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

MFN 06-297
Supplement 2

Docket No. 52-010

December 21, 2006

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. 53 Related to ESBWR Design Certification Application – DCD Chapter 4 and GNF Topical Reports – RAI Numbers 4.3-4, 4.4-48 and 4.8-7 – Supplement 2**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

Enclosure 1 contains GNF proprietary information as defined by 10 CFR 2.390. GNF 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 GNF. GE 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.

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If you have any questions about the information provided here, please let me know.

Sincerely,

James Kinsey

James C. Kinsey
Project Manager, ESBWR Licensing

Reference:

1. MFN 06-288, Letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 53 Related to ESBWR Design Certification Application,* August 16, 2006

Enclosures:

1. MFN 06-297, Supplement 2 – Response to Portion of NRC Request for Additional Information Letter No. 53 Related to ESBWR Design Certification Application – DCD Chapter 4 and GNF Topical Reports – RAI Numbers 4.3-4, 4.4-48 and 4.8-7 – Supplement 2 – GNF Proprietary Information
2. MFN 06-297, Supplement 2 - Response to Portion of NRC Request for Additional Information Letter No. 53 Related to ESBWR Design Certification Application – DCD Chapter 4 and GNF Topical Reports – RAI Numbers 4.3-4, 4.4-48 and 4.8-7 – Supplement 2 – Non Proprietary Version
3. Affidavit – Jens G. M. Andersen – dated December 21, 2006

cc: AE Cubbage USNRC (with enclosures)
AA Lingenfelter GNF/Wilmington (w/o enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRFs 0060-6096 for RAI 4.3-4, Supplement
0062-2295 for RAI 4.4-48 Supplement
0056-5590/R1 for RAI 4.8-7

ENCLOSURE 2

MFN 06-297, Supplement 2

Response to Portion of NRC Request for

Additional Information Letter No. 53 Related to ESBWR Design Certification Application

DCD Chapter 4 and GNF Topical Reports

RAI Number 4.3-4, 4.4-48, 4.8-7

Non-Proprietary Version

NRC RAI 4.3-4:

Discuss any recent changes made to PANACEA since the staff's last approval. Provide similar information to that requested in RAI 4.3-3. It is presumed that this version of the code is the NRC-approved version of record.

GE Response:

Original Response:

PANAC11A was reviewed and approved by Letter from Stuart A. Richards to Glen A. Watford, "Amendment 26 to GE Licensing Topical Report NEDE-24011-P-A, GESTAR II - Implementing Improved GE Steady- State Methods (TAC No. MA6481)," November 10, 1999.

There have been no changes to the approved methodology used for design and/or monitoring. All corrections have impacted eigenvalue and power distribution in a negligible manner. The technical impact determination is based on specific testing related to the identified problems as well as regression testing consisting of test cases used to validate previous versions.

The history of the changes in PANAC11A is described below:

PANAC11A	Conversion or Correction Details
PANAC11A	**Original version, Level 2 ECP on June 9, 1997**
PANAC11AE2	**First correction, August 20, 1997 [[**]]
PANAC11AE3	**Second correction, November 18, 1998** [[ ]]

PANAC11AE4	**Third correction, January 17, 2001** [[ ]]

PANAC11AE5	**Fourth correction, July 16, 2003**. [[ ]]

PANAC11AE6	**Fifth correction, August 10, 2005.** [[ ]]
PANAC11AE7	**Sixth correction, September 23, 2005.** [[ ]]

PANAC11AE8	**Seventh correction, April 20, 2006** [[

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NRC RAI 4.3-4 Supplement:

TGBLA06A 2006 Audit Request:

Using both TGBLA06E4 and TGBLA06E5 with PANAC11, perform a cycle analysis of Limerick's Cycle 5 using current methods including core eigenvalues, PC, etc. and compare back to the original results submitted in 1997. Make results available at GE's Washington Office or expect the request to be formalized as an action item in the audit report.

NRC staff comments on GE's partial response to RAI letter 53 (MFN-06-297)

Additional Comments on response to RAI 4.3-4

Provide a cycle re-analysis of [[ ]]. *The purpose of this analysis is to demonstrate that the code error corrections and revisions have not resulted in a significant change to the predictive capability of the nuclear design codes or have led to an unnoticed error in the implementation of the methodology.*

The calculation will use TGBLA06AE4 and TGBLA06AE5 generated lattice parameters and be performed with PANAC11AE8. The re-analysis will be performed with the [[ ]] *disabled. The re-analysis will include a plot of the cycle* [[ ]]. *Provide the* [[ ]]. *Provide a comparison of the* [[ ]] *to the quantities provided in MFN-098-96.*

As part of this analysis provide the [[ ]] *in the* [[ ]] *GE fuel lattices as calculated using TGBLA06AE4 and TGBLA06AE5 for each depletion analysis in the standard production method* [[ ]].

GE Response to NRC RAI 4.3-4 Supplement:

The original submittal in 1997 demonstrated the differences between PANAC11A/TGBLA6E2 results and the previous analysis system PANAC10A/TGBLA04A. To respond to the above request, three additional analyses of the Limerick operation beginning in Cycle 1 and continuing through Cycle 5 were performed. The fuel types utilized in the first three Limerick operating cycles are 9x9

GE6 and GE7 designs. Cycle 4 of Limerick shows the introduction of a large central water rod 8x8 GE9 design and Cycle 5 introduces the first GE11 9x9 design into the Limerick core.

The three codes sets which were used are: PANAC113/TGBLA6E2, PANAC118/TGBLA6E4, and PANAC118/TGBLA6E5. The results compared are core reactivity, peak linear heat generation (kW/ft), core minimum critical power ratio (MCPR), and TIP uncertainty for Cycle 5.

In Figure 1, the core reactivity for the first 5 cycles of operation is presented. Figure 1 also contains the PANAC10A/TGBLA04A and the PANAC11A/TGBLA6E2 results as contained in the original submittal. In Figure 2, the linear heat generation rate for the first 5 cycles of operation is presented. In Figure 3, the core minimum critical power ratio for the first 5 cycles of operation is presented.

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It can also be observed that the thermal performance predictions are essentially identical for the 3 code sets.

Table 1 shows the radial and nodal results of the TIP Uncertainty analysis for Limerick Cycle 5. Figure 4 presents the trends of the nodal RMS analysis as a function of cycle exposure for Limerick Cycle 5. This analysis shows that the agreement between the three code sets is very good.

The requested fission density comparison data can be found in three spreadsheets that have been transmitted as part of this RAI response. The spreadsheets are
Lat_3875_T6E5_T6E4_Data.xls,
Lat_3876_T6E5_T6E4_Data.xls,
Lat_3877_T6E5_T6E4_Data.xls.

In conclusion, it is shown that the current (P118/T6E4) and the proposed (P118/T6E5) code set continue to agree well with the original submitted method set.

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Table 1: Nodal TIP Uncertainty for Limerick Cycle 5		
Nuclear Method Set	**TIP Radial RMS**	**TIP Nodal RMS**
PANAC113/TGBLA6E2	[[	
PANAC118/TGBLA6E4		
PANAC118/TGBLA6E5		]]

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NRC RAI 4.4-48:

Section 1.7 of NEDC-33239P, Reactivity Coefficient Methods, references an NRC-approved lattice physics code. State the code referenced.

GE Response:

Original Response:

All lattice calculations used for the reactivity coefficient analyses, steady state thermal limit analyses, and reactivity analyses were based from the currently approved lattice physics code TGBLA Version 6. Similarly, the currently approved nodal physics simulator PANACEA Version 11 (PANAC11) was used for all 3D simulations. These codes and versions are identical to the methods used in the other BWR operating plants.

NRC RAI 4.4-48 Supplement:

The response to RAI 4.4-48 states that the code used is TGBLA Version 6. TGBLA06A has been modified and the applicant refers to the modified version T6E5. Specify whether T6E5 was used for calculation of the reactivity coefficients. If T6E4 (the unmodified version 6) and T6E5 (the modified version 6) where both used, specify for each calculation (moderator temperature, hot void reactivity, cold void reactivity, and Doppler) which code was used.

GE Response RAI 4.4-48 Supplement:

The current version (T6E4) has been used for all of the reactivity coefficients included in Section 1.7 of NEDC-33239P.

NRC RAI 4.8-7:

Section 3.3.3 of NEDC-33240P states, "Testing is performed to assure that the mechanical features of the design do not result in significant vibration and consequent fretting wear."

(a) Provide the flow induced vibration (FIV) test results for the GE14E assembly design.

(b) Discuss the impact of in-reactor dimensional changes (e.g. fuel rod growth, grid spring relaxation, etc.) on the adequacy of laboratory testing of unirradiated samples.

(c) If specific GE14E FIV test results have not been conducted, demonstrate the applicability of previous FIV test results to the GE14E design. Describe any differences in assembly design e.g. part-length rods, grid springs, grid elevations, materials, etc.) which may potentially impact the FIV test results.

GE Response:

Original Response:

a) FIV testing specifically for GE14E has not been performed to-date. GE will confirm by test the FIV performance of the GE14E design prior to the delivery of the GE14E fuel. As discussed below, the similarity of the GE14 and GE14E designs, tests previously performed for GE14 for BWR/4-6 reactors, and many years of successful in-reactor operation of the GE14 design provide assurance that FIV will not be a significant issue for GE14E.

b) [[

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c) With respect to potential for fretting caused by FIV, the GE14E design is nearly identical to GE14. [[

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NRC RAI 4.8-7 Supplement:

From Fuels Audit 10/23 - 10/31

Provide:

a. For flow-induced vibration, type of testing that will be performed

b. Acceptance Criteria

c. Make comparisons between GE 14 and GE 14E fuel bundle

d. Compare peak and RMS

GE Response to RAI 4.8-7 Supplement:

a) FIV testing specifically for GE14E has not been performed to-date. GE will confirm by test the FIV performance of the GE14E design prior to the delivery of the GE14E fuel. The test will compare the GE14E design to the current GE14 production design, which has many years of successful in-reactor experience. Test methodology, data acquisition and reduction and acceptance criteria will be the same as for the previous testing performed for GE14 and described in NEDC-33240P. As discussed above, the similarity of the GE14 and GE14E designs, tests previously performed for GE14 for BWR/4-6 reactors, and many years of successful in-reactor operation of the GE14 design provide assurance that FIV will not be a significant issue for GE14E.

b) No change to original response

c) No change to original response

d) Peak and RMS acceleration data for GE14E will be compared to those for GE14. These results will be summarized and sent by letter to the NRC to close the open item.

Enclosure 3

MFN 06-297, Supplement 2

Affidavit

Affidavit

I, Jens G. M. Andersen, state as follows:

(1) I am Consulting Engineer, Thermal Hydraulic Methods, Global Nuclear Fuel – Americas, L.L.C. ("GNF-A") 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 GE letter MFN 06-297, Supplement 2 James C. Kinsey to U. S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 53 Related to ESBWR Design Certification Application – DCD Chapter 4 and GNF Topical Reports – RAI Numbers 4.3-4, 4.4-48 and 4.8-7 – Supplement 2,* dated December 21, 2006. The proprietary information in Enclosure 1, *MFN 06-297, Supplement 2, Response to Portion of NRC Request for Additional Information Letter No. 53 Related to ESBWR Design Certification Application – DCD Chapter 4 and GNF Topical Reports – RAI Number 4.3-4, 4.4-48 and 4.8-7,* is delineated by double underlined dark red font text and is enclosed inside double square brackets. Figures and large equation objects are identified with double square brackets before and after the object. 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, GNF-A 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 GNF-A's competitors without license from GNF-A 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 GNF-A customer–funded development plans and programs, of potential commercial value to GNF-A;

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 the 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 GNF-A, and is in fact so held. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in (6) and (7) following. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GNF-A, 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.

(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 GNF-A. Access to such documents within GNF-A 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, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GNF-A 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 GNF-A's fuel 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, on the order of several million dollars, to GNF-A or its licensor.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GNF-A's competitive position and foreclose or reduce the availability of profit–making opportunities. The fuel design and licensing methodology is part of GNF-A'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 GNF-A or its licensor.

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.

GNF-A's competitive advantage will be lost if its competitors are able to use the results of the GNF-A 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 GNF-A 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 GNF-A 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 at Wilmington, North Carolina this 21st day of December 2006.

Jens G. M. Andersen
Global Nuclear Fuels – Americas, LLC