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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 09-188

Docket No. 52-010

March 24, 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. 276 - Related To ESBWR Design Certification Application – RAI Number 4.4-70 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 4.4-70 Supplement 1 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 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

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-957, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 276 Related To ESBWR Design Certification Application*, dated December 4, 2008.

Enclosures:

1. MFN 09-188 – Response to Portion of NRC Request for Additional Information Letter No. 276 – Related To ESBWR Design Certification Application – RAI Number 4.4-70 – GEH Proprietary Information
2. MFN 09-188 – Response to Portion of NRC Request for Additional Information Letter No. 276 – Related To ESBWR Design Certification Application – RAI Number 4.4-70 – Public Version
3. MFN 09-188 – Response to Portion of NRC Request for Additional Information Letter No. 276 – Related To ESBWR Design Certification Application – RAI Number 4.4-70 – Affidavit

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF	0000-0095-9377

Enclosure 2

MFN 09-188

Response to Portion of NRC Request for

Additional Information Letter No. 276

Related to ESBWR Design Certification Application

RAI Number 4.4-70 S01

Public Version

NRC RAI 4.4-70 S01

Transient test data and statistical evaluation for the GE14E fuel

Per a teleconference with GEH on September 8, 2008, GNF stated that transient tests were included in the recent critical power testing for GE14E fuel conducted at Stern Labs, but because of time constraints, the test results and statistical evaluation were not included in Revision 0 of Topical Report NEDC-33413P. This is consistent with the response to RAI 4.4-70 (MFN 08-711). Please provide in a revision to Topical Report NEDC-33413P the test results and a statistical evaluation which demonstrates the acceptability of applying the GEXL14 correlation to GE14E fuel for ESBWR transients.

GEH Response

The evaluation of the GEXL14 correlation for the GE14E transient data is performed. Test results and the statistical evaluation are provided in the attached LTR markup. It is confirmed that the GEXL14 correlation conservatively predicts ΔCPR/ICPR of the GE14E transient data. Therefore, it is concluded that GEXL14 is qualified to predict the transient critical power response of GE14E fuel.

DCD/LTR Impact

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

LTR NEDO-33413 will be revised as shown in the attached markup. The revised information is identified within red-lined boxes.

Attachment

Revision Pages for NEDO-33413

1. INTRODUCTION

The passive safety features and natural circulation operating strategy employed in the ESBWR require a reactor core design with minimum resistance to two-phase pressure drop, while still providing sufficient density head to maintain natural circulation flow. ESBWR design optimization studies have resulted in a core bundle design, which is for the most part identical to the standard bundle design used in the BWR4/5/6 and ABWR designs except that the overall fuel bundle length has been reduced by about 27 inches and the active fuel length reduced by about 30 inches.

The GE critical quality - boiling length correlation (GEXL) was developed to accurately predict the onset of boiling transition in BWR fuel assemblies during both steady-state and reactor transient conditions. The GEXL critical power correlation for conventional GE14 10x10 fuel (GEXL14) has been developed using data obtained from the ATLAS critical power test facility. GE14 fuel is currently producing power in BWRs worldwide with successful operating performance. The ESBWR version of GE14 (GE14E) is identical to GE14, except for those features related to the axial length of the fuel, i.e., the total fuel axial length, the number and axial location of the fuel rod spacers, and the axial length of the part length rods.

Due to the similarity between the two GE14 versions, GE14 and GE14E, the GEXL14 correlation can be applied to ESBWR applications, provided that the geometry differences between the two versions of GE14, however small these differences are between the two versions, are quantified and properly accounted for.

Reference 1 discussed the application of the GEXL14 critical power correlation to GE14E fuel and the supporting analyses performed to quantify and subsequently account for the effect (on critical power) of the differences between GE14 for the conventional BWRs and GE14E. In Reference 1, the ATLAS critical power data for the conventional BWR version of GE14 was adjusted due to shortening of the heated length and a subchannel analysis model of GE14, previously qualified based on the ATLAS GE14 critical power data, was then used to quantify the effect of the geometry differences between the two GE14 versions on the critical power performance. Based on the ATLAS GE14 data and the subchannel analysis, the statistics of the GEXL14 correlation for GE14E were established and subsequent operating limit and safety limit minimum critical power ratio (MCPR) evaluations were conducted.

Full-scale critical power and pressure drop tests were conducted to collect sufficient data to validate the use of the GEXL14 correlation for the GE14E fuel and demonstrate the adequacy of the established GEXL14 statistics for the GE14E fuel.

GE14E test assembly characteristics, test matrix, and critical power database used in the GEXL14 analysis are provided in Section 2. The GEXL14 analysis and the resulting statistics for the GE14E fuel are discussed in Section 3. An overview of the R-factor calculation method is provided in Section 4. Transient test data and the evaluation of the GEXL14 correlation for the transient data are provided in Section 5. The measure of the capability of a boiling transition prediction correlation is its ability to predict the test data. The GEXL14 correlation is demonstrated to be an accurate predictor of the GE14E test data.

5. GEXL14 EVALUATION FOR GE14E TRANSIENT TEST

The transient qualification of GEXL14 was accomplished by comparing the change in critical power ratio with experimental results obtained from the ATLAS thermal hydraulic test facility as discussed in Reference 2. The GE14E transient critical power test results from the Stern test facility and the evaluation of the GEXL14 correlation for the GE14E transient data are provided in this section.

Changes in critical power during an operational transient are calculated with a two-phase transient thermal hydraulic model. The thermal hydraulic program, as qualified in Reference 5, solves the heat conduction equation for the fuel rods and the conservation equations for mass, momentum and energy for the fluid. The GEXL14 correlation is used together with the transient thermal hydraulic conditions computed by the program to compute the change in CPR during a given transient.

In addition to measuring steady state critical power, the Stern facility is capable of determining critical power or dryout conditions under transient conditions. Transient conditions are generated by varying the inlet flow, pressure, and bundle power as a function of time.

[[

]] (5-1)

Five GE14E transient critical power tests were performed. The experimental conditions are summarized in Table 5-1. Transient test responses and temperature traces from several thermocouples for test case 998 are plotted in Figure 5-1. Note the temperature rise in two of the thermocouples, indicating a degradation of heat transfer capability and critical power condition.

A comparison of calculated versus measured results is summarized in Figure 5-2. These results show that the GEXL14 correlation conservatively predicts the transient ΔCPR/ICPR. The mean error for the calculated ΔCPR/ICPR compared to the five measurements is [[

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Table 5-1 Summary of GE14E Transient Tests

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*Note: Actual transient responses are slightly different from the control specified in this Table.

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Figure 5-1 Transient Test Response for Test Run 998

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Figure 5-2 Summary of Transient ΔCPR/ICPR Comparison

GEXL14 correlation is evaluated for additional GE14E transient test data obtained from the Stern test facility and it is confirmed that the GEXL14 correlation conservatively predicts the transient ΔCPR/ICPR. Therefore, it is concluded that the GEXL14 is qualified to predict the transient critical power response of GE14E fuel in the ESBWR.

7. REFERENCES

1. NEDC-33237P, *GE14 for ESBWR – Critical Power Correlation, Uncertainty, and OLMCPR Development*, Revision 4, July 2008.

2. NEDC-32851P, *GEXL14 Correlation for GE14 Fuel*, Revision 5, January 2008.

3. GE Nuclear Energy, *ESBWR Design Control Document Tier 2 Chapter 15 Safety Analyses*, 26A6642BP Revision 5, May 2008.

4. NEDC-32505P-A, *R-Factor Calculation Method for GE11, GE12, and GE13 Fuel*, Revision 1, July 1999.

5. NEDE-32177P, *TRACG Qualification*, Revision 3, August 2007.

Enclosure 3

MFN 09-188

Response to Portion of NRC Request for

Additional Information Letter No. 276

Related to ESBWR Design Certification Application

RAI Number 4.4-70 S01

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, David H. Hinds, state as follows:

(1) I am 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 09-188 Mr. Richard E. Kingston to U.S. Nuclear Energy Commission, entitled "*Revised Response to Portion of NRC Request for Additional Information Letter No. 276 – Related to ESBWR Design Certification Application – RAI Number 4.4-70 Supplement 1,*" dated March 24, 2009. The proprietary information in enclosure 1, which is entitled "*MFN 09-188 – Revised Response to Portion of NRC Request for Additional Information Letter No. 276 – Related to ESBWR Design Certification Application – RAI Number 4.4-70 S01 – GEH Proprietary Information,*" is indicated as the content contained between opening double brackets ([[) and closing double brackets (]]). 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) 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 24th day of March 2009.

David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC