



**HITACHI**

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MFN 08-356

Docket No. 52-010

April 11, 2008


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. 148 Related to ESBWR Design Certification Application - Design of Structures, Components, Equipment, and Systems - RAI Number 3.10-8**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to a portion of the U.S. Nuclear Regulatory Commission Request for Additional Information (RAI) sent by NRC Letter No. 148, dated February 19, 2008 (Reference 1). The GEH response to RAI Number 3.10-8 is addressed in Enclosure 1.

Should you have any questions about the information provided here, please contact me.

Sincerely,

  
James C. Kinsey  
Vice President, ESBWR Licensing

D068  
NRO

Reference:

1. MFN 08-158, Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 148, Related To ESBWR Design Certification Application*, dated February 19, 2008

Enclosure:

1. Response to Portion of *NRC Request for Additional Information Letter No. 148 Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Number 3.10-8*

cc: AE Cabbage      USNRC (with enclosure)  
RE Brown      GEH/Wilmington (with enclosure)  
DH Hinds      GEH/Wilmington (with enclosure)  
GB Stramback      GEH/San Jose (with enclosure)  
eDRF      0000-0082-5313

**Enclosure 1**

**MFN 08-356**

**Response to Portion of NRC Request for**

**Additional Information Letter No. 148**

**Related to ESBWR Design Certification Application**

**Design of Structures, Components, Equipment, and Systems**

**RAI Number 3.10-8**

**NRC RAI 3.10-8**

*NRC Summary:*

*Address seismic qualification of mechanical and electrical equipment for plant sites with high frequency seismic excitations.*

*NRC Full Text:*

*Recent ground motion studies for some hard rock sites indicated that the resulting seismic inputs to SSCs contain high-frequency excitations. For the seismic qualification of mechanical and electrical equipment, some safety-related active components in nuclear power plants have been qualified by IEEE 344-type tests with intentional high-frequency contents to account for concurrent boiling-water reactor hydrodynamic loads. However, the vast majority of the existing seismic test data available in the industry are those tested with input frequencies up to 33 hertz (Hz), although the test response spectra may have shown the zero period acceleration (ZPA) of up to 100 Hz.*

*The inadvertent high-frequency contents shown in the ZPA, because of ball-joints and kinematic linkages of shake tables, present in the seismic qualification of equipment by IEEE-344-type tests for the past 30 years are the noise signals that may not have the proper frequency contents with sufficient energy to be compatible with the amplified region of the required response spectra (RRS) at high frequencies. In order for existing qualification test data to be valid for resolving high-frequency concerns, the adequacy of the frequency content and the stationarity of the frequency content of the synthesized waveform used for the tests have to be demonstrated. The frequency content of the Fourier transform of the test waveform or the frequency content of the power spectral density of the test waveform must be compatible with the amplified portion of the RRS. Guidelines on frequency content and stationarity appear in Annex B to IEEE 344-2004.*

*In view of these concerns, please address the adequacy of the seismic qualification of ESBWR mechanical and electrical equipment for plant sites with high-frequency seismic excitations.*

**GEH Response**

DCD Tier #2, Rev 4; Section 3.7.1.1 Design Ground Motion states "The ESBWR standard plant SSE design ground motion is rich in both low and high frequencies. The low-frequency ground motion follows Regulatory Guide 1.60 ground spectra anchored to 0.3 g. The high-frequency ground motion matches the North Anna ESP site-specific spectra as representative of most severe rock sites in the Eastern US."

The following sections discuss ESBWR seismic requirements:

- Section 3.7.1.1.1 Low-Frequency Ground Motion
- Section 3.7.1.1.2 High-Frequency Ground Motion
- Section 3.7.1.1.3 Single Envelope Ground Motion

The seismic design response spectra of the Single Envelope Ground Motion, also termed Certified Seismic Design Response Spectra (CSDRS), containing both Low-Frequency Ground Motion and High-Frequency Ground Motion are utilized in generation of in-structure response spectra for use in seismic qualification of mechanical and electrical equipment.

ESBWR is a boiling water reactor and seismic qualification of mechanical and electrical equipment meets IEEE 344-1987, the RRS includes intentional high-frequency contents to account for concurrent boiling-water reactor hydrodynamic loads for the affected systems and equipment.

Section 3.7.3 Seismic Subsystem Analysis discusses qualification to codes and IEEE-344 for piping and equipment.

Section 3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment discusses ESBWR electrical and mechanical equipment qualification to IEEE 344-1987. The adequacy of the seismic qualification of ESBWR mechanical and electrical equipment for plant sites with high-frequency seismic excitation follows Annex B to IEEE 344-1987 guidelines on frequency content and stationarity to demonstrate that the frequency content of the Fourier transform of the test waveform or the frequency content of the power spectral density of the test waveform is compatible with the amplified portion of the RRS. Note "Annex B Frequency Content and Stationarity" is essentially the same in IEEE 344-1987 and IEEE 344-2004.

ESBWR SSE RRS include intentional high-frequency contents for hard rock sites, additional high frequency content for applicable hydrodynamic loads, and demonstrates frequency content and stationarity. Therefore, seismic qualification of ESBWR mechanical and electrical equipment is adequate for plant sites with high-frequency seismic excitations.

### **DCD Impact**

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