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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 06-307

Docket No. 52-010

September 1, 2006

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

Subject: **Response to NRC Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application – Seismic and Dynamic Qualification of Equipment - RAI Numbers 3.10-1 through 3.10-6**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter. This completes GE's response to RAI Letter No. 46.

Enclosure 1 contains GE proprietary information as defined by 10 CFR 2.390. GE customarily maintains this information in confidence and withholds it from public disclosure.

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 2.390 and 9.17. A non proprietary version is contained in Enclosure 2.

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

D068

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

Enclosures:

1. MFN 06-307 - Response to NRC Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application – Seismic and Dynamic Qualification of Equipment - RAI Numbers 3.10-1 through 3.10-6 – GE Proprietary Information
2. MFN 06-307 - Response to NRC Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application – Seismic and Dynamic Qualification of Equipment - RAI Numbers 3.10-1 through 3.10-6 – Non Proprietary Version
3. Affidavit – George B. Stramback – dated September 1, 2006

Reference:

1. MFN 06-269, Letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application,* August 1, 2006

cc:

WD Beckner	USNRC (w/o enclosures)
AE Cubbage	USNRC (with enclosures)
LA Dudes	USNRC (w/o enclosures)
GB Stramback	GE/San Jose (with enclosures)
eDRF	0000- 0057-4610

ENCLOSURE 2

MFN 06-307

Response to NRC Request for

Additional Information Letter No. 46

Related to ESBWR Design Certification Application

Seismic and Dynamic Qualification of Equipment

RAI Numbers 3.10-1 through 3.10-6

Non Proprietary Version

NRC RAI_3.10-1

Explain the absence of compliance to meet the requirements in Appendix S to 10 CFR Part 50 in Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," of ESBWR DCD/Tier 2.

GE Response

ESBWR design will meet the 10CFR 50 Appendix S.

The DCD Subsection 3.10 (1) will be revised as noted in the attached markup.

NRC RAI _3.10-2

For seismic and dynamic qualification of mechanical and electric equipment in ESBWR, the Design Control Document (DCD)/Tier 2 listed the following three versions of IEEE-344 Standards as the guidelines to be followed: (1) IEEE-344-2004, (2) Regulatory Guide (RG) 1.100, Revision 2, 1988, which endorses the IEEE-344-1987 with some conditions, and (3) Section 4.4 of GE Environmental Qualification Program, NEDE-24326-1-P, January 1983, which used IEEE-344-1975 as its guidelines. Specifically state which parts (chapters or sections) of each version of IEEE-344 guidelines that ESBWR DCD/Tier 2 will meet. Note that IEEE-344-2004 has not been endorsed by RG 1.100 (will be done in the near future) and the staff does not endorse Section 10 (Experience) of IEEE-344-2004 in its entirety.

GE Response

ESBWR will meet the IEEE-344-1987 Standard.

The DCD Table 1.9-22 will be revised as noted in the attached markup.

NRC RAI 3.10-3

Subsection 4.4.3, Operating Experience, of Section 4.4 of GE report, NEDE-24326-1-P (dated January 1983), provides a definition of "operating experience" for environmental qualification of equipment. The 1987 version and 2004 version of IEEE-344 Standards also provide guidelines for "Qualification by Experience," including both earthquake experience data and test experience data. In the application, you made a commitment to meet the requirements of IEEE-344. Clarify, in sufficient detail, whether the database documents described in NEDE-24326-1-P are consistent with and satisfy the requirements in the IEEE-344 Standards. Discuss the level of documentation currently available for the cited experience database for seismic and dynamic qualification of mechanical and electrical equipment. Also, discuss whether such documentation is sufficiently complete for staff audit/review.

GE Response

GE does not utilize "operating experience" for equipment qualification. Furthermore, GE does not maintain any database for operating experience.

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

NRC RAI_3.10-4

In Section 3.10.2.4 (Qualification by Experience) of the ESBWR DCD/Tier 2, the application states that the methods outlined in IEEE-344 are followed. Clarify which version of IEEE-344 you commit to follow. As indicated in RAI 3.10-2 above, some aspects of the criteria provided in Section 10 (Experience) of IEEE-344-2004 are not acceptable to the NRC staff. For examples, the staff does not agree with: (1) the use of median centered spectra to define the required response spectra for a candidate equipment, (ii) inadequate provisions for meeting the operating basis earthquake (OBE) requirements, (iii) the use of "mean" of test response spectra to define the test experience spectra (TES), (iv) inadequate provisions for meeting OBE TES requirements, and (v) inadequate provisions for the demonstration of operability during and after the safe shutdown earthquake loads and Service Level D reactor building vibration dynamic loads. Having noted some unacceptable criteria provided in IEEE-344-2004 as described above, (1) discuss, in detail, the criteria and procedures for seismic and dynamic qualification of electric equipment by experience for ESBWR, including the experience database and all pertinent references for the experience database; (2) state whether you intend to commit to particular industry Standard guidelines for seismic qualification of ESBWR mechanical equipment by experience, and discuss the experience database and all pertinent references for the experience database; and (3) state at what stage the specific detailed experience database documents will be available for staff audit/review.

GE Response

GE does not utilize operating experience for equipment qualification. Furthermore, GE does not maintain a database for operating experience.

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

NRC RAI _3.10-5

In Section 3.10.4 (Combined Operation License Information) of the ESBWR DCD/Tier 2, the application states that the qualification records including reports for equipment included in Subsection 3.10.2.1 and 3.10. 2.2 shall be maintained in a permanent file and shall be readily available for audit. However, the application did not address the qualification records for equipment included in Subsections 3.10.2.3 and 3.10.2.4, or their availability for audit. Please discuss the availability of qualification records and reports for equipment included in Subsections 3.10.2.3 and 3.10.2.4, for the purpose of staff review/audit.

GE Response

The DCD Subsections 3.10.2.3 and 3.10.2.4 will be revised to include "Qualification Documentation" and "Documentation of Qualification' as noted in the attached markup.

The DCD Subsection 3.10.4 will also be revised to include sections 3.10.2.3 and 3.10.2.4 as noted in the attached markup.

NRC RAI _3.10-6

In Subsection 4.4.2.5.1, General Requirements for Dynamic Testing, of Section 4.4 of GE Report NEDE-24326-1-P (dated January 1983), Item (d) stated that [[

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Clarify (1) the applicability of the above statement with respect to ESBWR, and provide the basis for those numbers used and (2) the last sentence of item (d) which stated that [[

]].

GE Response

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

3.10 SEISMIC AND DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

This section addresses methods of test and analysis employed to ensure the operability of mechanical and electrical equipment (includes instrumentation and control) under the full range of normal and accident loadings (including seismic), to ensure conformance with the requirements of General Design Criteria (GDC) 1, 2, 4, 14 and 30 of Appendix A to 10 CFR 50, as well as Appendix B to 10 CFR Part 50 and Appendix A to 10 CFR 100, as discussed in SRP 3.10 Draft Revision 3 (Reference 3.10-1). Mechanical and electrical equipment are designed to withstand the effects of earthquakes, i.e., seismic Category I requirements, and other accident-related loadings. Mechanical and electrical equipment covered by this section include equipment associated with systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment. Also covered by this section is equipment (1) that performs the above functions automatically, (2) that is used by the operators to perform these functions manually, and (3) whose failure can prevent the satisfactory accomplishment of one or more of the above safety functions. Instrumentation that is needed to assess plant and environ conditions during and after an accident, as described in Regulatory Guide 1.97, are also covered by this section. Examples of mechanical equipment included in these systems are pumps, valves, fans, valve operators, snubbers, battery and instrument racks, control consoles, cabinets, and panels. Examples of electrical equipment are valve operator motors, solenoid valves, pressure switches, level transmitters, electrical penetrations, and pump and fan motors.

The methods of test and analysis employed to ensure the operability of mechanical and electrical equipment meet the relevant requirements of the following regulations:

(1) Code Federal Regulations (CFR):

a. 10 CFR 50 "General Design Criteria (GDC) for Nuclear Power Plants Appendix A (Criteria 1, 2, 4, 14 and 30)."

b. 10 CFR 50 "Quality Assurance Criteria for Nuclear Power Plants Appendix B and Fuel Reprocessing Plants."

c. 10 CFR 100 Appendix A "Seismic and Geological Siting Criteria for Nuclear Power Plants."

d. 10 CFR 50 Appendix S "Earthquake Engineering Criteria for Nuclear Power Plants

(2) Institute of Electrical and Electronic Engineers (IEEE):

a. IEEE-323 "Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

b. IEEE-382 "Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety Related Functions for Nuclear Power Plants."

c. IEEE-344 "Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations."

If the equipment is not rigid, the effects of the changes are analyzed. The test results combined with the analysis allow the model of the similar equipment to be adjusted to produce a revised stiffness matrix and to allow refinement of the analysis for the modal frequencies of the similar equipment. The result is a verified analytical model that is used to qualify the similar equipment.

Extrapolation of Dynamic Loading Conditions.

Test results can be extrapolated for dynamic loading conditions in excess of or different from previous tests on a piece of equipment when the test results are in sufficient detail to allow an adequate dynamic model of the equipment to be generated. The model provides the capability of predicting failure under the increased or different dynamic load excitation.

Qualification Documentation

The demonstration of qualification is documented (see Subsection 3.10.4) including the requirements of the equipment specification, the results of the qualification and the justification that the methods used are capable of demonstrating that the equipment does not malfunction.

If qualification is by analysis and testing or by extrapolation from similar equipment, the report includes:

- Reference to the specific method of combined analysis and testing used;
- Description of equipment involved;
- Analysis data;
- Test data;
- Justification of results.

When extrapolation of data is made from similar equipment, a description of the differences between the equipment items involved is required. Justification that the differences do not degrade the seismic adequacy below acceptable limits and any additional supporting data shall be included.

3.10.2.4 Qualification by Experience

The discussion presented in the following subsections apply to the qualification of equipment by experience. The methods outlined in IEEE 344 are followed.

Experience Data

When existing test data or experience data is available, the equipment database is reviewed to determine if the previous testing or experience meets or exceeds the new requirements of the equipment qualification. Depending on the source and level of documentation detail available, an appropriate approach is taken and documentation prepared to justify the qualification for the new requirements.

Qualification Determination

In order for the equipment to be qualified by reason of operating experience, documented data must be available confirming that the following criteria have been met as appropriate:

- The equipment providing the operating experience is identical or justifiably similar to the equipment to be qualified.
- The equipment providing the operating experience has operated under service conditions that equal or exceed, in severity, the service conditions and functional requirements for which the equipment is to be qualified.
- The installed equipment can, in general, be removed from service and subjected to partial type testing to include the dynamic environments for which the equipment is to be qualified.

Documentation of Qualification

The demonstration of qualification is documented (see Subsection 3.10.4) including the data-base equipment with its supports and interface conditions, its safety-function requirements and the experience response spectra. The report normally includes but is not limited to the following:

- Analysis reports, test-data records and logs of measurements;
- Contemporaneous operating logs and the results of reviews, inspections or interviews recorded sufficiently soon after an experience event to provide a valid data source to demonstrate that the equipment performed its safety function during and after the experienced event prior to any repairs or adjustments.

3.10.3 Analysis or Testing of Electrical Equipment Supports

The following subsections describe the general methods and procedures, as incorporated in the dynamic qualification program (see Subsection 3.10.1.3), for analysis and testing of supports of Seismic Category I electrical equipment. When possible, the supports of most of the electrical equipment (other than motor and valve-mounted equipment supports, mostly control panels and racks) are tested with the equipment installed. Otherwise, a dummy is employed to simulate inertial mass effect and dynamic coupling to the support.

Combined stresses of the mechanically designed component supports are maintained within the limits of ASME Code Section III, Division 1, Subsection NF, up to the interface with building structure, and the combined stresses of the structurally designed component supports defined as building structure in the project design specifications are maintained within the limits of the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

3.10.3.1 NSSS Electrical Equipment Supports (Other than Motors and Valve-Mounted Equipment)

The seismic and other RBV dynamic load qualification tests on equipment supports are performed over the frequency range of interest.

Some of the supports are qualified by analysis only. Analysis is used for passive mechanical devices and is sometimes used in combination with testing for larger assemblies containing Seismic Category I devices. For instance, a test is run to determine if there are natural frequencies in the support equipment within the critical frequency range. If the support is determined to be free of natural frequencies (in the critical frequency range), then it is assumed to be rigid and a static analysis is performed. If natural frequencies are present in the critical frequency range, then calculations of transmissibility and responses to varying input

for static load, span length, and response to excitation at the natural frequency. Restraint against excessive lateral and longitudinal movement uses the structural capacity of the tray to determine the spacing of the fixed support points. Provisions for differential motion between buildings are made by breaks in the trays and flexible connections in the conduit.

The following loadings are used in the design and analysis of Seismic Category I cable tray and conduit supports.

- Loads
- Dead loads and live loads 112 kg/m (75 lbm/linear-ft) load used for 0.46-m (18-inch) and wider trays 75 kg/m (50 lbm/linear-ft) load used for 0.31-m (12-inch) and narrower trays.
- Dynamic loads - SSE loads plus appropriate RBV dynamic loads.
- Dynamic Analysis
- Regardless of cable tray function, all supports are designed to meet Seismic Category I requirements. Seismic and appropriate RBV dynamic loads are determined by dynamic analysis using appropriate response spectra.
- Floor Response Spectra — Floor response spectra used are those generated for the supporting floor. In case supports are attached to the walls or to two different locations, the upper bound envelope spectra are used. In many cases, to facilitate the design, several floor response spectra are combined by an upper bound envelope.

Local Instrument Supports

For field-mounted Seismic Category I instruments, the following is applicable:

- The mounting structures for the instruments have a fundamental frequency above the excitation frequency of the RRS.
- The stress level in the mounting structure does not exceed the material allowable stress when the mounting structure is subjected to the maximum acceleration level for its location.

Instrument Tubing Support

The following bases are used in the seismic and appropriate RBV dynamic loads design and analysis of Seismic Category I instrument tubing supports:

- The supports are qualified by the response spectrum method;
- Dynamic load restraint measures and analysis for the supports are based on combined limiting values for static load, span length, and computed dynamic response; and
- The Seismic Category I instrument tubing systems are supported so that the allowable stresses permitted by Section III of ASME Boiler and Pressure Vessel Code are not exceeded when the tubing is subjected to the loads specified in Subsection 3.9.2 for Class 2 and 3 piping.

3.10.4 Combined Operating License Information

Equipment Qualification Records

COL holders shall maintain the equipment qualification records including the reports (see Subsections 3.10.2.1, 3.10.2.2, 3.10.2.3 and 3.10.2.4) in a permanent file readily available for audit.

Dynamic Qualification Report

COL holders shall prepare a Dynamic Qualification Report (DQR) identifying all Seismic Category I electrical equipment and their supports. The DQR shall contain the following:

- A table or file for each system that is identified in Table 3.2-1 to be safety-related or having Seismic Category I equipment, shall be included in the DQR containing the MPL item number and name, the qualification method, the input motion, the supporting structure of the equipment, and the corresponding qualification summary table or vendor's qualification report.
- The mode of safety-related operation (i.e., active, manual active or passive) of the equipment along with the manufacturer identification and model numbers shall also be tabulated in the DQR. The operational mode identifies the instrumentation, device, or equipment
  - That performs the safety-related functions automatically,
  - That is used by the operators to perform the safety-related functions manually, or
  - Whose failure can prevent the satisfactory accomplishment of one or more safety-related functions.

3.10.5 References

3.10-1 USNRC, SRP 3.10 Draft 3 (04/1996), "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment."

3.10-2 General Electric Co., "General Electric Environmental Qualification Program," NEDE-24326-1-P, Proprietary Document, January 1983.

3.10-3 USNRC, NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment."

ENCLOSURE 3

MFN 06-307

Affidavit

General Electric Company

AFFIDAVIT

I, George B. Stramback, state as follows:

(1) I am Manager, Regulatory 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 Enclosure 1 of GE letter MFN 06-307, David H. Hinds to USNRC, *Response to NRC Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application – Seismic and Dynamic Qualification of Equipment - RAI Numbers 3.10-1 through 3.10-6,* dated September 1, 2006. The proprietary information in Enclosure 1, *Response to NRC Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application – Seismic and Dynamic Qualification of Equipment - RAI Numbers 3.10-1 through 3.10-6,* 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 SRV dynamic qualification testing performed by GE over a period of more than ten years at a cost of over one million dollars. This information, 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.

(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 1st day of September 2006

George B. Stramback
General Electric Company