



Global Nuclear Fuel

A Joint Venture of GE, Toshiba, & Hitachi

Charles M. Vaughan

April 18, 2005

Mr. E. William Brach, Director
Spent Fuel Project Office, M/S O-13D13
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: GNF-A's Response to the NRC's 3/15/05 RAI for the Model RA-3 Package – TAC No. L23695

Reference(s):(1) Certificate of Compliance (CoC) 4986, Docket 71-4986, TAC No. L23695
(2) Application Dated 1/21/04
(3) NRC Request for Additional Information (RAI), dated 5/26/04
(4) Letter, CM Vaughan to EW Brach, dated 7/15/04
(5) Letter, CM Vaughan to EW Brach, dated 12/3/04
(6) Letter JR Cuadrado to CM Vaughan, dated 1/18/05
(7) Letter JR Cuadrado to CM Vaughan, dated 3/15/05

Attachment 6 of this letter contains Proprietary Information. Upon removal of this Attachment, this application is decontrolled.

Dear Sir:

Global Nuclear Fuel, Americas – L.L.C. (GNF-A) in Wilmington, NC hereby submits our response to the 3/15/05 Request for Additional Information (RAI) related to Certificate of Compliance (CoC) number 4986 for the Model RA-3 package.

The following are Attachments to this letter:

Attachment 1 is suggested wording for NRC CoC 4986.

Attachment 2 is the Affidavit requesting the information identified as proprietary within this application be withheld from the public. The original affidavit will be mailed to you under a separate cover.

Attachment 3 is GNF-A's response to the NRC's Request for Additional Information.

Attachment 4 is an explanation of changes made to the Criticality Safety Analysis (CSA).

Attachment 5 is the non-proprietary version of the Criticality Safety Analysis and the GEMER Monte Carlo Validation Report. This report is not a proprietary document. This Revision 2 replaces the previous Revision 1 in its entirety. The "GEMER Monte Carlo Validation Report: RA-3 Analysis with GNF2 Fuel", dated November, 2004 remains valid and should continue to be kept in Appendix 7-J(a) of the SAR.

An asterisk has been placed in the right hand margin of the CSA indicating the removal of proprietary information from that page. The sections removed within

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the text are indicated with a double bracket. This version has been identified as Appendix 7-J(a), because it is associated with the existing 10x10 analysis. Attachment 6 is GNF-A's Proprietary Information Notice and the proprietary version of the Criticality Safety Analysis and has been marked in accordance with 10CFR2.390(b)(1)(i). The proprietary information has been identified by enclosing it in double brackets with a superscript notation ^{3} of the enclosed Affidavit that provides the basis for the proprietary determination. This version has been identified as Appendix 8-J(a), because it is associated with the existing 10x10 analysis. Attachment 7 contains replacement / new pages to the existing consolidated application. They are identified on the footer showing the date of the change and the revision number.

Please contact me on (910) 675-5656 or charles.vaughan@gnf.com, if you have any questions or would like to discuss this subject further.

Sincerely,

Global Nuclear Fuel – Americas, L.L.C.

ORIGINAL SIGNATURE ON FILE

Charles M. Vaughan, Manager
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P.O. Box 780, Mail Stop K-84
Wilmington, NC 28402

cc: CMV-05-023
Dr. W. Travers, Region II
R. Lukes, HQ Washington, DC

Attachment 1

Suggested wording for NRC CoC 4986.

Suggested wording to be used in Condition 5(b)(1)

Add duplicate statement as new Condition (iv), and change last sentence to read,

“...in accordance with Section 5.1 and Table 5.1 contained in Appendix 8-J(a) of the application dated 4/18/05.”

Re-order remaining (iv) and (v) to be (v) and (vi)

Suggested wording to be used in Condition 5(c)

Add at the end of the existing listing a new contents description/CSI as follows:

"For contents described in 5(b)(1)(iv) 0.8"

NOTE: CSI assignment for previous contents (iv) and (v) will need to be changed according to above re-ordering.

Attachment 2

The Affidavit requesting the information identified as proprietary within this application be withheld from the public. The original affidavit will be mailed under a separate cover.

Affidavit

I, **Charles M. Vaughan**, state as follows:

- (1) I am Manager, Facility Licensing, 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 an attachment to the letter, “Response to Request for Additional Information” “GNF-A’s Response to the NRC’s 3/15/05 RAI for the Model RA-3 Package – TAC No. L23695,” dated April 18, 2005. GNF-A proprietary information is indicated by enclosing it in double brackets. 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 and commercial or financial information obtained from a person and privileged or confidential” (Exemption 4). The material for which exemption from disclosure is here sought is all “confidential commercial information,” and some portions 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 cost or price information, production capacities, budget levels, or commercial strategies of GNF-A, its customers, or its suppliers;
 - d. Information which reveals aspects of past, present, or future GNF-A customer-funded development plans and programs, of potential commercial value to GNF-A;
 - e. 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 18th day of April 2005

Original Signed by Charles M. Vaughan

***Original Signed Affidavit Mailed Under a
Separate Cover***

Charles M. Vaughan,
Manager, Facility Licensing
Global Nuclear Fuel – Americas, LLC

Attachment 3

GNF-A's response to the NRC's request for additional information.

Response To NRC RAI For Model No. RA-3

Reference: Certificate Of Compliance No. 4986 For The Model No. RA-3 Package – Request For Additional Information, JR Cuadrado (USNRC, Spent Fuel Project Office, Office of NMSS) To CM Vaughan (GNF-A, Manager, Facility Licensing), Docket No. 71-4986, TAC No. L23695, March 15, 2005.

Introduction

The following discussion serves to answer remaining criticality safety concerns expressed in the referenced RAI dealing with authorization of a new GNF2 10x10 lattice design payload in the RA-3 nuclear package.

NRC RAI 6-1

6-1 Justify the assumed fuel assembly positioning within the RA-3 basket cells for the analysis of the damaged package array case.

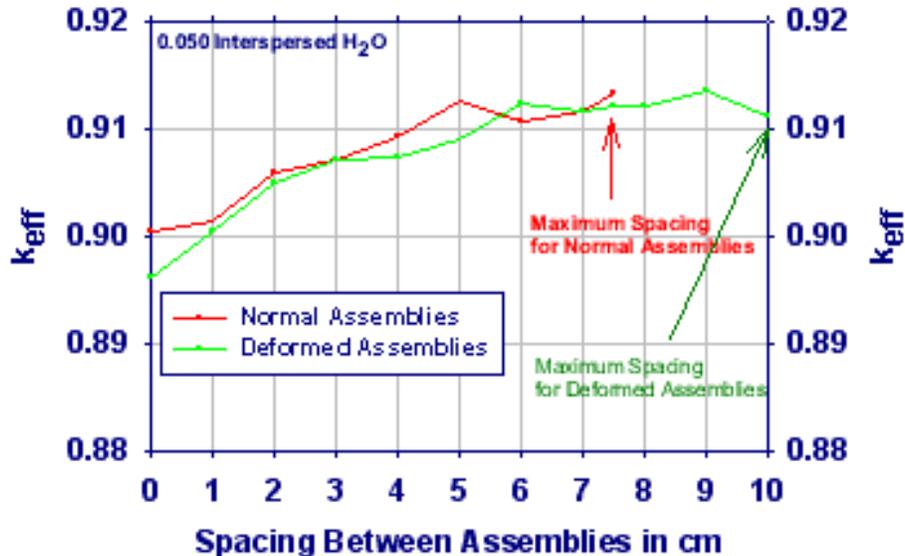
In the current analysis, the fuel assemblies are nearly centered vertically and horizontally in the individual RA-3 basket cells. No analysis was performed to determine the most reactive positioning of the assemblies within the basket. It is noted that in a previous amendment, some analysis of assembly positioning had been performed; however, it did not include modeling the assemblies placed at the maximum horizontal separation from each other (within the basket). Staff calculations indicate that the positioning used in the current analysis is not the most reactive the damaged array case. Justification for the assumed assembly positioning in the current analysis should include an analysis of various assembly positions, including maximum horizontal separation, to demonstrate the most reactive positioning of the assemblies has been identified. A discussion of any other bases for selecting the assembly should also be included.

This information is needed to confirm compliance with 10CFR71.59.

GNF-A Response: 6-1 – Effect of Horizontal Assembly Spacing

The damaged package array has been revised to include an independent assessment of the maximum spacing of the fuel assemblies within the basket region of the RA-3 inner container. This work is premised on prior work for a similar RA-series container (RA-3D) analysis, that demonstrates the maximum reactivity occurs when the fuel assemblies are physically spaced farthest apart - as shown in Figure 10(a) below.

**Figure 10(a). Rectangular Deformation Spacing Effects [10x10 Assembly]
 k_{eff} vs Assembly Spacing - 360 Unit Array**



As noted on page 5 footnote of the prior RA-3 application, the RA-3D is nearly identical to the RA-3 container; however, the RA-3D container differs in that the inner container material is fabricated out of stainless steel 321 rather than carbon steel. Dimensionally, the neutronic models used in criticality safety demonstrations are equivalent. The absolute magnitude of the delta-k reactivity effect of the fuel assembly spacing would be expected to be different for the carbon steel inner used in the RA-3 nuclear package, but the overall reactivity trend the same.

The above forms the basis for the maximum horizontal spacing study contained in the revised RA-3 submittal. The analysis for GNF2 fuel has been revised to incorporate this new study and demonstrates that indeed, the most limiting damaged package array occurs for this configuration. In fact, since the prior GNF2 safety demonstration was very near the established USL = 0.933, the limiting damaged package array size was required to be adjusted to $2N = 9 \times 15 \times 1 = 135$ unit close-packed array. [The previous $2N = 10 \times 16 \times 1 = 160$ unit array size slightly exceeded the established USL, by one-tenth of one percent delta-k or 0.001]. The associated CSI for the RA-3 containing GNF2 fuel is revised to reflect this limiting condition damaged package array size.

NRC RAI 6-2

6-2 Specify whether or not the partial length rods in the fuel assembly may include any of the assembly's Gadolinia-Urania rods.

The applicant states that a fuel assembly may have partial length rods. The applicant's analysis assumes all the partial rods to be fuel rods that don't contain Gadolinia. However, it is not clear from the application where the partial length rods may or may not include any Gadolinia-Urania rods. If Gadolinia-Urania rods may be included in an assembly's partial length rods, the criticality analysis should account for the effect on k-effective.

This information is needed to determine compliance with 10 CFR 71.55(e), 71.59.

GNF-A Response: 6-2 – Gd₂O₃ Loading in Part Length Rods

Current GNF design basis documents do not stipulate gadolinia loading permitted in any part length rods (PLRs) for GNF2 fuel designs. However, the option to include Gd₂O₃ in PLRs may be required in future designs. This RA-3 safety demonstration for GNF2 fuel will not be affected, provided no credit is taken for the gadolinia content in the PLRs.

The existing lattice average enrichment gad loading requirements shall be required, independent of the gadolinia content contained in the PLRs, i.e., any Gd₂O₃ loading in a PLR could not be used to show compliance with the specified minimum gad rod loading requirements for that lattice average enrichment band.

The fuel assembly requirements Table 5.1, "Enrichment and Gad Rod Requirements for GNF2 Fuel Assemblies" is modified in the revised analysis accordingly.

Attachment 4

Explanation of Changes made to the previous Criticality Analysis.

Explanation of Changes made to the previous Criticality Analysis
 (Reference eDRF No. 0000-0024-2885, rev. 02)

Page / Section Changed	Description of Change	Explanation of Change
1	Revision 02 title	Revision 02 changes
Page 2 / Table of Contents (TOC)	Added Section 2.5.1	Corrected typo error.
Page 2 / TOC	Added Section 3.6.1	Added model description for assembly horizontal spacing study in response to RAI.
Page 2 / TOC	Added Section 4.6	Corrected typo error.
Page 2 / TOC	Added Section 4.4.1	Added section to part length rods results to address gad loading per in response to RAI.
Page 2 / TOC	Renamed Section 4.5	Renamed to clarify this results section deals with centered assembly orientations.
Page 2 / TOC	Added Section 4.6	Added section to assembly orientation results section to include maximum assembly spacing in response to RAI.
Page 2 / TOC	Renamed Section 5	Renamed section to acknowledge CSI determination to conclusion section.
Page 3 / Section 1, 1.2	Update reference no.'s	Align with references.
Page 4 / Section 1.2	Bullet description	Acknowledge new limiting array size $2N=135$.
Page 8 / Section 2.3	Include second cpu	Include second verified workstation used for calc's
Page 8 / Section 2.4	Update reference no.	Align with references.
Page 8 / Section 2.5.1	Rename header	Correct error.
Page 13 / Section 3.3	Revise first para.	Acknowledge assembly (bundle) spacing reactivity studies.
Page 14 / Section 3.3	Include Table 3.3-1 and title.	Corrected typo error.
Page 18 / Section 3.4	Renumber Figure 3.3-4	Corrected typo error.
Page 19 / Section 3.4	Renumber Figure 3.5-1 and cross ref.	Corrected typo error.
Page 20 / Section 3.4	Renumber Figure 3.5-2	Corrected typo error.
Page 21 / Section 3.4	Renumber Figure 3.5-3 and cross ref.	Corrected typo error.
Page 22 / Section 3.4	Renumber Figure 3.5-4	Corrected typo error.
Page 23 / Section 3.6	First para. - acknowledge initial $2N = 160$ unit array, include Table 3.6-1 title.	Acknowledge initial 'centered' assembly model treatment within basket cavity.
Page 24 / Section 3.6	Renumber Figure 3.6-1, 3.6-2	Corrected typo error.
Page 25 / Section 3.6.1	Add section to include assembly	Assess reactivity effect of

	horizontal spacing model construct description, filename convention	assembly spacing on damage package array sizes 2N=160, 2N=135.
Page 25 / Section 3.6.1	Add Figure 3.6-3	Include 2D close up image of max. spacing model
Page 26 / Section 3.6.1	Add Figure 3.6-4	Include 2D image of max. spacing model
Page 38 / Section 4.3	Add case cross ref.	Clarification.
Page 39 / Section 4.3	Acknowledge initial damaged array tabulation.	Clarification.
Page 41 / Section 4.4	Re-title table 4.4-1	Clarification
Page 42 / Section 4.4	Re-title table 4.4-2	Clarification
Page 43 / Section 4.4.1	Add section to include part-length rod gad loading	Acknowledge gad loading requirement for PLRs per RAI.
Page 43 / Section 4.5	Add "Assembly" orientation to Figure 4.5-1	Clarification
Page 44 / Section 4.6	Add description to include horizontal spacing results.	Describe calculational results of max. horizontal spacing per RAI.
Page 45 / Section 4.6	Add Figure 4.6-1 and discussion relating to horizontal spacing results .	Describe calculational results of max. horizontal spacing per RAI.
Page 46 / Section 4.6	Add Table 4.6-1 tabulated results.	Describe calculational results of max. horizontal spacing per RAI.
Page 47 / Section 4.6	Add convergence Figure 4.6-2 for most reactive case.	Describe calculational results of max. horizontal spacing per RAI.
Page 48 / Section 4.6	Add results summary per ULS equation	Demonstrate most reactive case remains < USL for modified 2N=135 damaged package array.
Page 48 / Section 5	Modify CSI discussion to align with limiting 2N=135 damaged package array size.	Summarize CSI for RA-3 package for GNF2 payload.
Page 50 / Section 5.1	Modify / correct Table 5.1.	Correct lattice average enrichment bands; include gadolinia requirement for part- length rods.
Page 50 / Section 6	Add new references 10,11	Acknowledge new references used in response to RAI.
Pages 67-70 / Section 8.1.5	Add new sample GEMER input.	Provide sample input for most reactive damaged package array using max. horizontal spacing, 2N=135 unit array.