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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 09-318

Docket No. 52-010

May 20, 2009

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. 311 - Related to Design Control Document (DCD) Revision 5 – RAI Number 21.6-123 Supplement 1**

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 21.6-123 Supplement 1 is addressed in Enclosures 1 and 2.

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. Enclosure 2 is the public version, which does not contain proprietary information and is suitable for public disclosure.

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 in Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 10 CFR 9.17.

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

Sincerely,

Richard E. Kingston  
Vice President, ESBWR Licensing

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Reference:

1. MFN 09-152, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 311 Related to Design Control Document (DCD) Revision 5*, dated February 25, 2009.

Enclosures:

1. MFN 09-318 – Response to Portion of NRC Request for Additional Information Letter No. 311 - Related to Design Control Document (DCD) Revision 5 – RAI Number 21.6-123 S01 – GEH Proprietary Information
2. MFN 09-318 – Response to Portion of NRC Request for Additional Information Letter No. 311 - Related to Design Control Document (DCD) Revision 5 – RAI Number 21.6-123 S01 – Public Version
3. MFN 09-318 – Response to Portion of NRC Request for Additional Information Letter No. 311 - Related to Design Control Document (DCD) Revision 5 – RAI Number 21.6-123 S01 - Affidavit

cc: AE Cabbage      USNRC (with enclosures)  
JG Head            GEH/Wilmington (with enclosures)  
DH Hinds           GEH/Wilmington (with enclosures)  
eDRF                0000-0100-8033

**Enclosure 2**

**MFN 09-318**

**Response to Portion of NRC Request for**

**Additional Information Letter No. 311**

**Related to Design Control Document (DCD) Revision 5**

**RAI Number 21.6-123 S01**

**Public Version**

**NRC RAI 21.6-123 S01**

*3D momentum equation formulation of TRACG*

*In the response to RAI 21.6-123 (MFN 09-002), GEH has evaluated the impact of inaccurate models in the 3D momentum equation formulation of TRACG. GEH concludes that the TRACG models could overestimate the lower plenum pressure drop by as much as [[ ]] under typical ESBWR conditions. The staff is concerned that this non-physical increase in friction in the lower plenum is equivalent to increasing the single-phase pressure drop, which is non-conservative for stability calculations. The staff has performed a scoping LAPUR6 calculation and determined that an increase of [[ ]] in the single-phase channel region (at the inlet orifice) has a significant effect on core-wide decay ratio [[ ]]. A similar evaluation has been performed for the regional mode of oscillation, but the non-physical increased friction is smaller [[ ]] because only the lower plenum components of the 3D flow is involved in regional oscillations (the downcomer flow remains constant). The staff scoping calculations indicate that the regional decay ratio is also affected nonconservatively [[ ]] for ESBWR typical conditions.*

*Staff requests GEH provide the following information:*

- 1. Estimate the difference between the real expected ESBWR core flow and the core flow predicted by TRACG with the additional pressure drop.*
- 2. Estimate the impact on core-wide decay ratio of the additional pressure drop caused by the axial and radial components of the lower plenum flow. Separate the effects from the flow reduction (conservative) and the pressure drop increase (nonconservative)*
- 3. Estimate the impact on regional decay ratio of the additional pressure drop caused only by the radial component of the lower plenum flow. Separate the effects from the flow reduction (conservative) and the pressure drop increase (nonconservative).*

*Additionally, the staff expects that the upcoming revisions to topical reports NEDO-33337 and NEDO-33338, as well as DCD, Revision 6, will include the nodalization changes necessary to preclude momentum term errors in the analyses.*

**GEH Response**

**Response to Item 1**

Based on maximum Lower Plenum (LP) pressure drop error of [[ ]] evaluated in Reference [2], the realistic core flow is expected to increase approximately by [[ ]] relative to a nominal prediction. The following paragraphs provide additional details on this.

The root cause for over-prediction of pressure drop at LP, as identified in Reference [2], is the [[ ]



average pressure of 18 cells inside core shroud; while "DP\_Max" was evaluated by subtracting the maximum pressure of 6 DC cells from the minimum of 18 cells inside core shroud.

[[

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#### **Figure 21.6-123 S01-1, Core Flow Variation Against LP Pressure Drop**

As can be seen from Figure 21.6-123 S01-1, for a total reduction of average LP pressure drop of [[ ]] core flow increased linearly by [[ ]]. Based on previously evaluated maximum LP pressure drop error of [[ ]] the realistic core flow is expected to increase approximately by [[ ]] relative to a nominal prediction. This difference is expected to remain about the same for different cycle points because the hydraulic characteristics in the LP are independent of core condition.

#### **Response to Item 2**

For the natural circulation design of ESBWR, the core flow rate is primarily dependent on the void fraction distribution and the component pressure drops. Any change in component pressure drops will naturally result in flow variation. The capability for TRACG to predict such important thermal-hydraulic phenomena for natural circulation and flow instabilities has been assessed against separate effect tests, integral effects tests and full plant data (Reference [1]). The pressure drop error and the core flow are interlinked. When the dP error is reduced (e.g. using finer nodalization) the core flow is expected to increase correspondingly. The sensitivity studies presented in this response that vary the lower plenum radial loss coefficient over a large range, are deemed sufficient to address the dP error and the core flow sensitivity on decay ratio.

Therefore, it's not necessary to separate the effect of flow increase from the LP pressure drop decrease by imposing an unrealistic change to other pressure drops, i.e., two phase pressure drop through the core or chimney.

Figure 21.6-123 S01-2 summarizes the results of core wide decay ratios against  $k$ . The observation here is that in the direction of better differencing scheme, the change in decay ratio is very small ( $<0.015$ ). This shows the core wide decay ratio is not sensitive to the pressure drop over-prediction at LP region. It is also seen from Figure 21.6-123 S01-2 that the conservative results (higher core-wide decay ratio) are obtained with the existing uncorrected higher LP dP error.

[[

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### **Figure 21.6-123 S01-2 Core-Wide Decay Ratio Sensitivity Results**

#### **Response to Item 3**

Figure 21.6-123 S01-3 shows results of regional mode decay ratio sensitivity. Please note that only the radial losses are affected by  $k$  for these regional cases.

As discussed in response to item 2, core flow impact is not separated from the LP pressure drop change. Similar to core wide mode, regional decay ratio improves in the direction of better differencing scheme by only insignificant magnitude ( $< 0.01$ ).

[[

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### **Figure 21.6-123 S01-3 Regional Decay Ratio Sensitivity Results**

In summary, the sensitivity results from both core-wide and regional mode stability analyses consistently demonstrate that the effects of LP single phase pressure drop over-prediction on decay ratios are insignificant, and in the conservative direction.

Together with assessment in the original response in Reference [2], it is concluded that, for ESBWR TRACG applications involving 3D VSSL component, the effects of error in momentum formulation on the core-wide and regional mode decay ratios are conservative and insignificant.

Furthermore, as discussed in response to item 1, it is not necessary to use finer nodalization in the TRACG ESBWR DCD and LTR analyses to reduce errors in the momentum term related to lower plenum pressure drop. This means the beneficial effects of the resulting higher core flow will not be credited, and the current conservatism will be retained.

#### **References**

1. GE Nuclear Energy, B.S.Shiralkar, et al, "TRACG Application for ESBWR Stability Analysis," NEDE-33083P-A, Supplement 1, Revision 1, January 2008.
2. MFN 09-002, "Response to Portion of NRC Request for Additional Information Letter No. 262 Related to the ESBWR Design Certification – TRACE Momentum Equation – RAI Number 21.6-123", January 8, 2009.

**DCD Impact**

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

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

**Enclosure 3**

**MFN 09-318**

**Response to Portion of NRC Request for**

**Additional Information Letter No. 311**

**Related to Design Control Document (DCD) Revision 5**

**RAI Number 21.6-123 S01**

**Affidavit**

# GE-Hitachi Nuclear Energy Americas LLC

## AFFIDAVIT

I, Larry J. Tucker, state as follows:

- (1) I am Manager, ESBWR Engineering, GE Hitachi Nuclear Energy ("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 09-318 Mr. Richard E. Kingston to U.S. Nuclear Energy Commission, entitled "*Response to Portion of NRC Request for Additional Information Letter No. 311 – Related to Design Control Document (DCD) Revision 5 – RAI Number 21.6-123 Supplement 1,*" dated May 20, 2009. The proprietary information in enclosure 1, which is entitled "*MFN 09-318 – Response to Portion of NRC Request for Additional Information Letter No. 311 – Related to Design Control Document (DCD) Revision 5 – RAI Number 21.6-123 S01 – GEH Proprietary Information,*" is delineated by a [[dotted underline inside double square brackets<sup>(3)</sup>]]. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation <sup>(3)</sup> 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) is classified as proprietary because it contains details of GEH's design and licensing methodology. The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost to GEH.
- (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.

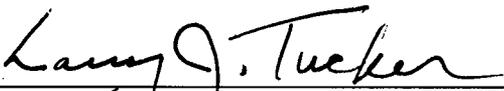
The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

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 20<sup>th</sup> day of May 2009.

  
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Larry J. Tucker  
GE-Hitachi Nuclear Energy Americas LLC