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Supplement 3

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Subject: **Response to Portion of NRC Request for Additional Information
Letter No. 46 Related to ESBWR Design Certification Application –
Seismic and Dynamic Qualification of Equipment – RAI Number
3.10-5 S02**

Enclosure 1 contains GEH's response to the subject NRC RAI transmitted via e-mail on May 10, 2007. GEH's previous responses were provided in the Reference 1 and 2 letters.

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

Sincerely,



James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

References:

1. MFN 06-307, Letter from David Hinds to U.S. Nuclear Regulatory Commission, *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*, September 1, 2006
2. MFN 06-307, Supplement 1, Letter from James C. Kinsey to U.S. Nuclear Regulatory Commission, *Response to Portion of 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 S01 through 3.10-5 S01*, March 26, 2007

Enclosure:

1. MFN 06-307, Supplement 3 – Response to Portion of NRC Request for Additional Information Letter No. 46 Related to ESBWR Design Certification Application – Seismic and Dynamic Qualification of Equipment – RAI Number 3.10-5 S02

cc: AE Cabbage USNRC (with enclosures)
DH Hinds GEH (with enclosures)
RE Brown GEH (w/o enclosures)
eDRF 0000-0069-8831/1

Enclosure 1

MFN 06-307

Supplement 3

Response to Portion of NRC Request for

Additional Information Letter No. 46

Related to ESBWR Design Certification Application

Seismic and Dynamic Qualification of Equipment

RAI Number 3.10-5 S02

For historical purposes, the original text and GE responses to RAIs 3.10-5 and 3.10-5 S01 are included.

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 3.10-5 S01

The response states that GE does not use 'operating experience' for equipment qualifications. What does GE mean by 'operating experience'; does it include both earthquake and test experience? If you don't maintain any operating experience database, why was 'operating experience' left in DCD Section 3.10.2.4? If operating experience isn't used, why isn't DCD Section 3.10.2.4 deleted? If using test experience as a method for qualification, please respond to RAI's 3.10-3, -4 and -5 from that perspective including the last three items in RAI 3.10-4.

E-mail from Larry Rossbach: NRC can not approve the design certification with open-ended answers. If "Qualification by Experience" is an option in the DCD, provide responses to RAIs 3.10-3, 4, and 5 in detail so that the staff can make a determination whether GE's approach is acceptable or not.

GE Response

Please see response to RAI 3.10-3 S01.

DCD Impact

As described in response to RAI 3.10-3 S01.

NRC RAI 3.10-5 S02

RAI 3.10-5 S02 Comment on response to RAI 3.10-5 S01:

In response to RAI 3.10-5, GE stated that the DCD Subsection 3.10.4 will be revised to include subsection 3.10.2.3 for Equipment Qualification Records. However, it is not implemented in DCD, Tier 2, Revision 3. GE is requested to revise the DCD Subsection 3.10.4.

Furthermore, in DCD Subsection 3.10.4 of ESBWR DCD, Tier 2, Revision 2 and Revision 3, GE stated that COL holders shall prepare a Dynamic Qualification Report and shall maintain the equipment records including the reports in a permanent file readily available for audit. The COL holders should be revised to the COL applicant, and the COL information should be available for staff review/audit before the issuance of the COL.

GEH Response

The commitment to make available records of equipment qualification for staff audit is covered under DCD Tier 1. In Tier1, Equipment Qualification is included in the scope of the system Basic Configuration. Each system has an ITAAC requirement to validate the Basic Configuration which includes making the equipment qualification records available. As a result, the requirement to maintain records available for audit will be removed from Subsection 3.10.4

DCD Tier 2, Subsection 3.10.4, is being revised to require the COL applicant to describe the requirements of the Dynamic Qualification Report (DQR) as shown in the attached markup. Specific requirements for the DQR are contained in Subsection 3.10.1.4. The results of this qualification will not be available at the time of COL application, so this information cannot be made available prior to issuance of the COL.

DCD Impact

DCD Tier 2, Section 3.10.1.4 and 3.10.4 will be revised as noted in the attached markup.

3.10.1 Seismic and Dynamic Qualification Criteria

3.10.1.1 Selection of Qualification Method

The qualification of Seismic Category I mechanical and electrical equipment is accomplished by test, analysis, or a combination of testing and analysis. Qualification by actual seismic experience, as permitted by IEEE 344-1987 is not utilized.

In general, analysis is used to supplement test data although simple components may lend themselves to dynamic analysis in lieu of full scale testing. The deciding factors for choosing between tests or analysis include:

- Magnitude and frequency of seismic and RBV dynamic loadings;
- Environmental conditions (Appendix 3H) associated with the dynamic loadings;
- Nature of the safety-related function(s);
- Size and complexity of the equipment;
- Dynamic characteristics of expected failure modes (structural or functional); and
- Partial test data upon which to base the analysis.

The selection of qualification method to be used is largely a matter of engineering judgment; however, tests, and/or analyses of assemblies are preferable to tests or analyses on separate components (e.g., a motor and a pump, including the coupling and other appurtenances should be tested or analyzed as an assembly).

3.10.1.2 Input Motion

The input motion for the qualification of equipment and supports is defined by response spectra. The Required Response Spectra (RRS) are generated from the building dynamic analysis, as described in Section 3.7. They are grouped by buildings and by elevations. This RRS definition incorporates the contribution of RBV dynamic loads as specified by the load combinations in Table 3.9-2 and 3.9-3. When one type of equipment is located at several elevations and/or in several buildings, the governing response spectra are specified.

3.10.1.3 Dynamic Qualification Program

The dynamic qualification program is described in Section 4.4 of GE's Environmental Qualification Program (Reference 3.10-2). The program conforms to the requirements of IEEE 323 as modified and endorsed by the Regulatory Guide 1.89, and meets the criteria contained in IEEE 344 as modified and endorsed by Regulatory Guide 1.100.

3.10.1.4 Dynamic Qualification Report

The Dynamic Qualification Report (DQR) identifies all Seismic Category I electrical and mechanical equipment and their supports. The DQR contains 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 Material Parts List (MPL) item number and name, the qualification method, the input

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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.

3.10.2 Methods and Procedures for Qualifying Mechanical and Electrical Equipment

The following subsections describe the methods and procedures incorporated in the above mentioned dynamic qualification program. Described here are the general methods and procedures for qualifying by testing, analysis, or combined testing and analysis, the Seismic Category I mechanical and electrical equipment for operability during and after the SSE loads and Service Level D RBV dynamic loads and for continued structural and functional integrity of the equipment after low level earthquake loading of lesser magnitude (Section 3.7) and Service Level B RBV dynamic loads.

3.10.2.1 Qualification by Testing

The testing methodology includes the hardware interface requirements and the test methods.

Interface Requirements

Intervening structures or components (such as interconnecting cables, bus ducts, conduits, etc.) that serve as interfaces between the equipment to be qualified and that supplied by others are not qualified as part of this program. However, the effects of interfacing are taken into consideration. When applicable, accelerations and frequency content at locations of interfaces with interconnecting cables, bus ducts, conduits, etc., are determined and documented in the test report. This information is specified in the form of interface criteria.

To minimize the effects of interfaces on the equipment, standard configurations using bottom cable entry are utilized whenever possible. Where non-rigid interfaces are located at the equipment support top, equipment qualification is based on the top entry requirements. A report including equipment support outline drawings is furnished specifying the equipment maximum displacement due to the SSE loads including appropriate RBV dynamic loads. Embedment loads and mounting requirements for the equipment supports are also specified in this manner.

Test Methods

The test method is biaxial, random single- and/or multi-frequency excitation to envelop generic RRS levels in accordance with Section 7 of IEEE 344. Past testing demonstrate that Seismic Category I electrical equipment has critical damping ratios equal to or less than 5%. Hence, RRS at 5% or less critical damping ratio are developed as input to the equipment base.

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.

See Subsection 3.10.1.4 for additional information on the documentation of qualification results.

3.10.4 Combined Operating License Information

3.10-1-A Dynamic Qualification Report

The COL applicant will provide a milestone for completing the Dynamic Qualification Report (DQR) per Subsection 3.10.1.4.

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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.