

Based on its review of topical reports NEDC-33237P and NEDC-33413P, the staff finds the application of the GEXL14 critical power correlation and OLMCPR calculation methodology acceptable for application to ESBWR GE14E fuel thermal-hydraulic performance and plant safety analyses, provided that the conditions and limitations specified in Section 4.0 above are met. Since the GEXL14 correlation is the only correlation developed to predict the critical power of the GE14E fuel design, no other critical power correlation may be used to simulate the thermal-hydraulic behavior of the GE14E fuel design without further justification and approval by the NRC staff.

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