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MFN 06-298
Supplement 6

Docket No. 52-010

August 21, 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. 176 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.8 – Seismic Category I Structures – RAI Number 3.8-9 S04

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 letter dated March 13, 2008 (Reference 1). Previous NRC requests and GEH responses were transmitted via references 2 through 7.

RAI Number 3.8-9 S04 is addressed in Enclosure 1.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 08-375, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, Request For Additional Information Letter No. 176 Related To ESBWR Design Certification Application, April 10, 2008

2. MFN 06-298, Supplement 5, Letter from James C. Kinsey, GEH, to U.S. Nuclear Regulatory Commission, Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application, Seismic Category I Structures, RAI Numbers 3.8-5 S03 and 3.8-9 S03, March 13, 2008

3. MFN 08-029, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, Request For Additional Information Letter No. 124 Related To ESBWR Design Certification Application, January 14, 2008

4. MFN 06-298, Supplement 3, Letter from James C. Kinsey, GEH, to U.S. Nuclear Regulatory Commission, Response to NRC Request for Additional Information Related to ESBWR Design Certification Application – Structural Analysis - RAI Numbers 3.8-5 S02 and 3.8-9 S02 – DCD Section 3.8 – Structural Analysis, August 13, 2007

5. MFN 06-298, Supplement 1, Letter from James C. Kinsey, GEH, to U.S. Nuclear Regulatory Commission, Response to Portion of NRC Request for Additional Information Letter No. 38 Related to ESBWR Design Certification Application – Structural Analysis - RAI Numbers 3.8-1 S01, 3.8-2 S01, 3.8-4 S01, 3.8-5 S01, 3.8-7 S01, 3.8-9 S01, 3.8- 10 S01, 3.8-12 S01, 3.8-15 S01, 3.8-29 S01, 3.8-30 S01, 3.8-31 S01, 3.8-42 S01, 3.8-52 S01, 3.8-53 S01, 3.8-54 S01, 3.8-58 S01, 3.8-60 S01, 3.8-61 S01, 3.8-67 S01, 3.8-70 S01, 3.8-71 S01, 3.8-72 S01, 3.8-74 S01 & 3.8-98 S01, January 29, 2007

6. MFN 06-298, Letter from David H. Hinds, GEH, to U.S. Nuclear Regulatory Commission, Response to Portion of NRC Request for Additional Information Letter No. 38 Related to ESBWR Design Certification Application – Structural Analysis - RAI Numbers 3.8-1, 3.8-2, 3.8-4, 3.8-5, 3.8-7 through 3.8-12, 3.8-15, 3.8-16, 3.8-21, 3.8-22 3.8-29 through 3.8-31, 3.8-39, 3.8-42, 3.8-43, 3.8-45, 3.8-50, 3.8-52through 3.8-55, 3.8-57, 3.8-58, 3.8-60, 3.8-61, 3.8-66 through 3.8-68, 3.8-70 through 3.8-72, 3.8-74, 3.8-75, 3.8-78, and 3.8-98, August 31, 2006

7. MFN 06-197, Letter from U.S. Nuclear Regulatory Commission to Mr. David H. Hinds, GEH, Request for Additional Information Letter No. 38 Related to ESBWR Design Certification Application, June 23, 2006

Enclosure:

1 Response to Portion of NRC Request for Additional Information Letter No. 176 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.8 – Seismic Category I Structures – RAI Number 3.8-9 S04

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF	0000-0087-6884 (RAI 3.9-200, -203, -204)

ENCLOSURE 1

MFN 06-298
Supplement 6

Response to Portion of NRC RAI Letter No. 176
Related to ESBWR Design Certification Application

DCD Tier 2 Section 3.8 – Seismic Category I Structures

RAI Number 3.8-9 S04

For historical purposes, the original text of RAI 3.8-9 and the GE responses are included. The attachments (if any) are not included from the original response to avoid confusion.

NRC RAI 3.8-9

Provide a description of the different subcategories for SRV discharge (e.g., single valve, two valve, automatic depressurization system (ADS), and all valves) and for LOCA (large, intermediate, and small) if applicable, and how they are treated in the load combinations described in DCD Section 3.8.1.3. Also, provide a description and the basis for the method used to combine all of the dynamic loads.

In addition, (1) identify the applicable detailed report/calculation (number, title, revision and date, and brief description of content) that will be available for audit by the staff, and (2) reference this report/calculation in the DCD.

GE Response

LOCA (large, intermediate, and small break) and SRV discharges (single valve first actuation, single valve subsequent actuation, and multiple valves) are discussed the in Containment Load Definition (CLD) - NEDE-33261P. The bounding pressure and temperature values are used respectively as accident pressure P_a and LOCA temperature T_a in load combinations for design. The bounding pressure values are used as SRV loads for design. The SRV pressure values for these three limiting conditions (single valve first actuation, single valve subsequent actuation, and multiple valves) are furnished in Table 6 of NEDE-33261P. The multiple valve case bounds ADS. The SRV pressure values for these three limiting conditions cover the different subcategories of SRV discharge (e.g., single valve, two valve, ADS, and all valves). The bounding values of these three limiting conditions are shown in DCD Figure 3B-1 and are considered as SRV loads in DCD Subsections 3.8.1.3 and in the load combination DCD Tables 3.8-2, 3.8-4 and 3.8-7. Depending on the distribution of SRV loads in the suppression pool, they are further classified as axisymmetrical loads, or non-axisymmetrical loads. The SRV pressure loads are applied throughout the entire suppression pool as axisymmetrical SRV (DCD Subsection 3.8.1.4.1.1.2), which represents all of the (or multiple) valve cases. The SRV pressure loads are applied on half of the entire suppression pool as non-axisymmetrical SRV (DCD Subsection 3.8.1.4.1.1.1), which represents the single valve or two-valve case. Because the total load for the axisymmetrical SRV load case is greater than those for the non-axisymmetrical cases, only the former is considered in the RCCV and vent wall design. The design evaluation of the affected structures for SRV loads is performed using equivalent static pressure input equal to a dynamic load factor (DLF) of 2 times the peak dynamic pressure (i.e., the bounding values). The resulting forces or stresses were combined with those due to other loads in the most conservative manner by systematically varying the signs associated with dynamic (including seismic) loads. (See also response to RAI 3.8-48).

The SRV pressure time history and other related information is presented in DCD Appendix 3B. The SRV forcing function as defined in DCD Appendix 3B and the CLD (NEDE-33261P) has a range between 5 to 15 Hz. To perform dynamic analyses to generate response spectra, a finite number of cases using various forcing function frequencies are selected to match with the natural frequencies of the structure to maximize the responses and is described in DCD Appendix 3F as follows:

Axisymmetrical SRV (all) response analysis is covered by n=0 harmonic. Non-axisymmetrical of SRV actuation is covered by n=1 harmonic that corresponds to the effect of the overturning moment.

Frequency range of SRV Loads: $f_1 \leq f \leq f_2$ ($f_1 = 5$ Hz, $f_2 = 12$ Hz)

For vertical structural frequencies $(fs)_v$ (n=0):

a. If $(fs)_v > f_2$ then use f_2

b. If $f_1 < (fs)_v < f_2$ then use $(fs)_v$

c. If $f_1 > (fs)_v$ then use f_1

For horizontal structural frequencies $(fs)_h$ (n=1):

a. If $(fs)_h > f_2$ then use f_2

b. If $f_1 < (fs)_h < f_2$ then use $(fs)_h$

c. If $f_1 > (fs)_h$ then use f_1

In an axisymmetrical load case, three vertical frequencies of 5 Hz, 6.06 Hz and 12 Hz are selected. In a non-axisymmetrical load case, 3 horizontal frequencies of 5 Hz, 8.83 Hz and 12 Hz, of the structure satisfying the above selection are adopted as SRV forcing function frequencies.

The bounding response spectra of these cases are documented in DCD Appendix 3F. They are to be used with the response spectra due to seismic and other hydrodynamic loads for the design of safety-related structures, systems, and components inside of containment using the SRSS method of combination.

(1) The applicable detailed report/calculation that will be available for the NRC audit is:

NEDE-33261P, *Containment Load Definition, Revision 1*, May 2006, containing the description of the hydrodynamic loads.

(2) Since this information exists as part of GE's internal tracking system, it is not necessary to add it to the DCD submittal to the NRC.

A markup of DCD Section 3.7 was provided under MFN 06-298.

NRC RAI 3.8-9, Supplement 1

NRC Assessment Following the December 14, 2006 Audit

a) *If NEDE-33261P indicates that SRV has a range of 5 to 15 Hz, why does the analysis only consider a range of 5 to 12 Hz.*

b) *Are the values 6.06 and 8.83 the fundamental natural frequencies of the structure in the vertical and horizontal direction respectively?*

c) *Provide a comparable description for selecting the appropriate forcing functions for the different LOCA loads (chugging, CO, pool swell, AP, vent clearing, etc.)*

d) *Since this is done for generation of floor response spectra throughout the building (not just local containment response), aren't there other structural natural frequencies that should be considered?*

e) *GE provided a markup to 3.7 (first paragraph) where it states that the method for combining seismic and RBV loads for reinforced concrete structures varies the sign (+ or -), equivalent to ABS. This is acceptable for reinforced concrete structures. However, it also states that the method used (presumably for all other SSCs) is the SRSS in accordance with NUREG-0484., Rev. 1. This is acceptable for seismic plus LOCA; however, the criteria for combining other dynamic loads (e.g., SRV and individual LOCA loads (AP, PS, CO, CH, LCO, HVL, etc) are not clearly defined. According to NUREG-0484, the use of SRSS for the other loads would require demonstrating a non-exceedance probability (NEP) of 84 percent or higher is achieved. Some of this information may be implied and buried within various scattered sections of the DCD (e.g., response spectra for some of the loads in App. 3F; however, the criteria should be clearly specified in one location. e) If time permits during the audit, the referenced NEDE report should be looked at, not for development of the loads (not within BNL's scope) but for proper application of the defined loads to the plant structures. Note: This is also identified as an RAI (RAI-3.12-17) during the piping review of DCD Section 3.9.*

During the audit, GE provided a draft supplemental response to this RAI. The staff needs to review this information. The response for items a, b, c, and d are acceptable. For item e, GE needs to provide documentation which describes the use of the SRSS method based on demonstrating that the NEP criteria was met.

GE Response

a) Frequency range of 5 to 15 Hz, as stated in the original response, was a typographical error. NEDE-33261P, page 6-5 specifies the bubble frequency range to be 5 to 12 Hz.

b) Yes, 6.06 and 8.83 Hz are the fundamental frequencies of the structure in the vertical and horizontal directions respectively.

a) Sixteen chugging and five CO cases, as described in DCD Tier 2 Subsection 3F.2.3 (4), cover the entire range of forcing functions, and there is no need to select specific structural frequencies.

b) The dynamic analysis model includes all structures in the reactor building. The resulting natural frequencies of 6.06 and 8.83 Hz are the only structural frequencies within the SRV forcing frequency range of 5 to 12 Hz.

c) ESBWR hydrodynamic loads are the same as the ABWR. The ABWR loads satisfy the 84-percentile non-exceedance (NEP) requirement of NUREG-0484, Rev. 1 as shown in the following memorandum that documents the applicability of the SRSS method for hydrodynamic loads.

Confirmation of Hydrodynamic Loads

Reference:
1. Letter, GE-1997-0731, U.C. Saxena to Ai-Shen Liu, Confirmation of Hydrodynamic Loads, dated 12/19/97
2. Response of Structures Due to Containment Loads, 299X700-001, Rev. 2
3. Containment Load, 299X701-030, Rev. 1
4. FOAKE Containment Accident Response Calculations Report, 24156-1A10-1820, Rev. 0

As a follow-up to my letter (Reference 1), additional analyses were performed to determine and confirm applicability of hydrodynamic loads for Lungmen application. Conclusion results from these analyses are summarized in this letter.

1. SRSS in Combining Dynamic Loads

NUREG-0484, Rev. 1 allows SRSS combination of dynamic loads, if these loads meet the Condition B (i). This condition requires that the loads must have an 84% non-exceedance probability or have a load magnitude which is 1.15 times the median, whichever is greater.

Results from the additional analyses confirm that SRV/CO/Chugging loads described in Reference 3 and used in Reference 2, meet the Condition B (i) of NUREG-0484, Rev. 1.

This letter, we hope, addresses your project needs. If you have any questions, please let us know. Evidence of verification is contained in DRF U71-00024/18.

DCD Impact

No DCD change was made in response to this RAI Supplement.

NRC RAI 3.8-9, Supplement 2

NRC Assessment from Chandu Patel E-mail Dated May 24, 2007

In response to item (e), the applicant stated that ESBWR hydrodynamic loads are the same as the ABWR. The ABWR loads satisfy the 84-percentile non-exceedance (NEP) criteria of NUREG 0484, Rev. 1, as shown in the memorandum attached to the response that documents the applicability of the square root of sum of squares (SRSS) method for hydrodynamic loads. The staff could not confirm that the ESBWR hydrodynamic loads are the same as the ABWR. In addition, the memorandum attached to the response does not clearly establish that the NEP criteria was satisfied for ABWR. Therefore, the staff requests the applicant to provide additional information demonstrating that the ESBWR hydrodynamic loads satisfy the 84 percentile NEP criteria of NUREG 0484, Rev. 1.

GE Response

The ESBWR hydrodynamic load definitions and bases are described in the ESBWR containment loads report NEDE-33261P (Reference 1). These include the SRV loads, the LOCA CO loads and the LOCA chugging loads. As described in Reference 1 the ESBWR load definitions are developed based on the corresponding ABWR loads.

SRV Loads

The ESBWR plant uses X-Quencher devices based on the design used in Mark II and Mark III plants and also in the ABWR. The ESBWR SRV induced pool boundary bubble pressure loads are defined using the GE X-Quencher SRV load methodology which is described in Appendix 3B, Attachment A of GESSAR II (Reference 2). The GE X-Quencher load methodology was approved for BWR plants with X-Quenchers in Mark II and Mark III plants in NUREG-0802 (Reference 3). The GE X-Quencher load methodology was also used to define the ABWR X-Quencher SRV loads. The GE X-Quencher SRV load methodology employs empirically derived correlations, developed from partial and full scale tests, to generate a load definition with a statistical 95%/95% confidence level. This means that there is 95% confidence that the defined load will bound 95% of all future occurrences. This statistical confidence level bounds 84% non-exceedance probability (NEP) required by NUREG-0484.

LOCA CO and Chugging Loads

The ESBWR LOCA CO and chugging load definition consists of wall pressure time histories, which were originally defined for the ABWR. Justification for application of the ABWR CO and chugging wall pressure histories to the ESBWR containment is provided in NEDE-33261P (Reference 1).

The basis for the ABWR CO and chugging loads are described in Appendix 3B of the ABWR SSAR and is also included in the ESBWR containment loads report (Reference 1). A source load approach was used to define both the ABWR CO load and the ABWR chugging loads.

With this approach, a test source load is initially developed with an acceptance criterion that the source load, when applied to the analytical model of the test facility, produces wall pressure histories, which match the test data. This test source, with appropriate adjustments is then applied to the full-scale ABWR containment to generate the ABWR wall pressure loads.

The sources loads for CO and chugging were developed from a comprehensive database (Reference 4) developed to envelope the range of expected conditions during CO and chugging in an ABWR plant. A set of sources for CO and chugging were developed with the criteria that when the sources are applied to an analytical model of the test facility, the Power Spectral Densities (PSD) of the resultant pressure histories envelope the PSDs for the measured CO and chugging test data.

Since the CO and chugging source loads, used to generate the load definition, were developed to envelope all available test data, the associated non-exceedance probability is considered to be near 100%. Therefore the ABWR CO and chugging load definitions, which have been applied to the ESBWR, meet the 84% NEP criteria required by NUREG-0484.

REFERENCES:

1. NEDE-33261P, "Licensing Topical Report, ESBWR Containment Load Definition," May 2006.
2. GESSAR II, 238 Nuclear Island, General Electric Company, Docket No. STN 50- 447, Amendments 1 through 21, Appendix 3B (Attachment A).
3. NUREG-0802, "Safety/Relief Valve Quencher Loads: Evaluation for BWR Mark II and III Containment," Oct. 1982.
4. NEDC-31393, "ABWR Containment Horizontal Vent Confirmatory Test, Part I," March 1987.

DCD Impact

No DCD change was made in response to this RAI Supplement.

NRC RAI 3.8-9, Supplement 3

In the response dated August 13, 2007, GEH stated that the ESBWR hydrodynamic load definitions and bases are described in the ESBWR containment loads report NEDE-33261P. These include the SRV loads, LOCA CO loads, and LOCA chugging loads. The ESBWR load definitions are developed based on the corresponding ABWR loads. The response explained, for each of these loads, how the specific defined load bounds all future occurrences of the load with a confidence level that is greater than 84% non-exceedance probability. The concern raised by the staff in the RAI was not in demonstrating a confidence level of 84% when defining each individual load, but rather the technical basis for combining multiple dynamic loads using the SRSS method. SRSS combination method is acceptable for combining the structural responses from seismic plus LOCA; however, the basis of the criteria for combining other dynamic loads (e.g., SRV and individual LOCA loads (AP, PS, CO, CH, LCO, HVL, etc) is not evident. According to NUREG-0484, Revision 1, the use of SRSS (rather than the absolute sum method) for combining the other loads would require demonstrating that a non-exceedance probability (NEP) of 84% or higher is achieved for the combined response due to multiple dynamic loadings considering the time-phase relationship. Acceptable methods for achieving this goal are clearly described in the conclusion section of NUREG-0484, Revision 1. If GEH uses the SRSS method for combining the other dynamic loads, then the technical basis for using this method needs to be provided as discussed above.

GEH Response

Compliance with NUREG-0484, Revision 1 requirements to justify the SRSS response combination for the combined response of dynamic loads other than SSE and LOCA was demonstrated by extensive studies in the following GEH reports for existing GEH BWR plants of various containment configurations:

1. NEDE-24010-P, Technical Basis for the Use of the Square Root of the Sum of Squares (SRSS) Method for Combining Dynamic Loads for Mark II Plants, July 1977. NEDE-24010-1, Supplement 1, SRSS Application Criteria as Applied to Mark II Load Combination Cases, October 1978. NEDE-24010-2, Supplement 2, Bases for Criteria for Combination of Earthquake and Other Transient Responses by the Square-Root-Sum-of-the-Squares Method, December 1978. NEDE-24010-3, Study to Demonstrate the SRSS Combined Response has Greater than 84 Percent Non-Exceedance Probability When the Newmark-Kennedy Acceptance Criteria are Satisfied, August 1979. These reports were reviewed by the NRC and quoted as references in NUREG-0484, Revision 1.

2. NEDE-24632, Mark I Containment Program Cumulative Distribution Functions for Typical Dynamic Responses of Mark I Torus and Attached Piping Systems, December 1980. This report was reviewed and accepted by the NRC in a March 10, 1983 NRC letter, Acceptability of SRSS Method for Combining Dynamic Responses in Mark I Piping Systems.

3. SMA 12109.01-R001, Study to Demonstrate the Generic Applicability of SRSS Combination of Dynamic Responses for Mark III Nuclear Steam Supply System and Balance-of-Plant Piping and Equipment Components, November 1981. This report was reviewed by the NRC and quoted as a reference in NUREG/CR-2686.

An important observation from these studies is that the combined response for dynamic loads other than SSE and LOCA achieves a non-exceedance probability (NEP) of 84% or higher due to the similarities of hydrodynamic loadings and responses in all GEH BWR plants, despite the different containment configurations. On the basis of similarity, it can be concluded that the SRSS combination of response to dynamic loads, other than SSE and LOCA, is also applicable to the ESBWR.

DCD Impact

No DCD change was made in response to this RAI Supplement.

NRC RAI 3.8-9, Supplement 4

In the Supplement 3 response dated March 13, 2008, GEH identified a number of GEH reports, two NUREG reports, and an NRC letter which relate to the SRSS method for combining dynamic loads. Simply listing such documents does not provide the technical basis for acceptance of the use of the SRSS method for combining seismic and hydrodynamic loadings. As stated in the response, NUREG-0484, Rev. 1 does use information from several of the GEH referenced reports. Based on the use of this information, the staff notes that NUREG-0484 concludes that the use of the SRSS method is acceptable for SSE plus LOCA, but the NUREG report indicates that the use of SRSS for combination of dynamic responses, for loads other than SSE plus LOCA, requires satisfying specific criteria provided in the NUREG. Therefore, GEH is requested again to specifically provide the technical basis for combining dynamic responses for loads other than SSE plus LOCA. If a technical basis is specifically given in any of the referenced documents, then the specific section(s) or page(s) should be identified and the documents should be provided, since often they are not readily available as in this case.

GEH Response

A copy of the report SMA 12109.01-R001 (NRC RAI 3.8-9, Supplement 4, Reference 1 or "Reference 1" hereafter), being the most recent one among the referenced documents in NRC RAI 3.8-9, Supplement 3 transmitted on March 13, 2008 via MFN 06-298, Supplement 5, is attached as Attachment 3.8-9, Supplement 4(1).

The Executive Summary section of Reference 1 provides an overview of the generic Mark III study performed for 167 response combination analyses associated with NSSS, BOP piping and BOP equipment for the following 3 load combinations: OBE+SRV, SSE+SRV, and SRV+LOCA (Small Break Accident/Intermediate Break Accident). In this study, the LOCA load is represented by the chugging hydrodynamic loading.

Table 1-2 of Reference 1 is the evaluation matrix for the combination cases and response locations. For each load combination, a Cumulative Distribution Function (CDF) curve was generated taking into account only random time phasing of the individual responses. Section 2 of Reference 1 presents the details of the CDF curve generation.

Per NUREG-0484, Revision 1 Condition A and Condition B have to be met for the SRSS method to be considered acceptable for loading combinations for loads other than SSE and LOCA.

Condition A involves satisfying the following:

(i) The dynamic response time function is rapidly varying;

(ii) Duration of the strong motion portion of the function is short;

(iii) Function consists of a few distinct high peaks which are random with respect to time;

(iv) Response is calculated on a linear elastic basis; and

(v) Time-phase relationship among functions to be combined is random.

Examination of the individual time histories used to generate CDF curves presented in Appendix C of Reference 1 reveals characteristics of rapidly varying amplitude and short duration peak responses. Thus, items (i), (ii), and (iii) above are met. Item (iv) is met because response calculations for dynamic loads are performed on the basis of the structures being linear and elastic. Regarding Item (v), Earthquake, SRV, and LOCA are independent events and their relative start times are unknown. Therefore, the time-phasing among functions to be combined is random.

Condition B involves satisfying the following requirements:

(i) Define loads at approximately the 84 percentile or 1.15 times the median, whichever is greater.

(ii) The SRSS value of the response combination has an NEP > 50 percent selected from a Cumulative Distribution Function (CDF) curve constructed on the assumption that individual response amplitudes are known and only random time phasing defined by its probability density function exists. The CDF curve may be developed using the procedures of Appendix N of Section III of the ASME Code, or alternative methods developed by BNL or by Westinghouse in WCAP-9279 using absolute (unsigned) values of response amplitude. The method selected shall be justified in the submission for the application being analyzed.

(iii) 1.2 times the SRSS value of the response combination has an NEP > 85 percent from the CDF curve constructed as in (ii) above assuming only random time phasing.

Reference 1 justifies SRSS on the basis of Newmark-Kennedy Criterion 2, which are consistent with the three items of Condition B shown above.

Item (i) is satisfied because Mark III suppression pool loads used in the study were defined at the greater of approx. 84^{th} percent quartile or 1.15 times the median values. Similarly the process used to define seismic loading results in loading approximately 84^{th} percentile or greater. (See Page 2-1 of Reference 1).

Item (ii) of Condition B is re-stated in the above Criterion 2 as less than 50% conditional probability that the actual peak combined response exceeds approximately SRSS calculated peak response i.e. R_{50}/SRSS must be approximately equal to or less than 1.0. These ratios as applied to the data in Reference 1 are shown therein on Tables 3-1 through 3-18. An analysis of the data described on Page 3-5 of Reference 1 shows that, even with very conservative distribution–free confidence limits assumption, there is 90% confidence that 98.6% of all samples would have a ratio of R_{50}/SRSS less than 1.095. Note the CDF curves were generated in accordance with the methodology outlined in NUREG/CR-1330 (see page 2-2 of Reference 1), which is the BNL method permitted by item (ii) of Condition B.

Item (iii) of Condition B is re-stated in the above Criterion 2 as less than 15% conditional probability that the actual peak combined response exceeds approximately 1.2 times the SRSS calculated peak response, i.e. R_{85}/SRSS must be approximately equal to or less than 1.2. These ratios as applied to the data in Reference 1 are shown therein on Tables 3-1 through 3-18. An analysis of the data described on Page 3-4 of Reference 1 shows that, even with very conservative distribution–free confidence limits assumption, there is 90% confidence that 98.6% of all samples have a ratio of R_{85}/SRSS less than 1.228.

In conclusion, Reference 1 provides sufficient justification to show that SRSS methods are acceptable for combining dynamic loads other than SSE plus LOCA since the conditions described in NUREG-0484, Revision 1 are met.

Reference:

1. SMA 12109.01-R001, "Study to Demonstrate the Generic Applicability of SRSS Combination of Dynamic Responses for Mark III Nuclear Steam Supply System and Balance-of-Plant Piping and Equipment Components", General Electric Company Nuclear Energy Division, November 1981.

DCD Impact

No DCD change is required in response to this RAI Supplement.

Attachment 3.8-9, Supplement 4(1)

SMA 12109.01-R001, "Study to Demonstrate the Generic Applicability of SRSS Combination of Dynamic Responses for Mark III Nuclear Steam Supply System and Balance-of-Plant Piping and Equipment Components", General Electric Company Nuclear Energy Division, November 1981