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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 08-660

Docket No. 52-010

September 4, 2008

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. 66 – Related to ESBWR Design Certification Application – RAI Number 21.6-90

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 21.6-90 is addressed in Enclosures 1, 2 and 3.

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 non-proprietary 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

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

References:

1. MFN 06-377, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, GEH, *Request For Additional Information Letter No. 66 Related To ESBWR Design Certification Application*, dated October 10, 2006

Enclosures:

1. MFN 08-660 – Response to Portion of NRC Request for Additional Information Letter No. 66 – Related to ESBWR Design Certification Application – RAI Number 21.6-90 – GEH Proprietary Information
2. MFN 08-660 – Response to Portion of NRC Request for Additional Information Letter No. 66 – Related to ESBWR Design Certification Application – RAI Number 21.6-90 – Non-Proprietary Version
3. MFN 08-660 – Response to Portion of NRC Request for Additional Information Letter No. 66 – Related to ESBWR Design Certification Application – RAI Number 21.6-90 – Affidavit

cc:	AE Cubbage	USNRC (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0067-4381

Enclosure 2

MFN 08-660

Response to Portion of NRC Request for Additional Information Letter No. 66 Related to ESBWR Design Certification Application RAI Number 21.6-90

Non-Proprietary Version

NRC RAI 21.6-90

Question Summary: Control blade dimensions in full out position.

Reviewer Summary: In an ATWS event, the presence of control blades in the lower bypass will affect the boron distribution. Provide the height of the control blades above the top of the core plate when blades are in the full out position. Discuss how the presence of control blades in the lower bypass affects the boron distribution. If this is not accounted for in the TRACG analyses of an ATWS event, demonstrate that the presence of the control blades does not affect the ATWS analyses.

GEH RESPONSE

The height of the control blades above the top of the core plate, when the blades are in the fully withdrawn, or "Full-Out" position, is at [[ ]]. For reference, the height of the bottom of the top guide above the top of the core plate is at [[ ]], and the height of the highest-most SLCS injector nozzle above the top of the core plate is at [[ ]].

The presence of the control blades acts as blockage to the radial migration of boron through the core bypass spaces. Figure 1 shows that alternate unobstructed paths also exist between the control blades through which boron is free to migrate radially through the bypass space lattice.

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]] The TRACG ATWS input model for the MSIV closure event does, however, include significant conservatism in the form of radial flow area blockages. These blockages force the injected boron solution to flow downwards toward the core support plate, where it then is allowed to spread radially to the inner core region. The degree of this conservatism has been discussed in Reference [1]. The present response will show that significant conservatism in the TRACG results exists, when compared with two sets of CFD results: (1) with all control blades fully withdrawn from the core and (2) with a set of representative control blades fully inserted into the core (while remaining control blades remain in a fully withdrawn position).

CFD Model Calculations with All Control Blades in the Full-Out Position

To demonstrate the conservatism of the TRACG results for boron mixing, a high-fidelity CFD model analysis of the boron mixing through the ESBWR core bypass spaces (labeled here as "RevIV") was performed as an alternative calculation to a corresponding TRACG ATWS prediction. The documentation of the RevIV model, including its validation versus data and its appropriateness for gauging TRACG conservatism, has been previously provided to the NRC as response to RAI 21.6-44 S1 (Reference [1]). The RevIV CFD model geometry includes the control blades, with each blade in the fully withdrawn, or Full-Out position.

An illustration of the full-out control blade geometry's representation in the RevIV model is shown in Figure 2. Note the narrow fluid gap that exists between the sides of the control blade and the fuel bundles was modeled as solid blockage in the RevIV CFD model. The size of this gap is the spacing between adjacent fuel bundles ([[ ]]) minus the true thickness of the control blade handle ([[ ]]), and divided by 2, which amounts to [[ ]] on each side of the control blade, or [[ ]]) of the passage space ([[ ]] total). To include the gap space as fluid volume in the RevIV model was prohibitive in terms of the size & complexity of the CFD grid. For the Full-Out control blade, the gap between the control blades and the bundles were modeled as total blockage. The assumption of zero clearance between the control blades and the fuel bundles represents a slight conservatism in the CFD model in the form of artificially increased blockage to boron transport.

Two relevant Figures of Merit (FOM's) were used to compare the corresponding TRACG and CFD calculation results. A brief description of the FOM's is provided here, while further details can be found in [1]. FOM1 is the total mass of boron present in a particular portion of the bypass space. FOM1 values were extracted from the models for Inner, Middle, and Outer annular regions of the bypass spaces, as well as the total for the entire core bypass. FOM2 is the time-aggregate mass of boron that has passed through the fuel assembly leakage holes for the same channel (fuel assembly) groups as were used in the TRACG ATWS MSIV closure boron mixing case. FOM2 values were extracted from the models for Inner, Middle, Outer, and Peripheral fuel bundle groupings, as well as the total for the entire core.

In Reference [1], the RevIV solution was validated to be representative of the boron mixing and transport in ESBWR bypass region, using scaling arguments and comparisons with test data. Also in Reference [1], the TRACG solution was demonstrated to be conservative versus the RevIV solution. A brief recap of the rationale leading to those conclusions is provided here. Figure 3 (which was also included and discussed in Reference [1]) shows FOM1 comparisons between the TRACG and RevIV models in Part (A), and FOM2 comparisons between the same two models in Part (B). As a result of the artificial blockages in the TRACG model, Part (A) of Figure 3 shows the TRACG results exhibiting significantly more boron pooling in the outer regions of the bypass space (Outer Ring), and significantly less boron penetrating the inner regions of the bypass space (Middle and Inner Rings). Likewise, Part (B) of Figure 3 shows the TRACG model exhibiting very little boron entering the Inner and Middle fuel assemblies. Reduced boron content in the inner regions of the core leads to a reduced capacity for poisoning the core's reactivity and, thus, an increased prediction of core shutdown times. Hence, the TRACG predictions with artificial radial blockage lead to a conservative solution for core shutdown times. Note that the "Spill" captions in Figures 3 and 5 are defined in [1].

<u>**CFD Model Calculations Including 32 Core Control Blades Fully-Inserted and Remaining Control Blades Full-Out**</u>

Additionally, a Sensitivity CFD solution was also performed (labeled here as "RevIV_WithCBI"): identical to that described in [1], but with 32 selected control blades (out of 269 total) fully inserted (or "Full-In") through the core. As with the RevIV model, all control blades were assumed to have zero clearance between the control blade and the fuel bundles. A scenario of select control blades in the Full-In position is possible if, just prior to an ATWS event, control blades were partially inserted for the purpose of controlling the core's power distribution. All other aspects of the RevIV_WithCBI solution (geometry, grid resolution, boundary conditions, settings & assumptions) were identical to that of the original RevIV solution of Reference [1].

In the RevIV_WithCBI model, four (3 + ½ + ½) control blades were modeled as Full-In for the 1/8th sector CFD model domain. This is equivalent to 8 inserted blades in the quarter sector of the core, as is shown in Figure 4. The control blades selected for Full-In were chosen based on the occurrence of maximum control blade density during the initial fueling cycle of the ESBWR. In reality, the Full-In control blades are only partially inserted into the core during this scenario, and are inserted to various extents depending on the control blade. For the RevIV_WithCBI model, the control blades were fully inserted through the top of the model domain (bottom of the top-guide). This was done to simplify creation of the model's geometry and grid, and represents added conservatism to the model in the form of additional artificial radial blockage to boron transport.

Figure 5 compares the predictions of FOM1 and FOM2 from the RevIV and RevIV_WithCBI CFD models, following the same format as that of Figure 3. Parts (A) and (B) of Figure 5 show very little discernable difference between the RevIV and RevIV_WithCBI solutions. This finding indicates that the presence of select Full-In control blades in the bypass spaces has minimal influence on the boron mixing that occurs during ATWS events.

Based on the comparisons with the validated CFD model results (including bounding extents of control blade insertion), and the demonstrated conservatism of the TRACG predictions versus the CFD model results, it is concluded that the TRACG prediction of boron propagation through the core bypass space (and its associated impact on ATWS core shutdown times), is not adversely affected by the absence of the control blades from the TRACG model. Alternatively put – the inclusion of the control blades' influence in the TRACG model would only make the TRACG solution more conservative than it already is.

REFERENCES

[1] Response to RAI 21.6-44 S01, MFN 08-659, September 2008

DCD IMPACT

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.

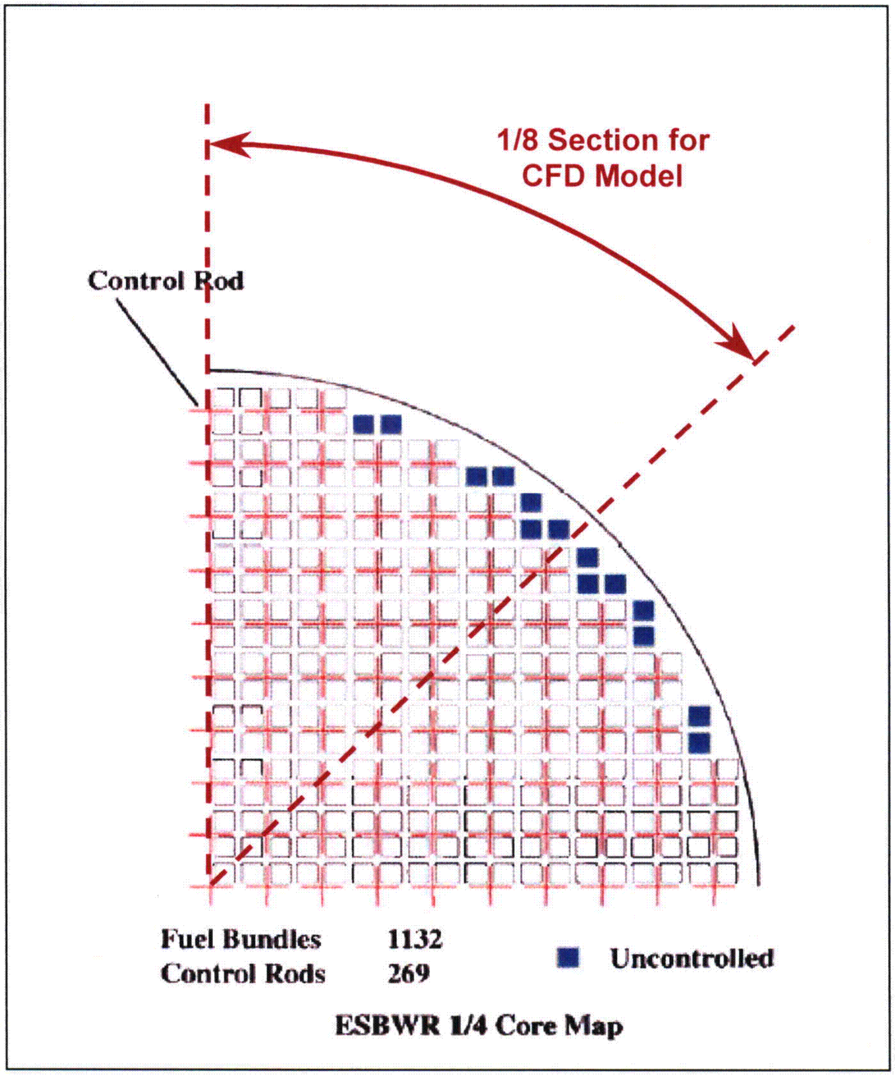

Figure 1: ESBWR ¼ Map, Showing the Placement of the Control Blades and Radial Migration Paths Through the Bypass Spaces

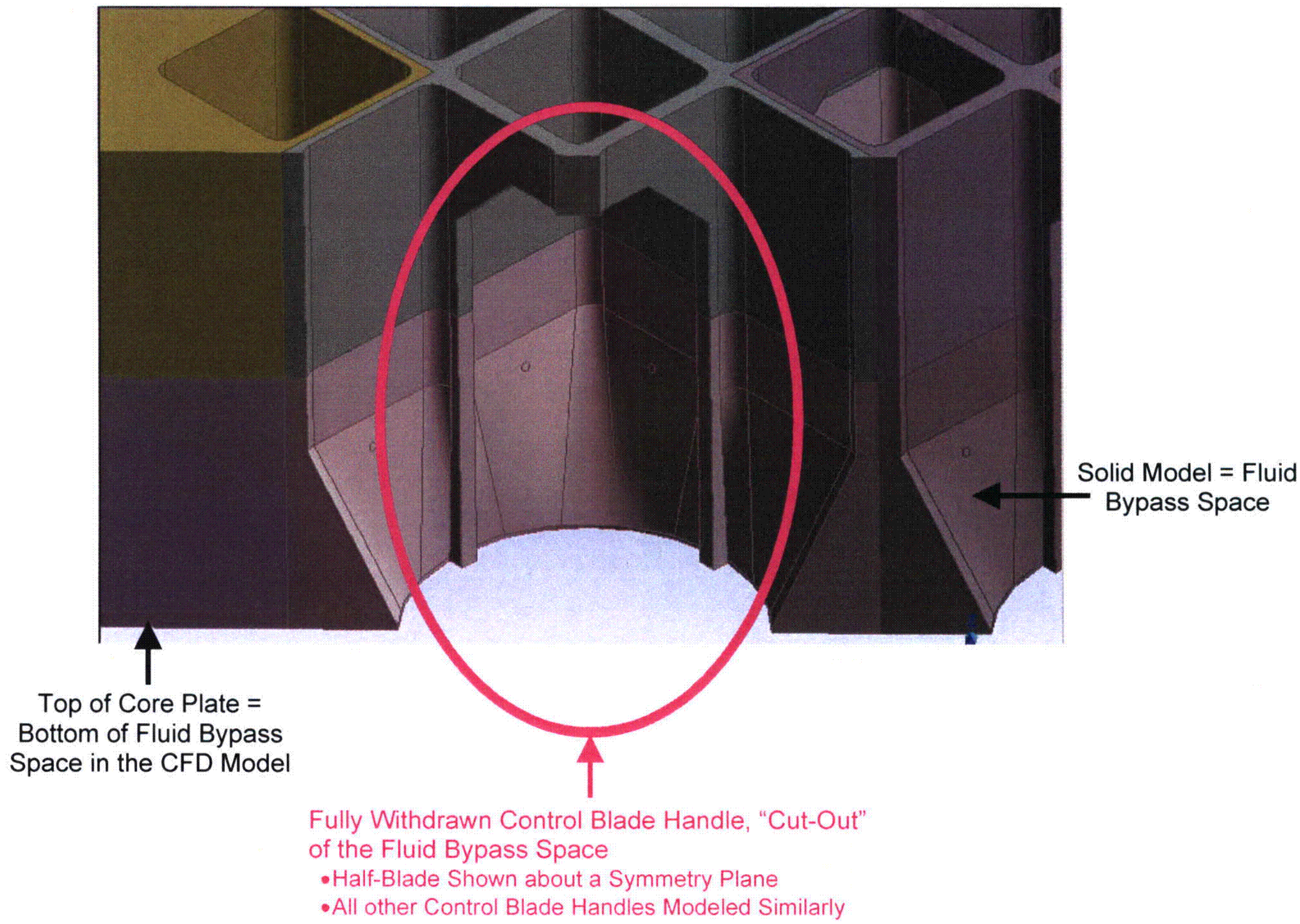

Figure 2: Illustration of the Control Blade Geometry in the CFD Model (fully-withdrawn position)

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Figure 3: Comparisons of RevIV CFD & TRACG Predictions of Boron Propagation through the Core

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Figure 4: Inserted Control Blade Handles in the Sensitivity CFD Solution

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Figure 5: Comparisons of RevIV and RevIV_WithCBI CFD Predictions of Boron Propagation through the Core

Enclosure 3

MFN 08-660

Response to Portion of NRC Request for

Additional Information Letter No. 66

Related to ESBWR Design Certification Application

RAI Number 21.6-90

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, David H. Hinds, state as follows:

(1) I am General Manager, New Units 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 08-660, Mr. Richard E. Kingston to U.S. Nuclear Energy Commission, entitled "*Response to Portion of NRC Request for Additional Information Letter No. 66 – Related to ESBWR Design Certification Application – RAI Number 21.6-90,*" dated September 4, 2008. The proprietary information in enclosure 1, which is entitled "*MFN 08-660 – Response to Portion of NRC Request for Additional Information Letter No. 66 – Related to ESBWR Design Certification Application – RAI Number 21.6-90 – 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 the results of TRACG analytical models, methods and processes, including computer codes, that GEH has developed and applied to ESBWR Anticipated Transients Without Scram (ATWS) response evaluations. GEH has developed this TRACG code for over fifteen years, at a significant cost. The reporting, evaluation and interpretation of the results, as they relate to the ATWS response evaluations for the ESBWR 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 4th day of September 2008.

David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC