HITACHI

GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

PO Box 780
3901 Castle Hayne Road, M/C A-55
Wilmington, NC 28402 USA

T 910 819 6192
F 910 362 6192

MFN 08-929

Docket No. 52-010

December 4, 2008

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Document Control Desk
Rockville, MD 20852

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 194 Related to ESBWR Design Certification Application - RAI Number 19.2-92**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI originally transmitted via the Reference 1 letter.

Please call me if you have any questions concerning this submittal.

Sincerely,

Lee F. Loughlin for

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-477, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 194 Related To ESBWR Design Certification Application*, dated May 13, 2008

Enclosure:

1. MFN 08-929, Partial Response to NRC RAI Letter No. 194 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Number 19.2-92

CC:

AE Cubbage	USNRC (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
eDRF Section	0000-0089-5271 R1

ENCLOSURE 1

MFN 08-929

Partial Response to NRC RAI Letter No. 194

Related to ESBWR Design Certification Application

Probabilistic Risk Assessment

RAI Number 19.2-92

NRC RAI 19.2-92

DCD Tier 2, Rev 4, Section 19.2.3.2.4 states that "The COL Holder referencing the ESBWR certified design shall compare the as-built SSC HCLPFs to those assumed in the ESBWR seismic margin analysis shown in Table 19.2-4. Deviation from the HCLPF values or other assumptions in the seismic margins evaluation shall be analyzed to determine if new vulnerabilities have been introduced." This statement can be interpreted as allowing COL Holder to analyze the as-built SSC HCLPFs with respect to the site ground motion response spectral input (GMRS). Without a clearly delineated process to verify all SSC in Table 19.2-4 to possess HCLPF capacity equal to 1.67 times the ESBWR CSDRS, the staff can not conclude that the ESBWR certified design has met SECY-93-087 seismic margin expectation.

The staff seismic margin requirement arose from the Commission's SRM (Staff Requirements Memorandum) to SECY 93-087, Section II.N and is quoted here for clarification:

"The Commission approves the following staff recommendation, as modified:

PRA insights will be used to support a margins-type assessment of seismic events. A PRA-based seismic margins analysis will consider sequence-level High Confidence, Low Probability of Failures (HCLPFs) and fragilities for all sequences leading to core damage or containment failures up to approximately one and two-thirds the ground motion acceleration of the Design Basis SSE."

It is clear that the spectra required by SRM are the design basis spectra, which for the certified designs, are the CSDRS.

*To address this issue, the staff requests that: (a) GEH states that the seismic margin earthquake (SME) for the PRA-based seismic margin assessment for ESBWR is the ESBWR CSDRS; (b) Note 1 to Table 19.2-4 be modified as "A minimum HCLPF value of 1.67*SSE, where SSE is the ESBWR CSDRS as provided in DCD Tier 1, rev. 4, Figures 5.1-1 and 5.1-2;" (c) In addition, verification of as-built design features is more appropriate as an ITAAC rather than a COL Holder item. The staff requested that ITAAC be provided for HCLPFs in previous RAIs, i.e., 19.2-43 and 19.5-4. Please provide an ITAAC for this verification.*

GEH Response

(a) DCD Tier 2 Subsection 19.2.3.2.4 will be revised stating that the seismic margin earthquake (SME) for the PRA-based seismic margin assessment for ESBWR is the ESBWR CSDRS.

(b) The first part of Note 1 to DCD Tier 2 Table 19.2-4 will be modified to read "A minimum HCLPF value of 1.67*SSE will be met for the structures and equipment shown. The SSE is the ESBWR Certified Seismic Design Response Spectrum as provided in DCD Tier 1, Figures 5.1-1 and 5.1-2".

(c) Existing ITAAC items for various SSCs already ensure that the plant has adequate seismic margin beyond the design basis SSE due to the various conservatism introduced in the normal design process. In addition, the COL holder is more appropriate for seismic margin

related items, since the as-built plant specific seismic related risk assessment would address inspection and testing aspects.

DCD/NEDO-33201 Impact

DCD Tier 2 Subsection 19.2.3.2.4 and Table 19.2-4 will be revised in DCD Revision 6 as noted in the attached markups.

NEDO-33201 Section 15 will be revised in Revision 4 to reflect the results of the seismic margin earthquake for the PRA-based seismic margin assessment based on the ESBWR CSDRS. Any DCD changes that result from the changes to NEDO-33201 Section 15 will be incorporated in DCD Revision 6.

ESBWR to calculate high confidence low probability of failure (HCLPF) accelerations for important accident sequences and accident classes. The seismic margin earthquake (SME) for the PRA-based seismic margin assessment for ESBWR is the ESBWR CSDRS. The ESBWR seismic margins HCLPF accident sequence analysis concludes that the ESBWR is inherently capable of safe shutdown in response to beyond design basis earthquakes and has a plant level HCLPF of at least 1.67 times the peak ground acceleration of a safe shutdown earthquake (SSE), where SSE is the ESBWR CSDRS, in compliance with SECY 93-087 requirement *"PRA insights will be used to support a margins-type assessment of seismic events. A PRA-based seismic margins analysis will consider sequence-level High Confidence, Low Probability of Failures (HCLPFs) and fragilities for all sequences leading to core damage or containment failures up to approximately one and two-thirds the ground motion acceleration of the Design Basis SSE."*

Table 19.2-4 contains the systems evaluated in the ESBWR and contains minimum HCLPF ratio for these systems.

Significant Core Damage Sequences of External Event Seismic

A PRA-based Seismic Margins Analysis is used to derive seismic vulnerability insights. The COL Holder referencing the ESBWR certified design shall compare the as-built SSC HCLPFs to those assumed in the ESBWR seismic margin analysis shown in Table 19.2-4. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation shall be analyzed to determine if any new vulnerabilities have been introduced. (COL 19.2.6-1-H) Therefore, there are no CDF calculations performed. The Seismic Margins Analysis concludes that the most significant HCLPF sequences are seismic-induced loss of DC power and seismic-induced ATWS due to seismic-induced failure of the fuel channels and seismic-induced failure of the SLC tank.

Based on previous industry seismic analyses, seismic risk is dominated by seismic-induced SSC failures, and not by random SSC failures or human actions. Human actions are typically not necessary until the long-term.

Significant Large Release Sequences of External Event Seismic

A PRA-based Seismic Margins Analysis is used to derive seismic vulnerability insights. Therefore, there are no LRF calculations performed.

Significant Offsite Consequences of External Event Seismic

A PRA-based Seismic Margins Analysis is used to derive seismic vulnerability insights. Therefore, there are no off-site consequences calculations performed. Due to the bounding method that is used to calculate the seismic margin, it is considered to be unnecessary to extrapolate offsite consequences.

Summary of Important Results and Insights of External Event Seismic

The ESBWR seismic margins HCLPF accident sequence analysis highlights the following results regarding the seismic capability of the ESBWR:

- The ESBWR is inherently capable of safe shutdown in response to strong magnitude earthquakes; and
- The most significant HCLPF sequences are seismic-induced loss of DC power and seismic-induced ATWS due to seismic-induced failure of the fuel channels and seismic-induced failure of the SLC tank.

Table 19.2-4
ESBWR Systems and Structures in Seismic Margins Analysis with Plant Level HCLPF not less than 1.67*SSE[1]

PLANT STRUCTURES

- Reactor Building
- Containment
- RPV Pedestal
- Control Building
- ~~Reactor Pressure Vessel~~ Support Brackets
- Firewater Service Complex

DC POWER

- Batteries
- Cable trays
- Motor control centers

REACTIVITY CONTROL SYSTEM

- Fuel assembly
- CRD Guide tubes
- Shroud support
- CRD Housing
- Hydraulic control unit

SRV

- SRV

STANDBY LIQUID CONTROL

- Accumulator Tank
- Check valve
- Squib valve
- Piping
- Valve (motor operated)

Table 19.2-4
ESBWR Systems and Structures in Seismic Margins Analysis with Plant Level HCLPF not less than 1.67*SSE[1]

ISOLATION CONDENSER
- Piping
- Heat exchanger
- Valve (motor operated)
- Valve (nitrogen operated)

DPV
- DPV

GRAVITY-DRIVEN COOLING
- Check valve
- Squib valve
- Piping

VACUUM BREAKERS
- Vacuum breaker valve

PASSIVE CONTAINMENT COOLING
- Heat Exchanger
- Piping

IC/PCCS POOL INTERCONNECTION
- Valve (motor operated)

FIRE PROTECTION WATER SYSTEM
- Pump (diesel driven)
- Tank
- Piping
- ~~Piping~~

Note: 1. A minimum HCLPF value of 1.67*SSE will be met for the structures and equipment shown. SSE is the ~~0.5g peak ground acceleration (PGA) of the~~ ESBWR Certified Seismic Design Response Spectrum (CSDRS) as provided in DCD Tier 1, Figures 5.1-1 and 5.1-2. Where applicable, differential building displacement is part of piping failure modes evaluation.