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MFN 08-515

Docket No. 52-010

June 17, 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. 16 Related to ESBWR Design Certification Application – RAI Number 3.12-17 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC (Amy Cubbage) by e-mail dated May 20, 2007 (Reference 1). GEH response to RAI Number 3.12-17 S01 is addressed in Enclosure 1.

The original RAI 3.12-17 was received from the NRC on March 30, 2006 (Reference 2), and the GEH response was transmitted to the NRC on May 3, 2006 (Reference 3).

If you have any questions or require additional information, please contact me.

Sincerely,

Charles W. Beyrodt
for

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

References:

1. Email from NRC (Amy Cubbage), dated May 20, 2007

2. MFN 06-103, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, *Request for Additional Information Letter No. 16 Related to the ESBWR Design Certification Application,* dated March 30, 2006

3. MFN 06-119, *Response to NRC Request for Additional Information Letter No. 16 Related to ESBWR Design Certification Application – Piping Design – RAI Numbers 3.12-1 through 3.12-37,* dated May 3, 2006

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 16 Related to ESBWR Design Certification Application – Piping Design RAI Number 3.12-17 S01

cc:	AE Cubbage	USNRC (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	eDRF	0000-0077-9033

Enclosure 1

MFN 08-515

Response to Portion of NRC Request for Additional Information Letter No. 16 Related to ESBWR Design Certification Application Piping Design RAI Number 3.12-17 S01

For historical purposes, the original text of RAI 3.12-17 and the GE response is included. The responses do not include any attachments or DCD mark-ups.

NRC RAI 3.12-17

Note 3 to DCD Tier 2, Table 3.9-2 indicates that the method used in the combination of dynamic responses of piping loadings is in accordance with NUREG-0484, Revision 1. Table 3.9-9 specifies a number of load combinations that specify an SRSS load combination. Describe how the NUREG-0484 criteria were satisfied for the Service Level D load combinations.

GE Response

The technical approach is a linear elastic analysis for Level D. According to that established criteria in Section 5 of NUREG-0484, SRSS combination specified in Table 3.9-9 is suitable for earthquake combinations with LOCA.

NRC RAI 3.12-17 S01

Justification for the use of SRSS in load combination tables for all load cases should be demonstrated by showing that the non-exceedance probability (NEP) of 84 percent or higher is satisfied as required in NUREG-0484.

GEH Response

References:

(1) GE Nuclear Energy Document No. NEDE 24010-P, "The Technical Bases for the Use of the Square Root of the Sum of Squares (SRSS) method for Combining Dynamic Loads for Mark II Plants", July 1977.

(2) GE Nuclear Energy Document No. NEDO 21061, Class 1 "Mark II Containment Dynamic Forcing Functions Information Report", Issued by General Electric Company and Sargent & Lundy Engineers, September 1975.

Technical Basis for GE BWR Mark II SRSS Load Combinations: The fundamental justification for the application of the SRSS methodology is based on probability theory. Before the Reference 1 study was completed by GE Nuclear Energy, the application of the SRSS methodology was qualitatively justified based on: (i) the unlikelihood of load events overlapping in time, (ii) the randomness of both the amplitude and the phasing of the responses, (iii) the rapid plus and minus variation and the very short duration of the peak responses. Due to these qualitative considerations, it was judged that the maximum peaks of the individual responses were very unlikely to coincide, i.e., to occur at the same instant in time.

The Reference 1 GE Nuclear Energy study was completed to justify the use of the SRSS rule for GE BWR Mark II nuclear power plant configurations. In the study, numerical computations were completed for a total of 291 cases of load combinations for actual Mark II systems, structures and components using the dynamic load combinations specified in the DFFR (Reference 2) for earthquake, LOCA and suppression pool hydrodynamic loadings. The justification is the quantified low probability of the peak dynamic responses occurring simultaneously even though the various components of the same event (e.g., seismic) or different events (e.g., seismic and SRV discharge) occur during the same time interval. In Reference 1, the technical basis for the use of the SRSS rule is quantified through the use of probability theory.

The results of the Reference 1 study are consistent with the requirements of NUREG-0484 and technically support the use of the SRSS rule for load combinations in GE BWR Mark II plants. This conclusion is based on the following factors:

(1) The calculation of the conditional probability level (based upon the condition that the events and the maximum calculated response occur) of not exceeding the SRSS load combination value, has a mean non-exceedance value of 86 percent.

(2) The very low probability of the simultaneous occurrence of the individual events that produce the dynamic load being combined.

(3) In comparing the SRSS with absolute sum rule for combining dynamic loads, the difference in calculated component reliability is very small. For the representative cases included in the Reference 1 report, the reliability value range for SRSS is 0.99999425 to 0.99999750 and for the absolute sum is 0.99999680 to 0.99999750.

Applicability to GEH ESBWR Nuclear Power Plant Equipment The corresponding safety related components from all GE BWR Nuclear Steam Supply System (NSSS) nuclear power plant configurations (i.e., Mark I, Marl II, Mark III, ABWR and ESBWR) are of similar design and construction and are fabricated from the same (or similar) materials to the same (or similar) fabrication and welding specifications. Consequently, the results of the Reference 1 study are applicable to each of the various GE BWR NSSS nuclear power plant configurations.

The ESBWR DCD load combination tables are consistent with the Reference 1 generic load combination tables. In Reference 1, the RPV and Internals, Piping and Piping Components are given in Table 3-1; the Containment and Internal Structures load combinations by Table 3-2; and the Steel Containment load combinations by Table 3-1. As indicated above, the NEP of all load combinations in these tables is 86%, or greater. Consequently, applying the SRSS methodology to GEH ESBWR NSSS structures and equipment for the SRSS load combination methodology satisfies the NUREG-0484 requirement of an 84% or higher NEP.

DCD Impact

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