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Proprietary Notice
This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 1, the balance of this letter may be considered non-proprietary.

MFN 07-461

Docket No. 52-010

August 21, 2007

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 99 Related to ESBWR Design Certification Application – RAI Number 4.3-10**

Enclosures 1, 2 and 3 contain GEH's response to the subject NRC RAI transmitted via the Reference 1 letter.

Enclosure 1 contains GEH proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure. A non-proprietary version is provided in Enclosure 2.

The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GEH. GEH hereby requests that the information of Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

James C. Kinsey

James C. Kinsey
Project Manager, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-244, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 99 Related to the ESBWR Design Certification Application*, April 25, 2007

Enclosures:

1. MFN 07-461 – Response to Portion of NRC Request for Additional Information Letter No. 99 – Related to ESBWR Design Certification Application –RAI Number 4.3-10 – GEH Proprietary Information
2. MFN 07-461 – Response to Portion of NRC Request for Additional Information Letter No. 99 – Related to ESBWR Design Certification Application –RAI Number 4.3-10 – Non-Proprietary Version
3. Affidavit – James C. Kinsey – dated August 21, 2007

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH Wilmington (with enclosures)
	BE Brown	GEH Wilmington (with enclosures)
	eDRF	-0072-9722

Enclosure 2

MFN 07-461

Response to Portion of NRC Request for

Additional Information Letter No. 99

Related to ESBWR Design Certification Application

RAI Numbers 4.3-10

Non-Proprietary Version

NRC RAI 4.3-10

Provide additional information regarding the capability of the control rod system to ensure subcriticality

In Rev. 3 to the DCD the applicant provided the control rod assignments to specific HCUs (Figure 4.3-5 in Section 4.3.3.3 of Tier 2). In Reference 4.3-8 (NEDC-33239P, rev. 0) the applicant provides the shutdown margin calculated assuming one control rod stuck out at the BOC, MOC, and EOC. The applicant identified the BOC as the limiting scenario (minimum R) and the control rod located at [[ ]] *as the highest worth rod (i.e. the rod stuck out that results in the minimum shutdown margin).*

(A) Correct Figure 3-34 through Figure 3-36 of NEDC-33239P

In Figures 3-34 through 3-36 of Reference 4.3-8 there are values in locations [[ ]] *yet no HCU assigned to these locations according to DCD Tier 2, Rev. 3. Since there does not appear to be a control blade in these locations correct the figure in the next revision of NEDC-33239P to remove these values.*

(B) SDMs quoted in Figures 3-35 and 3-36 do not correspond to control rods

There are SDMs quoted for control rods in Figures 3-35 and 3-36 of NEDC-33239P that do not have a corresponding HCU assigned in Figure 4.3-5 of the DCD, Tier 2, rev. 3. The SDM for these stuck out rods should be consistent with the fully controlled eigenvalue. The staff calculated the eigenvalue based on the reported stuck out rod SDM for these rod locations and found the values to be consistent with 0.9508 as presented in Table 4.3-1 of the DCD for BOC. Include the MOC and EOC fully controlled eigenvalues in NEDC-33239P. For completeness also include the cycle exposure for the MOC point.

(C) Provide information regarding cold criticality given the failure of a single HCU

Based on the shutdown margin map provided in Reference 4.3-8 the staff calculated the control rod worth for each control rod at the BOC. The control rod worth of the rod at location [[ ]] *was estimated to be* [[ ]] *using the relative eigenvalue difference between the rod stuck out eigenvalue and the fully controlled eigenvalue of 0.9508 in DCD Rev. 3 Tier 2 and the* [[ ]]. *The control rod paired with the control rod at* [[ ]] *is located at* [[ ]]. *The staff similarly calculated the control rod worth for the control rod at this location and found the reactivity worth to be* [[ ]]. *Assuming that the SDM values quoted account for the change in global eigenvalue from the local perturbation from cold conditions, and assuming that the distance between these control blades is sufficient such that the control blades are decoupled, the staff would expect the combined reactivity worth of this rod pair to be* [[ ]].

Verify that the PANAC11 calculations were performed using [[ ]].

Considering a cold fully controlled eigenvalue of 0.9508, it would appear to the staff that a failure of the [[ ]] *HCU would preclude the core from being made subcritical under cold conditions at the BOC without SLCS injection. The staff reached similar conclusions in regards to the following HCUs:* [[

]]. *If GE has reached a different conclusion, provide the basis for this conclusion and revise Reference 4.3-8 to include this information.*

(D) Provide the basis for compliance with GDC 26 in terms of the RPS

Section 4.3.1.2 in DCD Rev. 3 Tier 2 states that compliance with GDC 26 is demonstrated by assuring that the core can be made subcritical, with margin, in the most reactive condition throughout the operating cycle with the highest worth rod pair stuck out. Please clarify this statement in regards to the reactivity control system which is intended to comply with this requirement of GDC 26. GDC 26 speaks specifically to exceeding SAFDLs. Please describe the aspects of the RPS which ensure that SAFDLs are not exceeded following a SCRAM in which the single failure is one of the aforementioned HCUs.

(E) Provide the basis for compliance with GDC 25 in terms of cold shutdown capability

Clarify if it is the intent to ensure that SAFDLs are not exceeded by demonstrating cold shutdown margin with the control rod system assuming a single failure. If this is not the intention, specifically provide a discussion of the performance of the RPS to meet GDC 25 during a limiting AOO assuming a failure of one of the aforementioned HCUs.

(F) Clarify Appendix 4B.3 Criteria

Include demonstration of compliance with Appendix 4B.3 criterion 6: "The core is capable of being made subcritical with margin in the most reactive condition throughout the operating cycle with the most reactive control rod, or rod pair, in the full-out position and all other rods fully inserted" as an explicit COL action item for the first cycle core.

If criterion 6 is not fulfilled solely by the control rod system, state this explicitly in Appendix 4B in the next revision to the DCD.

(G) Describe the means for assuring compliance with the Technical Specification SDM requirement

Demonstrate compliance with a technical specification SDM limit of 0.0038 including any uncertainty in 3D MONICORE/PANAC11 predicted cold controlled eigenvalue. Update Reference 4.3-8 to include a condition, administrative limit, or acceptance criterion on the method of calculation of the shutdown margin that explicitly accounts for the technical specification limit as well as calculational uncertainties besides those accounted for the [[

]].

(H) Update the DCD

Revise the DCD accordingly in the next revision. Update the DCD to include:

- *Each clarification requested in items D through F*
- *A table of the minimum reactivity margin to criticality at cold conditions attributed to only the control rod system assuming the highest worth rod pair is fully withdrawn for BOC, MOC, and EOC*

Support the DCD statements by including information in the revised DCD text that is qualitatively similar in content to Figures 3-29 through 3-36 of Reference 4.3-8: NEDC-33239P.

(I) Update the LTR NEDC-33239P (Reference 4.3-8)

- *Include a disposition of the discrepancies in items A through C in the LTR revision*
- *Include the information requested in item G*
- *Update Reference 4.3-8 in the next revision to state that the HCU assignments are not an item for the COL applicant.*
- *In the next revision to Reference 4.3-8 provide the table of the minimum reactivity margin to criticality at cold conditions attributed to only the control rod system assuming the highest worth rod pair is fully withdrawn for BOC, MOC, and EOC*
- *Provide in the LTR a description of the calculations performed to develop the table of the reactivity margin.*

If PANAC11 is used to perform any of these analyses confirm that the calculations were performed using 3D simulations (and not the [[ ]]*) and incorporated the* [[ ]].

If the difference between the reactivity margin calculated by PANAC11 for the strongest rod pair withdrawn and the condition on the method of calculation mentioned in item G above is less than [[ ]], *then estimate the impact of control blade depletion on the shutdown margin. Alternatively verify that the aforementioned item G condition or acceptance criterion on the calculation accounts for control blade depletion.*

GEH Response

4.3-10 Part A

Figures 3-34 to 3-36 of NEDC-33239P Revision 0 incorrectly reported SDM values for peripheral core locations that did not contain a control rod. This has since been corrected in both Revisions 1 and 2 of NEDC-33239P.

4.3-10 Part B

The requested information applicable to Figures 3-32 and 3-34 that are shown in Revisions 1 and 2 of NEDC-33239P are provided in Table 4.3-10-1 below (note these figures are equivalent to Figures 3-34 to 3-36 of Revision 0). This information was only provided for BOC conditions in the report since BOC is the most limiting exposure point in the cycle.

Table 4.3-10-1 Cold Shutdown Margin Data at BOC,MOC and EOC[1]

Control Configuration and SDM Result for Revisions 1 and 2	BOC K-eff (0.0 GWd/ST	MOC K-eff (8.0 GWd/ST)	EOC K-eff (16.8 GWd/ST)
Fully Controlled (k_{CARI})	[[		
Strongest Rod Pair Out (k_{SRPO})			
Local Critical k-effective (k_{CRIT})			
Cold SDM (%)			]]

Note (1) Applicable to Revisions 1 and 2 of NEDC-33239P

4.3-10 Part C

Hydraulic control unit (HCU) assignments were not available when Revision 0 of NEDC-33239P was issued. HCU assignments were determined later and then specifically addressed in Revisions 1 and 2. All reported SDM results in these later revisions are based on PANAC11 Niter 4 cold calculations with the rod pairs explicitly withdrawn (i.e., similar to an ASDM Niter 6 calculation that withdraws a single rod). No Rod Worth Estimator (RWE) values were used in Revisions 1 or 2. The 2-D SDM maps appearing in these later revisions report the SDM value for the HCU rod pair withdrawn; hence the same SDM value is shown for both individual rod locations assigned to each HCU.

Extensive analyses were performed in order to determine HCU rod pairs that satisfied specific reactivity criteria. The selected rods for each HCU are sufficiently far apart in the core such that they are neutronically loosely coupled. That is, the reactivity worth of the rod pair is essentially the same as the worth of the strongest rod of the rod pair. The reactivity worths of the top 40 HCU rod pairs and the corresponding strongest worth rod are shown in Figure 4.3-10-1. These results are based on the ESBWR GE14E initial core and are provided as an example of rod worth behavior of loosely coupled rods. This same behavior has been demonstrated for the ESBWR GE14E equilibrium core.

[[

]]

Figure 4.3-10-1 HCU Rod Worth Example for ESBWR GE14E Initial Core

Note that if the selected rods were not loosely coupled, then the worth of the HCU rod pair would be larger than the worth of the strongest individual rod. The individual rod worths for each HCU pair would then essentially be additive and one would then come to the conclusion stated in Part C of RAI 4.3-10 (i.e., SLCS is required to achieve subcriticality with an HCU failure). However, as demonstrated in Figure 4.3-10-1, this is not true. HCU rods are loosely coupled, rod worths are not additive for loosely coupled rods and sufficient shutdown margin exists in the event of an HCU failure without the need for SLCS.

4.3-10 Part D to I

Parts D through I are based on the conclusion that there is insufficient shutdown margin capability in the event of an HCU failure as noted in Part C. However this is not true. All HCU rod pairs are loosely coupled and the shutdown margin is well above the 1% design limit through the entire cycle. No further action is required.

Affected Documents

No DCD changes will be made in response to this RAI.

No changes to the subject LTR will be made in response to this RAI.

Enclosure 3

MFN 07-461

Response to Portion of NRC Request for

Additional Information Letter No. 99

Related to ESBWR Design Certification Application

RAI Number 4.3-10

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, James C. Kinsey, state as follows:

(1) I am Project Manager, ESBWR Licensing, GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in enclosure 1 of GEH's letter, MFN 07-461, Mr. James C. Kinsey to U.S. Nuclear Energy Commission, entitled "*Response to Portion of NRC Request for Additional Information Letter No. 99 Related to ESBWR Design Certification Application – RAI Number 4.3-10*", dated August 21, 2007. The proprietary information in enclosure 1, which is entitled "*Response to Portion of NRC Request for Additional Information Letter No. 99 Related to ESBWR Design Certification Application – RAI Number 4.3-10 – GEH Proprietary Information*", is delineated by a [[dotted underline inside double square brackets.{3}]] Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) above is classified as proprietary because it contains details of GEH's evaluation methodology.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 21st day of August 2007.

James C. Kinsey

James C. Kinsey
GE-Hitachi Nuclear Energy Americas LLC