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Project 717

MFN 03-094
September 12, 2003

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20852-2738

Attention: Chief, Information Management Branch
Program Management
Policy Development and Analysis Staff

Subject: **Response to Request for Additional Information (RAI) numbers (7, 8, 106 and 177) for ESBWR Pre-application Review.**

GE Nuclear Energy is submitting, in enclosures 1 and 2, Response to NRC RAI numbers (106, 177), and supplemental information to the response of NRC RAI numbers (7&8). The original RAIs were included in the referenced letters. In addition as part of enclosure 1, GE is providing a proprietary electronic analysis file on CD titled "EOC_Nodal_Power.xls" to assist the NRC in confirming the results in the response to RAIs 7 & 8. A non-proprietary version of this file is not available.

Enclosure 1 contains the responses with GE proprietary information as defined by 10CFR2.790. GE customarily maintains this information in confidence and withholds it from public disclosure. Enclosure 1 also includes RAI responses, which contain no proprietary information in order to form a complete package. A non-proprietary version of the responses to the NRC's requests are 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 GE. GE hereby requests that the information of Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790 and 9.17.

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

D068

Sincerely,

Atambir S. Rao

Reference:

1. MFN 03-049, Letter From Amy E. Cubbage (NRC) To Atam S. Rao (GE), May 16, 2003, SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 1 RELATED TO ESBWR PRE-APPLICATION REVIEW (TAC NO. MB6801)
2. MFN 03-052, Letter From Amy E. Cubbage (NRC) To Atam S. Rao (GE), June 20, 2003, SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 4 RELATED TO ESBWR PRE-APPLICATION REVIEW (TAC NOS. MB6283 AND MB6801)
3. MFN 03-053, Letter From Amy E. Cubbage (NRC) To Atam S. Rao (GE), July 17, 2003, SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 5 RELATED TO ESBWR PRE-APPLICATION REVIEW (TAC NOS. MB6279, MB6281, AND MB7255)

Enclosures:

1. MFN 03-094 Response to NRC RAI numbers (106, 177), and supplemental information to the response of NRC RAI numbers (7&8) - Proprietary Information
2. MFN 03-094 Response to NRC RAI numbers (106, 177), and supplemental information to the response of NRC RAI numbers (7&8) - Non-proprietary Information
3. Affidavit, David J. Robare, dated September 12, 2003

cc:	A. Cubbage	USNRC (with enclosure)
	J. Lyons	USNRC (w/o enclosure)
	G.B. Stramback	GE (with enclosure)

General Electric Company

AFFIDAVIT

I, David J. Robare, state as follows:

(1) I am Technical Projects Manager, Technical Services, General Electric Company ("GE") 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 the Enclosure 1 of GE letter MFN 03-094, Atambir S. Rao to NRC, *Response to Request for Additional Information (RAI) numbers (7, 8, 106 and 177) for ESBWR Pre-application Review,* dated September 12, 2003. The proprietary information is in Enclosure 1 and on CD, *Response to NRC RAI numbers (106,and 177), and supplemental information to the response of NRC RAI numbers (7&8) And Analysis Files.* For text and text contained in tables, GE proprietary information is identified by a double underline inside double square 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. The electronic analysis files on the Enclosure 1 CD are entirely proprietary.

(3) In making this application for withholding of proprietary information of which it is the owner, GE 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 2.790(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 General Electric's competitors without license from General Electric 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 General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

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 2.790 (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 GE, 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 GE, 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. Access to such documents within GE 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 GE 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 details for licensing application of TRACG to the ESBWR passive safety system design of the BWR. This TRACG code has been developed by GE for over fifteen years, at a total cost in excess of three million dollars. The reporting, evaluation and interpretations of the results, as they relate to the ESBWR, was achieved at a significant cost, to GE.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE'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 GE.

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.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE 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 GE 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 GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing 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 12TH day of SEPTEMBER 2003.

David J. Robare
General Electric Company

ENCLOSURE 2

MFN 03-094

Response to NRC RAI numbers (106,and 177), and supplemental information to the response of NRC RAI numbers (7&8)

R7&8. Supplementary Information for RAIs 7 & 8

Appendix E

F-Lattice Control Rod Data

F-Lattice Control Rod Position

The distance a control rod is *inserted* into a BWR core is:

$$D = HCR - CRS * (NOTCH / NNOTCH)$$

where NOTCH is the control rod notch position (in notches withdrawn), HCR is the height of a fully inserted rod, CRS is the control rod stroke and NNOTCH is the number of notches in a full stroke. [[ ]]

NNOTCH = [[ ]]

HCR = [[ ]]

CRS = [[ ]]

F-Lattice Control Rod Design Parameters (Marathon Design)

The following table identifies the differences between the F-Lattice control blade and the original equipment N-Lattice (see reference figure on page D2). The following figure (next page) identifies the further manufacturing details of the F-Lattice Marathon design.

[[

Features	Ref	
Control Blade Dimensions:		Millimeters
Tie Rod Span:	J	41.12
Wing Length:	K	274
Wing Thickness:	L	7.92
Number of Absorber Tubes / Wing:	NT	32
Number of B4C Poison Tubes (per wing)		29
Number of Hf Poison Tubes (per wing at tip)		3
Atom Fraction of B10		19.8%
Diameter of B4C Poison Material		6.0
Outside Diameter of B4C Capsule Body		6.15
Wall Thickness of Capsule Body		0.076
Diameter of Hafnium Material		5.46
Absorber Tube Inside Diameter:	ID	6.35
Absorber Tube Outside Diameter:	OD	7.57
Absorber Tube Wall Thickness:	W	0.61
Fuel Cell Dimensions:		Millimeters
One Half of Wide Gap:	Q	7.9
One Half of Narrow Gap:	R	7.9

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The data and calculations provided are preliminary pending detail design.

4 Hypothetical ESBWR Core Design

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The data and calculations provided are preliminary pending detail design.

5 Hypothetical ESBWR Core Design

Q106. Section 3.6.1.2 (p. 3-70) - For the TRACG qualification calculations, the first rod in the ATLAS test bundle to undergo burnout was known a priori from the test result. For the LOCA analysis of an ESBWR how will the first rod to burnout be identified? How is the flow distribution to the 'hot rod' channel and the other lumped channels determined?

R106. The rod with the [[ ]] is the first rod to enter boiling transition, because that is how the [[ ]] for the rods in the bundle is calculated. [[

]] Subchannel effects are not considered in the TRACG analysis – an assumption that has been validated over many years of experience. TRACG represents the core with a combination of individual high power fuel channels and groups of fuel channels lumped together with averaged characteristics. The flow distributions to these channels are solved for with the constraint of a common pressure drop from the lower to upper plenum.

Q177. Comparison of non-dimensional parameters (similar to one presented for SBWR and CRIEPI in Table A.4-1 of NEDC-33079P), or dimension-less groups (PI-Groups) should be derived based on scaling analysis, and their numerical values should be compared for ESBWR with the test facilities in order to provide assurance that the test facility represents the ESBWR design. As indicated in Table 6.1 of NEDC-33079P, GE qualified TRACG code for its application to anticipated transient without scram (ATWS) and Stability events in ESBWR against the following facilities: 1/6 Scale Boron Mixing Test, CRIEPI and Dodewaard. GE, however, did not present comparisons of representative parameters for ESBWR design and the above facilities in the submittals. The staff, therefore, requests GE to submit scaling analyses for the above mentioned test facilities, and provide comparisons of dimension-less parameters as discussed above, between ESBWR and the test facilities in order for GE to qualify TRACG code for its application to ATWS and stability events in ESBWR against the test facilities.

R177 Rev 1.

Comparisons of relevant dimensionless parameters between the 1/6 Scale Boron Mixing Test, CRIEPI and Dodewaard and the ESBWR are provided below.

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[[$\frac{\partial C}{\partial t} + \nabla(CV) = S$]]

[[

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[[$V_{settling} = 0\vec{i} + K\sqrt{\frac{\Delta\rho g L}{\rho_l V_0^2}}\vec{j} + 0\vec{k}$]]

[[$CV_{diffusion} = -D_m \nabla C$]]

[[

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[[$\frac{\partial C}{\partial t} + \nabla(C(j + V_{settling})) = D_m \nabla^2 C + S$]]

[[ ]]

[[$\frac{\partial C^*}{\partial t^*} + \nabla^*(C^*(\frac{j}{V_0} + \frac{V_{settling}}{V_0})) = \frac{D_m}{V_0 L}\nabla^{*2}C^* + \frac{SL}{C_0 V_0}$]]

[[

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[[$\nabla^* = \frac{1}{L}\nabla$]]

[[

]] [[$\frac{\Delta\rho g L}{\rho_l V_0^2}$]]

[[

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[[$\rho_l V_0^2 = \frac{1}{K}(\rho_l - \rho_{core})gL$]]

[[

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[[$K\frac{(\rho_{Borated} - \rho_l)}{(\rho_l - \rho_{core})}$]]

It can be concluded that the 1/6th scale mixing tests are reasonable for evaluating the mixing in the ESBWR bypass regions because the density difference between the borated solution and water, the core average void fraction and the leakage loss coefficients are adequately matched. Numerical values for the parameters in the ESBWR and the 1/6 th Scale Boron Mixing Test are provided in the table below.

Comparison of Parameters for ESBWR and 1/6th Scale Boron Mixing Test

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CRIEPI Tests

The CRIEPI tests are natural circulation and stability tests, dominated by flashing instability at low pressure.

The relevant parameters that characterize these phenomena are shown in the table below.

Comparison of Non-Dimensional Parameters Between ESBWR and CRIEPI

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Dodewaard Data

The Dodewaard data have been used to qualify steady state natural circulation performance. The main parameters of interest are the geometrical configuration, flow rate and core and chimney void fractions. [[

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Comparison of Dodewaard and ESBWR Geometry and Steady-State Parameters

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