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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 07-166

Docket No. 52-010

March 21, 2007

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. 82 Related to ESBWR Design Certification Application – DCD Chapter 4 – RAI Numbers 4.9-2, 4.9-5 through 4.9-11**

Enclosure 1 contains proprietary information as defined in 10CFR2.390. 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 proprietary information in Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17. A non proprietary version is contained in Enclosure 2.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

James C Kinsey

James C. Kinsey
Project Manager, ESBWR Licensing

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Reference:

1. MFN 06-515, Letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 82 Related to ESBWR Design Certification Application,* December 7, 2006

Enclosures:

1. MFN 07-166 – MFN 07-166 - Response to Portion of NRC Request for Additional Information Letter No. 82 Related to ESBWR Design Certification Application – DCD Chapter 4 – RAI Numbers 4.9-2, 4.9-5 through 4.9-11 – GE Proprietary Information
2. MFN 07-166 – MFN 07-166 - Response to Portion of NRC Request for Additional Information Letter No. 82 Related to ESBWR Design Certification Application – DCD Chapter 4 – RAI Numbers 4.9-2, 4.9-5 through 4.9-11 – Non Proprietary Version
3. Affidavit – David H. Hinds – dated March 21, 2007 – GE Proprietary Information

cc:

AE Cubbage	USNRC (with enclosures)
GB Stramback	GE/San Jose (with enclosures)
BE Brown	GE/Wilmington (with enclosures)
eDRF	0063-5777

Enclosure 2

MFN 07-166

Response to Portion of NRC Request for Additional Information Letter No. 82 Related to ESBWR Design Certification Application

DCD Chapter 4

RAI Numbers 4.9-2, 4.9-5 through 4.9-11

Public Version

Non-Proprietary Notice

IMPORTANT NOTICE

This is a non-proprietary version of the Enclosure 1 of MFN 07-166, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[ ]].

NRC RAI 4.9-2:

Section 2 of NEDE-33243P states, "depletion fractions are converted to EOL fluence to facilitate plant monitoring".

a) Please discuss the methods and accuracy of monitoring control blade fluence over several cycles.

b) Please discuss any surveillance, control blade worth measurements, and inspections programs to validate blade lifetime predictions.

GE Response:

a) The nodal depletions for each control rod are tracked by the core monitoring computer. As part of a destructive evaluation of a DuraLife type control rod, the nodal depletions taken from the monitoring computer were compared to measured values from the control rod being examined. The two sets of depletions were found to be in good agreement.

b) GE letter to NRC, MFN 07-138 dated February 23, 2007; "Marathon Control Rod Assembly Surveillance Program Status", contains a summary of the surveillance inspection experience for the Marathon control rods for BWR/2-6. This in-progress surveillance program is performed to validate the lifetime predictions for Marathon control rods.

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-5:

Section 4.7.4 of NEDE-33244P refers to empirically-based B4C swelling and helium release fractions. Please provide the source of this experimental data.

GE Response:

B_4C Swelling: A total of [[ ]] test capsules were irradiated in a test reactor and later examined in a hot cell. Measurements of the boron carbide diameter indicated an average diametric swelling of [[ ]].

Helium Release Fractions: [[

]].

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-6:

Table 2.1 of NEDE-33244P summarizes the stress analyses. Please justify the lack of cold stress analyses for certain loads (e.g., internal pressure, seismic combination, etc.).

GE Response:

Results are shown in Table 2.1 of NEDE-33244 for operating temperature only in cases where either: (1) the applied loads only occur during operation; or (2) when it can be demonstrated that the operating temperature case is limiting over the room temperature case.

Specifically, the internal swelling calculation is only performed at operating temperature, [[

]]. The external (RPV) pressure calculation is only performed at operating conditions since the RPV pressure is higher, and the strength of the material is less at operating temperature than at room temperature. The thermal analysis is performed only at operating temperature, since this analysis will produce higher boron carbide centerline temperatures, [[ ]], and thermal stresses. The internal pressure analysis is only performed at operating temperature because this was demonstrated to be the limiting case. The combined loading analysis on the absorber tube including seismic, channel bow, and internal pressure is also only performed at operating temperature because this was determined to be the limiting case.

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-7:

Section 13.2 of NEDE-33244P describes the internal pressure analysis performed on the absorber tube.

a) Please justify the ultimate strain used in the analysis.

b) Please discuss the impact of (1) irradiated material properties and (2) the cited irradiated assisted stress corrosion cracking strain limit on the analysis.

c) Results from burst testing are briefly mentioned. Please discuss in further detail these burst test results and their applicability to the ESBWR Marathon design.

GE Response:

a) The ultimate strain used to develop the true stress-strain curve for the absorber tube material is based on test results of absorber tube lots at elevated temperature (550°F). Therefore, since this ultimate strain is consistent with material test results, the stress-strain curve used in the analysis is justified.

b) The pressurization capability of the square absorber tube is evaluated using finite element analysis. [[

]]

(1) Beginning of life un-irradiated material properties are conservative since the true ultimate strength increases with irradiation.

(2) [[

]]

c) [[

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Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-8:

Section 1 of NEDE-33244P briefly describes the physical design of the ESBWR Marathon control blade. According to Section 1, the [[

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a) *Please discuss the [[*

]]

b) *Please discuss the impact of [[*

]].

c) *Please discuss the capabilities to detect [[*

]].

GE Response:

a) [[

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b) [[

]]

c) GE does not currently have a process to detect [[

]].

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-9:

Section 2 of NEDE-33244P states that the [[

]]. Please discuss how EOL predictions for the current Marathon design compared with in-reactor service (e.g., premature blade failures, reduced blade worth). As part of this response, please discuss the results of the surveillance program on the current generation Marathon control blade (part of NRC SE, 1991).

GE Response:

GE letter to NRC, MFN 07-138 dated February 23, 2007, "Marathon Control Rod Assembly Surveillance Program Status", contains a summary of the inspection history of the Marathon control rod, including the status of the surveillance program. As noted in the letter, while there have been isolated instances of crack indications, GE has not recommended a reduced lifetime for the Marathon control rod. GE is continuing to pursue visual inspections, and is performing a destructive evaluation of a control rod, to further evaluate the end of life predictions for the Marathon control rod.

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-10:

Table 2.1 of NEDE-33244P summarizes the various loadings and stress analysis results. Stress corrosion cracking (SCC) in the control blade components and relaxation of residual weld stresses are more difficult to model and/or predict compared with the loads identified in Table 2.1.

a) Please discuss in more detail in-reactor experience of the current Marathon control blades with respect to SCC and relaxation of weld stresses.

b) Please discuss the sensitivity of SCC to plant operating chemistry.

c) Please discuss any surveillance programs (e.g., pool-side PIEs) aimed at detecting SCCs and weld relaxation.

d) Please discuss the capabilities available to detect control blade failure (e.g., B4C leakage) and blade distortion during operation.

e) Please discuss the results of the surveillance program on the current generation Marathon control blade (part of NRC SE, 1991).

GE Response:

a) A summary of the inspection experience of the Marathon control rod in BWR/2-6 is contained in GE letter to NRC MFN 07-138 dated February 23, 2007; "Marathon Control Rod Assembly Surveillance Program Status". [[

]]

b) In addition to a susceptible material and a sustained tensile stress, an aggressive environment is a necessary factor to produce stress corrosion cracking (SCC). Specifically, chloride and sulfate levels, and conductivity of the reactor coolant are known to be factors in the occurrence of SCC. In order to reduce the likelihood of stress corrosion cracking, GE recommends that plants maintain these levels within the EPRI Water Chemistry Guidelines.

c) The GE letter to NRC, MFN 07-138 dated February 23, 2007; "Marathon Control Rod Assembly Surveillance Program Status", contains a summary of GE's Marathon control rod inspection experience. [[

]]

d) [[

]]

After many control rod visual inspections (see GE letter to NRC MFN 07-138 dated February 23, 2007; "Marathon Control Rod Assembly Surveillance Program Status"), GE has not observed distortion issues with the Marathon control rod. If distortion were to occur, the

result would be control rod/fuel channel interference. The detection of this interference would be the same as if caused by fuel channel distortion.

e) GE letter to NRC, MFN 07-138; "Marathon Control Rod Assembly Surveillance Program Status", contains a summary of the Marathon control rod surveillance program, which is still in progress.

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

NRC RAI 4.9-11:

Section 2 of NEDE-33244P states, "All control rod components are found to be acceptable in accordance with Reference 2 [ESBWR DCD Tier 2 Section 4C] criteria when analyzed due to internal and external loads". Please clearly disposition each of the design criteria GE plans to include in the ESBWR DCD.

GE Response:

The following licensing acceptance criteria from the ESBWR Tier 2 Design Control Document (DCD) Appendix 4C are evaluated.

The control rod stresses, strains, and cumulative fatigue shall be evaluated to not exceed the ultimate stress or strain limit of the material.

As summarized in Table 2.1 of NEDE-33244P, all load cases are evaluated to not exceed the ultimate stress or strain limit of the material, structure, or welded connection. Also, the fatigue usage factor is evaluated in Section 15 of NEDE-33244P, and found to be less than 1.0.

The control rod shall be evaluated to be capable of insertion into the core during all modes of plant operation within the limits assumed in the plant analyses.

The ESBWR Marathon control rod is designed to withstand maximum stresses and strains experienced during control rod insertion including scram. Sections 7 and 9 of the mechanical design report (NEDE-33244P) demonstrate the mechanical acceptability of the control rod under scram insertion and stuck control rod compression loads. In section 14 of the mechanical design report, combined scram and lateral bending due to channel bow is analyzed. All of these analyses demonstrate the structural acceptability of the ESBWR Marathon control rod.

The ability of the ESBWR Marathon control rod to insert into the core within acceptable scram times is discussed in section 4.2.4.2 of the ESBWR Tier 2 DCD. The worst-case scenario for a control rod scram within scram time requirements is a scram during a seismic event. As discussed in the ESBWR Tier 2 DCD, the ABWR Marathon control rod was tested during scram with simulated seismic fuel channel oscillation. This ABWR Marathon control rod inserted within scram time requirements, and suffered no detrimental damage. As noted in the ESBWR Tier 2 DCD, the ESBWR Marathon control rod seismic scram conditions are bounded by the ABWR test.

The material of the control rod shall be shown to be compatible with the reactor environment.

No new materials are introduced for the ESBWR Marathon control rod that have not been used in control rods in operating BWR/2-6 plants. The ESBWR Marathon control rod is designed to be crevice-free, and uses materials resistant to corrosion and stress corrosion cracking. For example, the absorber tubes are made from the same high purity, stabilized type 304S stainless steel as BWR/2-6 Marathon control rods. This material was developed by GE to be resistant to stress corrosion cracking.

The reactivity worth of the control rod shall be included in the plant core analyses.

The control rod described in NEDE-33243P and NEDE-33244P is the original equipment for the ESBWR. The reactivity worth of the control rod is evaluated in NEDE-33243P.

Affected Documents:

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

No changes to the subject LTR will be made in response to this RAI.

ENCLOSURE 3

MFN 07-166

AFFIDAVIT

General Electric Company

AFFIDAVIT

I, David H. Hinds, state as follows:

(1) I am Manager, New Projects Engineering, 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 Enclosure 1 of GE letter MFN 07-166, James C. Kinsey to NRC, *Partial Response to Portion of NRC Request for Additional Information Letter No. 82 Related to ESBWR Design Certification Application – DCD Chapter 4 – RAI Numbers 4.9-2, 4.9-5 through 4.9-11* dated March 21, 2007. The proprietary information in Enclosure 1, *Partial Response to Portion of NRC Request for Additional Information Letter No. 82 Related to ESBWR Design Certification Application – DCD Chapter 4 – RAI Numbers 4.9-2, 4.9-5 through 4.9-11, – Contains GE Proprietary Information* is delineated 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.

(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 2.390 (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 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 contains the results of control rod blade design, methods and processes, including computer codes, which GE has developed, and applied to design control rod blades for the ESBWR. GE has developed control rod blade designs utilizing industry experience and GE expertise for over twenty years, at a total cost in excess of millions of dollars. The reporting, evaluation and interpretations of the results, as they relate to control rod blade design for the ESBWR was achieved at a significant cost, in excess of millions of dollars, to GE.

The development of the testing and 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 21st day of March 2007.

David H. Hinds
General Electric Company