Global Nuclear Fuel

A Joint Venture of GE, Toshiba, & Hitachi

Proprietary Notice

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

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FLN-2007-035
November 30, 2007

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: Pre-Submittal of Supplement to Approved Channel Bow Methodology

In Reference 1 the NRC approved a channel bow methodology for use by plants referencing GESTAR II. The Safety Evaluation (SE) for the approved methodology can be found in Appendix C of the current U.S. Supplement to GESTAR II (NEDE-24011-P-A-15-US) on page US.C-279. The original model was described in Reference 2 and through RAI responses in References 3 and 4.

Enclosure 1 is a Supplement to the approved methodology which modifies a portion of the approach to change it from generic to plant specific. A brief discussion of the current approach and the revision is provided. Because the approval for this model occured a number of years ago, a pre-submittal meeting may be desireable to clearly communicate the change to the NRC Staff. We request that the Staff review Enclosure 1 and if desired a pre-submittal meeting can be planned for mid-January.

Please note that Enclosure 1 contains proprietary information of the type that GNF maintains in confidence and withholds from public disclosure. The information has been handled and classified as proprietary to GNF as indicated in its affidavit, also included in the report. The affidavit contained in Enclosure 3 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GNF. GNF-A hereby requests that the information in Enclosures 1 and 2 be withheld from public disclosure in accordance with the provisions of 10CFR2.390 and 9.17.

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NRR

If you have any questions about the information provided here, please contact me at (910) 675-5954 or Jim Harrison at (910) 675-6604.

Sincerely,

Anthony Reese
acting for:

Andrew A. Lingenfelter
Vice President, Fuel Engineering
Global Nuclear Fuel–Americas, LLC

Project No. 712

References

1. Letter from Ashok C. Thadani (NRC) to J. S. Charnley (GE), *Acceptance For Referencing of Topical Report Titled "GE–Nuclear Energy Report MFN086–89,"* January 11, 1991.

2. Letter and attachments to Robert C. Jones, Chief Reactor Systems Branch – USNRC, *Fuel Channel Bow Assessment,* November 15, 1989, JSC-89-115, MFN-086-89.

3. Letter and attachments to Robert C. Jones, Chief Reactor Systems Branch – USNRC, *Responses to Channel Bow Questions,* May 3, 1990, JSC-90-016, MFN-041-90.

4. Letter and attachments to Robert C. Jones, Chief Reactor Systems Branch – USNRC, *(Additional Responses to Channel Bow Questions),* September 26, 1990, MFN-109-90.

Enclosures

1. Pre-Submittal of Supplement to Approved Channel Bow Methodology - GNF Proprietary Information
2. Pre-Submittal of Supplement to Approved Channel Bow Methodology – Non-Proprietary Information

cc: MC Honcharik, USNRC
JGM Andersen, GNF/Wilmington
PL Campbell, GEH/Washington
RE Brown, GEH/Wilmington
JF Harrison, GEH/Wilmington
eDRF Section 0000-0078-1879

ENCLOSURE 2

FLN-2007-035

Pre-Submittal of Supplement to Approved Channel Bow Methodology

Non-Proprietary Information

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space with an open and closed bracket as shown here [[ ]].

Supplement to Approved Channel Bow Methodology

Introduction

For GNF reload licensing analyses, the critical power ratio (CPR) is evaluated using the GEXL methodology. An essential component of this CPR evaluation is the bundle "R-factor" term. The bundle R-factor accounts for the effects of the fuel rod power distributions as well as fuel assembly and channel geometry effect in determining the bundle's critical power (Reference 1). This R-factor is sensitive to the amount of channel bow that the bundle and its face-adjacent neighbors experience, as the amount of bow affects the adjacent water gaps and thus fuel rod local power peaking. Since 1990, GNF has implemented an NRC approved methodology for calculating and applying the effects of channel bow on bundle R-factors (References 2-5). The current design procedure implements this methodology by obtaining the core-average channel bow values [[

]] Core-average bow is defined as the average of the four-bundle cell-average bows for control cells that contain at least one high power bundle. [[

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Proposed Change

The inclusion of the core-average bow determination model into GNF's three-dimensional core simulator (PANACEA) allows the core-average channel bow parameter to be calculated for the specific plant/cycle conditions, using the same models and methodology as were used in developing the generic tables. The revision to the core-average bow procedure incorporates the effects of both the fast fluence from PANACEA and the initial (as-manufactured) channel bow, as a replacement to the generic tables. The revision allows the determination of the channel bow to be based on the specific bundle and channel characteristics for the plant and cycle being analyzed rather than on generic tables, which provide a reasonable but less precise estimate of the core-average channel bow.

In establishing the core-average bow, the model performs a Monte Carlo based analysis using a random sampling of the uncertainties associated with the channel bow mechanisms in a manner consistent with approved methodology. However, instead of relying on a sampling of variations in core loading and bundle operating history as done previously, the Monte Carlo calculation is now performed based on the specific plant/cycle core loading being analyzed. Uncertainties in individual channel bow with respect to the core-average bow value continue to be accounted for as part of the R-factor uncertainty used in the MCPR safety limit evaluation. The net effect of this procedure modification is to continue to perform the calculation of core-average bow (and its impact on bundle R-factors) in a manner that is consistent with the original approved methodology but with greater precision – precision that was not available at the time the methodology was first introduced. [[

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Since the initial approval of the methodology for calculating core-average bow and its impact on CPR an additional mechanism of channel distortion, shadow corrosion, has been discovered, in which BWR channels operating adjacent to an inserted control rod may experience additional bow later in life. This mechanism if present will always result in channel bow towards the control blade and thus is of concern in regards to potential channel/control blade interference. The ancillary channel distortion model in PANACEA also predicts this mechanism of channel distortion; however, it is not included in the core-average bow model for CPR, as the deflection is always in a direction that reduces the water gap, thus reducing the calculated core-average bow and reducing the impact on CPR. For this reason the calculation of core-average bow for CPR continues to be based on the initial, as-manufactured bow coupled with the in-core fast fluence induced bow.

Impact on Operating Plants

This change is not expected to result in a significant change in the calculated core-average bow or core CPR results. The new model has confirmed that the generic tables have continued to provide a reasonable, but conservative value for core-average bow when applied to recent core designs. This change regarding the implementation of the approved methodology will ensure that as future core and channel design changes are implemented their impact on core-average bow can be properly accounted for.

References

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

2. General Electric Standard Application for Reactor Fuel, NEDE-24011-P-A-15, September 2005; and the U.S. Supplement, NEDE-24011-P-A-15-US, September 2005 (page US.C-279, NRC Safety Evaluation Report Approving MFN 086-89 Channel Bow Effects on Thermal Margin).

3. Letter and attachments to Robert C. Jones, Chief Reactor Systems Branch – USNRC, Fuel Channel Bow Assessment, November 15, 1989, MFN-086-89.

4. Letter and attachments to Robert C. Jones, Chief Reactor Systems Branch – USNRC, Responses to Channel Bow Questions, May 3, 1990, MFN-041-90.

5. Letter and attachments to Robert C. Jones, Chief Reactor Systems Branch – USNRC, (Additional Responses to Channel Bow Questions), September 26, 1990, MFN-109-90.

ENCLOSURE 3

FLN-2007-035

Affidavit

Global Nuclear Fuel – Americas

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 FLN-2007-035, Andrew A. Lingenfelter (GNF) to Document Control Desk (USNRC), *Pre-Submittal of Supplement to Approved Channel Bow Methodology,* dated November 30, 2007. The proprietary information in Enclosure 1, *Pre-Submittal of Supplement to Approved Channel Bow Methodology,* is identified by a single [[dotted underline inside double square brackets{3}]]. Figures and other large 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, 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, resulting in potential products 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 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. 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. 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 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 information 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.

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 on this 30th day of November 2007.

Jens G. M. Andersen
Global Nuclear Fuel – Americas, L.L.C.