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MFN 10-012

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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. 404 Related to ESBWR Design Certification Application – Reactor – RAI Number 4.4-93**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by the Reference 1 NRC letter. GEH response to RAI Number 4.4-93 is addressed in Enclosure 1.

Enclosure 2 contains markups, as identified in Enclosure 1, to NEDC-33237P, which is proprietary to Global Nuclear Fuel – Americas, L.L.C. (“GNF-A”). However, the markups presented contain no proprietary information and so only a public version of the attachment is provided.

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 10-001, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, *Request for Additional Information Letter No. 404 Related to ESBWR Design Certification Application*, December 29, 2009

Enclosures:

1. MFN 10-012 - Response to Portion of NRC Request for Additional Information Letter No. 404 Related to ESBWR Design Certification Application – Reactor – RAI Number 4.4-93
2. MFN 10-012 - Response to Portion of NRC Request for Additional Information Letter No. 404 Related to ESBWR Design Certification Application – Reactor – RAI Number 4.4-93 – Markups to LTR NEDC-33237P

cc: AE Cabbage USNRC (with enclosures)
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Enclosure 1

MFN 10-012

**Response to Portion of NRC Request for
Additional Information Letter No. 404
Related to ESBWR Design Certification Application
Reactor**

RAI Numbers 4.4-93

NRC RAI 4.4-93

Update NEDC-33237P to include additional void fraction correlation information committed to in the response to RAI 4.4-2S02.

In GEH's response to RAI 4.4-2, Supplement 2 (MFN 08-115), reference was made to Section 4.4.3.4 of the Preliminary Safety Evaluation with Open Items for the Design Certification Document, where the staff proposed a penalty on the Operating Limit Minimum Critical Power Ratio (OLMCPR) to account for uncertainty in the Findlay-Dix void-quality correlation is documented. The staff intends to make the thermal margin adder (0.01) a condition for approval of the OLMCPR methodology for ESBWR. This condition will be documented in the Safety Evaluation Report (SER) for NEDC-33237P, "GE14 for ESBWR - Critical Power Correlation, Uncertainty and OLMCPR Development." Please revise NEDC-33237P to include the requirement for the 0.01 thermal margin adder.

GEH Response

In GEH's response to RAI 4.4-2, Supplement 2 (MFN 08-115), reference was made to Section 4.4.3.4 of the Preliminary Safety Evaluation with Open Items for the Design Certification Document, where the staff proposed a penalty on the Operating Limit Minimum Critical Power Ratio (OLMCPR) to account for uncertainty in the Findlay-Dix void-quality correlation. Since that NRC draft SER, the NRC has issued more recent final SERs, References 4.4-93-1 and 4.4-93-2.

Based on a review of Ref. 4.4-93-1 and Ref. 4.4-93-2, for limitations and conditions applied to the void-quality correlation, GEH will include in NEDC-33237P equivalent limitations and conditions as shown in the attached LTR markup.

References

- 4.4-93-1. Final Safety Evaluation for GE Hitachi Nuclear Energy Americas, LLC Licensing Topical Report NEDC-33173P, "Applicability Of GE Methods To Expanded Operating Domains" (TAC NO. MD0277), July 21, 2009
- 4.4-93-2. Final Safety Evaluation of GE Hitachi Nuclear Energy Americas, LLC Licensing Topical Report NEDE-32906P, Supplement 3, "Migration To TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO And ATWS Overpressure Transients" (TAC NO. MD2569), July 10, 2009

DCD Impact

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

LTR Impact

NEDC-33237P will be modified as shown in the attached LTR markup.

Enclosure 2

MFN 10-012

**Response to Portion of NRC Request for
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Reactor**

RAI Number 4.4-93

Markups to LTR NEDC-33237P

A review of Reference 18 determined the following limitations and conditions apply to the void-quality correlation:

19. Void-Quality Correlation 1 (Section 7.2.7)

For applications involving PANCEA/ODYN/ISCOR/TASC for operation at EPU and MELLLA+, an additional 0.01 will be added to the OLMCPR, until such time that GE expands the experimental database supporting the Findlay-Dix void-quality correlation to demonstrate the accuracy and performance of the void-quality correlation based on experimental data representative of the current fuel designs and operating conditions during steady-state, transient, and accident conditions.

20. Void-Quality Correlation 2 (Section 7.2.8)

The NRC staff has reviewed Supplement 3 to NEDE-32906P, "Migration to TRACG04/PANAC11 from TRACG02/PANAC10," dated May 2006. The adequacy of the TRACG interfacial shear model qualification for application to EPU and MELLLA+ has been addressed under this review. The conclusions specified in the NRC staff SE approving Supplement 3 to LTR NEDE-32906P are applicable as approved.

Based on a review of Reference 19, the following limitations and conditions apply. See section 3.20.1 of Reference 19 for the basis. They will be applied to GE14E until such time that requirements for removing the limitations and conditions are met. The applicability of the Reference 19 operating fleet requirements to ESBWR has been demonstrated in RAI 4.4-39 S02 (Reference 20) that is similar to RAI 32 in Reference 19 for the acceptance of the TRACG04 initialization (with interfacial shear model) to PANAC11 (with Findlay-Dix void quality correlation).

4.20 Interfacial Shear Model Qualification Condition

Any licensing analyses referencing TRACG04 methods for future GNF fuel products shall verify the applicability of the interfacial shear model using void fraction measurements or an alternative, indirect qualification approach found acceptable by the NRC staff.

14. Global Nuclear Fuel, "GE14 for ESBWR Nuclear Design Report", NEDC-33239P, February 2006.
15. GE Nuclear Energy, "GE14 Pressure Drop Characteristics", NEDC-33238P, Class III (proprietary), December 2005.
16. Global Nuclear Fuel, "Full Scale Critical Power Testing of GE14E and Validation of GEXL14", NEDC-33413P Revision 0, March 2008.
17. GE Nuclear Energy, "Qualification of the One-Dimensional Core Transient Model for Boiling Water Reactors", NEDO-24154-A Volumes 1 and 2 dated August 1986, NEDE-24154P-A Volume 3 dated August 1986, and NEDC-24154P-A Supplement 1 Volume 4 dated February 2000.
18. [Final Safety Evaluation for GE Hitachi Nuclear Energy Americas, LLC Licensing Topical Report NEDC-33173P, "Applicability Of GE Methods To Expanded Operating Domains" \(TAC NO. MD0277\), July 21, 2009.](#)
19. [Final Safety Evaluation of GE Hitachi Nuclear Energy Americas, LLC Licensing Topical Report NEDE-32906P, Supplement 3, "Migration To TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO And ATWS Overpressure Transients" \(TAC NO. MD2569\), July 10, 2009.](#)
20. [Richard E. Kingston \(GEH\) to Document Control Desk \(NRC\), Response to Portion of NRC Request for Additional Information Letter No. 106 - Related To ESBWR Design Certification Application - RAI Number 4.4-39 Supplement 2, MFN 08-949, December 15, 2008.](#)