May 28, 2008

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE Hitachi Nuclear Energy
3901 Castle Hayne Rd MC A-45
Wilmington, NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 206 RELATED TO NEDO-33411, "RISK SIGNIFICANCE OF STRUCTURES, SYSTEMS AND COMPONENTS FOR THE DESIGN PHASE OF THE ESBWR," REVISION 0.

Dear Mr. Brown:

By letter dated April 11, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff informed you of the result of the acceptance review of NEDO-33411, "Risk Significance of Structures, Systems and Components for the Design Phase of the ESBWR," Revision 0. In that letter, the staff determined that the material presented in the topical report sufficient to begin a detailed review as part of the ESBWR design certification review.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

If you have any questions or comments concerning this matter, you may contact me at 301-415-3104 or Michael.Eudy@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

/RA/

Michael A. Eudy, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
Request for Additional Information

cc: See next page

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Michael A. Eudy, Project Manager
ESBWR/ABWR Projects Branch 1
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Docket No. 52-010
Enclosure:
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cc: See next page

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DATE	05/28/2008	05/28/2008

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Requests for Additional Information (RAIs): ESBWR Design Control Document (DCD) Revision 4;
NEDO-33411, "Risk Significance of Structures, Systems and Components for the Design Phase of the ESBWR," Revision 0.

RAI Number	Reviewer	Question Summary	Full Text
17.4-18	Hilsmeier T	Clarify F-V value used in common industry practice (Section 2.1 of NEDO-33411)	Section 2.1 of NEDO-33411, Revision 0, states “The common industry practice is to apply recommended thresholds for plants with CDFs in the 1E-4/yr to 1 E-6/yr range (F-V greater than or equal to 0.05, Risk Achievement Worth (RAW) greater than or equal to 2.0).” The staff requests that GEH clarify in NEDO-33411 the Fussell-Vesely (F-V) value used in this statement since the F-V values typically used in common industry practice are 0.005 at the component level and 0.05 at the system level.

Enclosure

RAI Number	Reviewer	Question Summary	Full Text
17.4-19	Hilsmeier T	Provide basis for common cause threshold criteria (Section 2.1 of NEDO-33411)	Section 2.1 of NEDO-33411, Revision 0, provides the common cause threshold criteria (i.e., common cause basic events having a RAW greater than or equal to 50 is considered potentially risk-significant). The RAW for a common cause event generally reflects the relative increase in Core Damage Frequency/Large Release Frequency (CDF/LRF) that would exist if a set of components or an entire system was made unavailable. GEH did not provide the basis for the common cause threshold criteria (i.e., a basis was not found in NEDO-33411 or any of its references). The following suggest that a common cause threshold of 50 may be too high and inappropriate: - A RAW of 50 equates to a risk increase of about 6E-7/yr (based on ESBWR internal events CDF of 1.22E-8/yr), which is above GEH's CDF risk increase threshold of 1E-7/yr that is discussed in Section 17.1.2.2 of NEDO-33201, Revision 2 (i.e., "An increase in CDF risk of greater than or equal to 1E-7/yr is considered risk-significant for the design certification ESBWR PRA"). - Common cause failure probabilities generally have higher uncertainties; therefore, the RAWs associated with common cause basic events have higher uncertainties. - Technical guidance report NEI 00-04, Revision 0, 10 CFR 50.69 SSC "Categorization Guideline" (NEI 00-04 is endorsed by, with appropriate clarifications and exceptions, Regulatory Guide (RG) 1.201, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance") uses a common cause RAW greater than or equal to 20 (which equates to a risk increase of about 2.0E-7/yr for the ESBWR). The staff requests that GEH provide the basis for the common cause threshold criteria (i.e., common cause basic events having a RAW greater than or equal to 50 is considered potentially risk-significant).
17.4-20	Hilsmeier T	Clarify use of "not risk-significant" (Section 2.1 of NEDO-33411)	Section 2.1 of NEDO-33411, Revision 0, states "Basic events that do not meet the threshold values are considered not risk-significant." The staff requests that GEH clarify in NEDO-33411 the "not risk-significant" used in this statement since basic events or SSCs not meeting the risk threshold values may be risk-significant under other methods (e.g., regulatory treatment of non-safety systems (RTNSS), seismic margins analysis (SMA), expert panel).

RAI Number	Reviewer	Question Summary	Full Text
17.4-21	Hilsmeier T	Discuss use of integrated importance assessments in risk significance evaluations (Section 2.1 of NEDO-33411)	Section 2.1 of NEDO-33411, Revision 0, presents GEH's methodology for determining risk significance of SSCs using RAWs and F-Vs. Under this methodology, each risk hazard/contributor (i.e., internal/fire/flood/high winds at power and shutdown) is evaluated separately. This helps avoid reliance on a combined result that may mask the results of individual risk contributors. However, it is desirable in a risk-informed process to also understand risk significance from an overall perspective (e.g., an integrated importance assessment that combines the risk hazards). For example, if non-common cause basic event "a" has an internal events RAW of 4 and F-V of 0.001 (with internal events CDF = 1.22E-8/yr) and a high wind RAW of 45 and F-V of 0.001 (with high wind CDF = 1.3E-9/yr), then basic event "a" would be considered not risk-significant based on GEH's risk significance importance criteria. However, from an integrated importance assessment the RAW would be about 8 (i.e., a weighted-average importance based on the importance measures and the risk contributed by each hazard using the equations in Section 5.6 of technical guidance report NEI 00-04, Revision 0), which would suggest that basic event "a" may be risk-significant from an overall perspective. An integrated assessment allows the expert panel to determine whether risk significance of the SSC should be based on significance for individual hazards or from the overall integrated results. The staff requests that GEH discuss how risk significance evaluations under NEDO-33411, Revision 0, considered integrated importance assessments (i.e., risk significance based on an overall assessment that combines the risk hazards). If integrated importance assessments were not considered in the risk significance evaluations under NEDO-33411, then provide the basis for not considering these integrated importance assessments or incorporate them in the risk significance evaluations under NEDO-33411.
17.4-22	Hilsmeier T	Discuss how uncertainties in importance measures were addressed in the risk significance evaluations (Section 2.1 of NEDO-33411)	From Section 2.1 of NEDO-33411, Revision 0, the risk significance criteria for the ESBWR is not based on common industry practice but is a function of the ESBWR base CDF/LRF. This is acceptable under NRC RG 1.174. However, as indicated in RG 1.174, uncertainties associated with CDF, LRF, RAW, and F-V could mask the importance of SSCs (e.g., importance measures computed by the PRA may indicate that a component does not meet the RAW or F-V criteria, but sensitivity studies may show that other conditions might lead to the component being risk-significant). Uncertainties in human error rates, common cause failures, and component data contribute to the uncertainties in CDF, LRF, RAWs, and F-Vs. The staff requests that GEH discuss how these uncertainties were addressed in the risk significance evaluations under NEDO-33411, Revision 0 (i.e., how the sensitivities of importance measures caused by uncertainties in the parameter values were addressed in the risk significance evaluations).

RAI Number	Reviewer	Question Summary	Full Text
17.4-23	Hilsmeier T	Basis for not including in Table 6 of NEDO-33411 those SSCs identified as risk-significant under RTNSS Criterion A, B, or E (Section 2.3 of NEDO-33411)	In Section 2.3 of NEDO-33411, Revision 0, GEH stated that SSCs meeting RTNSS Criterion C or D are considered risk-significant and included in the reliability assurance program (RAP). GEH does not include SSCs that meet RTNSS Criterion A, B, or E, which are considered risk-significant based on deterministic methods. (The staff notes that this is contrary to DCD Tier 2, Section 19A.8.2 which states that "All RTNSS systems shall be in the scope of the Design Reliability Assurance Program…") During the design phase of RAP risk-significant SSCs are identified for inclusion in the program by using probabilistic, deterministic, and other methods (e.g., industry experience, expert panel). The staff requests that GEH include in RAP (i.e., Tables 3 and 6 of NEDO-33411, Revision 0) all SSCs identified as risk-significant under RTNSS (i.e., SSCs meeting Criterion A, B, C, D, or E of SECY-95-132, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems, RTNSS, in Passive Plant Designs). Otherwise, provide the basis for not including in Table 6 of NEDO-33411, Revision 0, the SSCs identified as risk-significant under RTNSS Criterion A, B, or E.
17.4-24	Hilsmeier T	Incorporate use of expert panel to review categorization of SSCs determined to be not risk-significant from PRA results, seismic margins analysis, and RTNSS (Section 2.6 of NEDO 33411)	Based on Section 2.6 and Figure 1 of NEDO-33411, Revision 0, the expert panel did not review the categorization of SSCs determined to be not risk-significant (NRS) from quantified PRA results, seismic margins analysis, and RTNSS. The expert panel plays an important role in reviewing the information that lead to these NRS determinations (e.g., assure the basis used in the categorization is technically adequate, review defense-in-depth implications, review safety margin implications, for additional information see Sections 9.2.2 and 9.2.3 of technical guidance report NEI 00-04, Revision 0). This is particularly important for those safety-related SSCs determined to be NRS from these processes. The staff requests that GEH incorporate into their risk significance methodology the use of an expert panel to review the categorization of SSCs that were determined to be not risk-significant from quantified PRA results, seismic margins analysis, and RTNSS. NEDO-33411, Revision 0, should be revised, accordingly, to describe the role that the expert panel has in reviewing these NRS determinations (e.g., assure the basis used in the categorization is technically adequate, review defense-in-depth implications, review safety margin implications).

RAI Number	Reviewer	Question Summary	Full Text
17.4-25	Hilsmeier T	Justify or revise the 1E-6/yr criterion used for identifying the risk significance of undeveloped events (Section 2.1.2 of NEDO-33411)	Section 2.1.2 of NEDO-33411, Revision 0, states the following: "For example, a system that has an undeveloped basic event above the risk thresholds is evaluated in a sensitivity study by quantifying the effect of deleting that system entirely. If the revised CDF is less than 1E-6/yr and if the revised results do not introduce any new systems above the risk thresholds, then the system is considered not risk-significant. Undeveloped events representing functions that are safety-related or RTNSS are retained and evaluated with respect to other basic events representing those functions." An undeveloped event represents a higher-level event that is not broken down into lower basic events because further resolution of that event is not necessary for proper evaluation, or the information necessary for developing this event is not currently available. For example, an undeveloped event may represent: multiple failure modes of a single component, a single train of components, multiple components in parallel, and so on. The staff's understanding of the criterion described in GEH's statement provided above is that undeveloped events not representing functions that are safety-related or RTNSS are subjected to the 1E-6/yr criteria, and undeveloped events representing functions that are safety-related or RTNSS are evaluated with respect to other basic events representing those functions. This 1E-6/yr criterion is equivalent to a RAW of about 80 (i.e., 1E-6/1.22E-8, where 1.22E-8/yr is the internal events base CDF) and this criterion exceeds GEH's CDF risk increase threshold of 1E-7/yr (which is discussed in Section 17.1.2.2 of NEDO-33201, Revision 2). Though this criterion may be appropriate for some undeveloped events (e.g., an undeveloped event representing failure of several systems), it is not appropriate in the general sense. For example, an RAW of five (which represents the individual basic event threshold) may be a more appropriate criterion for an undeveloped event representing a single train of components. An RAW of 50 (which represents the current common cause threshold) may be a more appropriate criterion for an undeveloped event representing a system. The staff requests that GEH justify or revise the 1E-6/yr criterion used for evaluating risk significance of undeveloped events to a more appropriate criterion (for example, the following may be a more appropriate criteria: evaluate undeveloped events with respect to other basic events/systems representing those functions; evaluate undeveloped events representing individual components, single trains, single systems against the basic event/common cause risk threshold criteria presented in Section 2.1 of NEDO-33411, Revision 0).

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17.4-26	Hilsmeier T	Basis for not including Balance of Plant Chilled Water System and Condensate/ Feedwater Pumps in Table 6 of NEDO-33411	In Table 4 of NEDO-33411, Revision 0, undeveloped event BOPCWS-SYS-FAILS represents failure of Balance of Plant Chilled Water System (BOPCWS) (see Section 4.9 of NEDO-33201, Revision 2). GEH did not include BOPCWS in RAP because its undeveloped event (BOPCWS-SYS-FAILS) is considered not risk-significant due to it being an "undeveloped event requiring multiple failures" (Table 4 of NEDO-33411, Revision 0). The basis for not including BOPCWS in RAP is insufficient, and the evidence presented below suggests that BOPCWS is risk-significant and should be included in RAP: - BOPCWS is considered risk-significant under Table 17.1-2 of NEDO-33201, Revision 2. - The ESBWR PRA models BOPCWS as a support system to the Condensate and Feedwater System (C&FS). C&FS is considered a risk-significant system and is included in RAP (i.e., Table 6 of NEDO-33411, Revision 0) and has an internal events RAW of about 30 and F-V of about 0.02 (Table 11.3-14 of NEDO-33201, Revision 2). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the BOBCWS. Otherwise, provide the basis for considering the BOPCWS system not risk-significant. Please include, in your discussion, the RAWs and F-Vs of BOPCWS basic events/undeveloped events (with consideration of uncertainties in these importance values due to parameter uncertainties), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including BOPCWS in RAP. The staff requests that GEH provide the basis for considering the condensate and feedwater system pumps as not risk-significant. Please include, in your discussion, the individual and common cause RAWs and F-Vs for these pumps (with consideration of uncertainties in these importance values due to parameter uncertainties), and the expert panel's deliberation for not including these pumps in RAP.

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17.4-27	Hilsmeier T	Basis for not including SSCs associated with TCCWS and PSWS in Table 6 of NEDO-33411	GEH did not include in Table 6 of NEDO-33411, Revision 0, the components related to the following basic events of the Turbine Component Cooling Water System (TCCWS) and Plant Service Water System (PSWS) because they are considered not risk-significant due to it being an "undeveloped system requiring multiple failures" (Table 4 of NEDO-33411, Revision 0): P22-HX_-PG-B001A P22-MOV-OC-F0005A P22-HX_-PG-B001B P22-MOV-OC-F0005B P22-ACV-OC-F0006 P22-TNK-RP-A001 P22-ACV-CO-F0008 P41-ACV-OC-F001A P41-MOV-OC-F008A P41-ACV-OC-F001B P41-MOV-OC-F008B The basis for not including these components in RAP is insufficient, and the evidence presented below suggests that these components are risk-significant and should be included in RAP: - The basic events listed above are considered risk-significant under Table 17.1-2 of NEDO-33201, Revision 2. - These events do not appear to be undeveloped events in that they refer to specific failure modes of individual components (e.g., P22-ACV-CO-F0008 refers to valve F0008 of the TCCWS system failing to remain closed). Therefore, the risk threshold criteria for individual/common cause events (i.e., individual event RAW threshold of 5, common cause RAW threshold of 50, F-V threshold of 0.01 from Section 2.1 of NEDO-33411, Revision 0) would appear to be more appropriate criteria for determining the risk significance of these basic events. - The ESBWR PRA models these basic events for supporting the Condensate and Feedwater System (C&FS). C&FS is considered a risk-significant system and is included in RAP (Table 6 of NEDO-33411, Revision 0) and has an internal events RAW of about 30 and F-V of about 0.02 (Table 11.3-14 of NEDO-33201, Revision 2). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the TCCWS and PSWS components that are associated with the basic events listed above. Otherwise, provide the basis for considering the TCCWS and PSWS components not risk-significant. Please include, in your discussion, the RAWs and F-Vs of these events (with consideration of uncertainties in these importance values due to parameter uncertainties), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these components in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-28	Hilsmeier T	Basis for not including PSWS HVAC Trains A(B) in Table 6 of NEDO-33411	Undeveloped events P41-SYS-FC-HVACPSW-A(B) represent failure of Plant Service Water (PSWS) HVAC Trains A and B (Section 4.11 of NEDO-33201, Revision 2). GEH did not include PSWS HVAC Trains A(B) in RAP because their undeveloped events are considered not risk-significant due to it being an "undeveloped event requiring multiple failures" (Table 4 of NEDO-33411, Revision 0). The basis for not including PSWS HVAC Trains A(B) in RAP is insufficient, and the evidence presented below suggests that PSWS HVAC Trains A(B) are risk-significant and should be included in RAP: - Undeveloped events P41-SYS-FC-HVACPSW-A(B) are considered risk-significant under Table 17.1-2 of NEDO-33201, Revision 2. - These undeveloped events are defined at a train level. Therefore, the risk threshold criteria for individual/common cause events (i.e., individual event/train RAW threshold of 5, common cause RAW threshold of 50, F-V threshold of 0.01 from Section 2.1 of NEDO-33411, Revision 0) would appear to be more appropriate criteria for determining the risk significance of these undeveloped events. - The ESBWR PRA models these undeveloped events as a support system to the PSWS. PSWS is considered a risk-significant system and is included in RAP (i.e., Table 6 of NEDO-33411, Revision 0) and has an internal events RAW of about 400 and F-V of about 0.05 (NEDO-33201, Revision 2, Table 11.3-14). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the PSWS HVAC Trains A and B. Otherwise, provide the basis for considering PSWS HVAC Trains A(B) not risk-significant. Please include, in your discussion, the RAWs and F-Vs of the associated basic events/undeveloped events (with consideration of uncertainties in these importance values due to parameter uncertainties), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including PSWS HVAC Trains A(B) in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-29	Hilsmeier T	Basis for not including SSCs associated IAS in Table 6 of NEDO-33411	GEH did not include in Table 6 of NEDO-33411, Revision 0, the components related to the following basic events of the Instrument Air System (IAS) because they are considered not risk-significant due to it being an "undeveloped system requiring multiple failures" (Table 4 of NEDO-33411, Revision 0): P52-BV_-OC-F004, P52-BV_-OC-F005, P52-TNK-RP-RCV002, P52-UV_-OC-F006. The basis for not including these components in RAP is insufficient, and the evidence presented below suggests that these components are risk-significant and should be included in RAP: - The basic events listed above are considered risk-significant under Table 17.1-2 of NEDO-33201, Revision 2. - These events do not appear to be undeveloped events in that they refer to specific failure modes of individual components (e.g., P52-BV_-OC-F004 refers to valve F004 of the IAS system failing to remain open). Therefore, the risk threshold criteria for individual/common cause events (i.e., individual event RAW threshold of 5, common cause RAW threshold of 50, F-V threshold of 0.01 from Section 2.1 of NEDO-33411, Revision 0) would appear to be more appropriate criteria for determining the risk significance of these basic events. - The ESBWR PRA models these basic events in the IAS top event. The IAS top event has an internal events RAW of about 11 (Table 11.3-14 of NEDO-33201, Revision 2). The RAWs for the basic events listed above should be similar (i.e., about 11) since each basic event fails the IAS top event. Also, Section 4.12.11 of NEDO-33201, Revision 2, shows these basic events to have an RAW of about 28 (this value is not consistent with Table 11.3-14 of NEDO-33201 which shows a RAW of about 11). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the IAS components that are associated with the basic events listed above. Otherwise, provide the basis for considering these components not risk-significant. Please include, in your discussion, the RAWs and F-Vs of these events (with consideration of uncertainties in these important values due to parameter uncertainties), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these components in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-30	Hilsmeier T	Basis for not including SLC squib valves F003 A, B, C, D in Table 6 of NEDO-33411	Standby Liquid Control System (SLC) squib valves F003 A, B, C, D are considered risk-significant from the Seismic Margins Analysis (SMA) (Table 2 of NEDO-33411, Revision 0). Based on GEH's discussion in Section 2.2 of NEDO-33411, these SLC squib valves should be included in Table 6 of NEDO-33411. However, these squib valves do not appear in Table 6 of NEDO-33411. The staff requests that GEH include the SLC squib valves F003 A, B, C, D in Table 6 of NEDO-33411, Revision 0. Otherwise, provide the basis for considering these valves not risk-significant. Please include, in your discussion, consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these valves in RAP.
17.4-31	Hilsmeier T	Basis for not including ICS motor-operated and nitrogen-operated valves in Table 6 of NEDO-33411	Isolation Condenser System (ICS) motor-operated and nitrogen-operated valves are considered risk-significant from the SMA (Table 2 of NEDO-33411, Revision 0). Based on GEH's discussion in Section 2.2 of NEDO-33411, these ICS valves should be included in Table 6 of NEDO-33411. However, these ICS motor-operated and nitrogen-operated valves do not appear in Table 6 of NEDO-33411. Also, it is unclear as to what specific ICS valves are referred to by the SMA (e.g., are valves F001, F002, F003, F004, F005, F006, F011, F012, and F013 risk-significant under SMA?). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the specific ICS motor-operated and nitrogen-operated valves (i.e., specific component IDs) determined to be risk-significant under the SMA. Otherwise, provide the basis for considering these valves not risk-significant. Please include, in your discussion, consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these valves in RAP.
17.4-32	Hilsmeier T	Clarify descriptions of UPS risk-significant SSCs in Table 6 of NEDO-33411	For Uninterruptible AC Power Supply (UPS), it is unclear as to what specific UPS components are considered risk-significant in Table 6 of NEDO-33411, Revision 0. For example: Does "Load Group B Transformer" refer to the UPS Nonsafety-Related Reactor Building Load Group B Transformer? Does "Nonsafety-Related Bus A, B" refer to UPS Nonsafety-Related 480VAC Buses A1, B1? Does "Manual Transfer Switch A,B" refer to the manual transfer switches for UPS Nonsafety-Related Buses A1 and B1? Does "Static Transfer Switch A, B" refer to the static transfer switches for UPS Nonsafety-Related Buses A1 and B1? Does the "UPS Inverters" refer to both the safety-related and nonsafety-related inverters of UPS? The staff requests the GEH more clearly identify the UPS risk-significant SSCs in Table 6 of NEDO-33411, Revision 0.

RAI Number	Reviewer	Question Summary	Full Text
17.4-33	Hilsmeier T	Basis for not including some nonsafety-related UPS SSCs in Table 6 of NEDO-33411	GEH did not include in Table 6 of NEDO-33411, Revision 0, the components related to the following basic events of UPS, which are considered risk-significant in Table 17.1-2 of NEDO-33201, Revision 2: R13-BAC-LP-R13RBB (Nonsafety-Related UPS Reactor Building Load Group B Bus) R13-LCB-CO-FR13RBB R13-LCB-CO-R13RBB R13-LCB-CO-TOR13A1 R13-LCB-CO-TOR13B1 R13-XFL-LP-R13RBA R13-XFL-LP-R13RBC The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the UPS components that are associated with the basic events listed above. Otherwise, provide the basis for not including these components in Table 6 of NEDO-33411. Please include, in your discussion, the RAWs and F-Vs of these events (with consideration of uncertainties in these importance values due to parameter uncertainties), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these components in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-34	Hilsmeier T	Provide basis for similar UPS SSCs having dissimilar risk significances	For UPS in Table 6 of NEDO-33411, Revision 0, there are numerous instances of similar SSCs of different UPS trains having dissimilar risk significances (e.g., based on Table 6 of NEDO-33411, Load Group B Transformer is considered risk-significant while Load Group A and C Transformers are considered not risk-significant). Often these dissimilar risk significances are real as they reflect actual differences in supporting functions. However, it is possible that these dissimilarities are not real and arise from assumptions made in the risk analyses. The staff requests that GEH provide the basis for considering the following UPS SSCs as not risk-significant (also, explain what is driving the risk differences relative to their risk-significant counterparts): 1) Nonsafety-Related UPS Bus C (note, Nonsafety-Related UPS Buses A, B are considered risk-significant in Table 6 of NEDO-33411). 2) Manual Transfer Switch on Nonsafety-Related UPS Bus C (note, Manual Transfer Switches A, B are considered risk-significant in Table 6 of NEDO-33411). 3) Static Transfer Switch on Nonsafety-Related UPS Bus C (note, Static Transfer Switches A, B are considered risk-significant in Table 6 of NEDO-33411). 4) Nonsafety-related UPS Reactor Building Load Group A and C Transformers and associated breakers (note, Load Group B Transformer is considered risk-significant in Table 6 of NEDO-33411). 5) Nonsafety-related UPS Reactor Building Load Group A and C buses (note, UPS Reactor Building Load Group B bus is considered risk-significant in Table 2 of NEDO-33201, Revision 2).
17.4-35	Hilsmeier T	Provide basis for not including safety-related UPS SSCs in Table 6 of NEDO-33411	For UPS in Table 6 of NEDO-33411, Revision 0, manual transfer switches, static transfer switches, buses, transformers, and circuit breakers are considered risk-significant under the nonsafety-related portion of UPS, but not considered risk-significant under the safety-related portion of UPS. The staff requests that GEH provide the basis for considering the safety-related UPS components as not risk-significant. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these components in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-36	Hilsmeier T	Clarify descriptions of risk-significant SSCs in Table 6 of NEDO-33411	In Table 6 of NEDO-33411, Revision 0, many risk-significant SSCs are identified through text descriptions, rather than specific component Identification numbers. As a result, it is unclear as to what specific components are in RAP. The staff requests that GEH more clearly describe the risk-significant SSCs in Table 6 of NEDO-33411, Revision 0 through use of text descriptions and specific component identification numbers, when applicable. For example: from Table 6 of NEDO-33411 the description “FDW Line A Check Valves (B21-F102A, F103A)” is clearer than description “FDW Line A Check Valves”; and “FAPCS Suppression Pool Isolation Valve (G21-F308)” is clearer than description “FAPCS Suppression Pool Isolation Valve”.
17.4-37	Hilsmeier T	Basis for not including hardware of QDCIS and NDCIS in Table 6 of NEDO-33411	GEH did not include in Table 6 of NEDO-33411, Revision 0, the “hardware” of QDCIS (C63) and NDCIS (C62) systems. The evidence presented below suggests that the hardware of these systems are risk-significant and should be included in RAP: - QDCIS and NDCIS are very risk-significant (RAWs of about 4200 and 400, respectively, and F-V of about 0.24 and 0.04, respectively, from Table 11.3-14 of NEDO-33201, Revision 2). - Undeveloped basic events C63-UNDEVSPUR## represent unmodeled hardware that could lead to a spurious actuation of an undesirable signal and are considered risk-significant in the ESBWR PRA (Table 17.1-2 of NEDO-33201, Revision 2). - Uncertainties inherent with the PRA modeling of digital hardware/software are large; therefore, it is inappropriate to specifically rely on PRA models alone to show that hardware of digital systems are not risk-significant. Other methods would need to be assessed (e.g., deterministic methods, defense-in-depth, expert panel). The staff requests that GEH include “hardware” of QDCIS and NDCIS in Table 6 of NEDO-33411, Revision 0. Otherwise, provide the basis for not including the QDCIS and NDCIS hardware in Table 6 of NEDO-33411. Please include, in your discussion, consideration of deterministic methods (e.g., defense-in-depth), and the expert panel’s deliberation for not including QDCIS and NDCIS hardware in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-38	Hilsmeier T	Basis for not including GDCS equalizing line squib valves F006 A, B, C, D in Table 6 of NEDO-33411	Basic event E50-SQV-CC-EQU_ALL represents common cause failure to open gravity driven cooling system (GDCS) equalizing line squib valves F006A,B,C,D (Section 4.6 of NEDO-33201, Revision 2) and is considered risk-significant in Table 17.1-2 of NEDO-33201. It is unclear as to whether these valves appear in the list of risk-significant SSCs in Table 6 of NEDO-33411, Revision 0. These valves should be included in the list of risk-significant SSCs in Table 6 of NEDO-33411. The staff requests that GEH include the GDCS equalizing line squib valves F006 A, B, C, D in Table 6 of NEDO-33411, Revision 0. Otherwise, provide the basis for not including these valves in Table 6 of NEDO-33411. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these valves in RAP.
17.4-39	Hilsmeier T	Basis for not including GDCS equalizing line check valves F007A,B,C,D in Table 6 of NEDO-33411	Basic event E50-UV_OC-EQU_ALL represents common cause failure of GDCS equalizing line check valves F007 A, B, C, D to remain open or plugged (Section 4.6 of NEDO-33201, Revision 2) and is considered risk-significant in Table 17.1-2 of NEDO-33201. It is unclear as to whether these check valves appear in the list of risk-significant SSCs in Table 6 of NEDO-33411, Revision 0. These check valves should be included in the list of risk-significant SSCs in Table 6 of NEDO-33411. The staff requests that GEH include the GDCS equalizing line check valves F007 A, B, C, D in Table 6 of NEDO-33411, Revision 0. Otherwise, provide the basis for not including these valves in Table 6 of NEDO-33411. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these valves in RAP.
17.4-40	Hilsmeier T	Basis for not including Low Voltage Distribution System in Table 6 of NEDO-33411	GEH did not include in Table 6 of NEDO-33411, Revision 0, the Low Voltage Distribution System (LVDS), which has an internal events RAW of about 400 (Tables 11.3-14 and 11.3-15 of NEDO-33201, Revision 2). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the Low Voltage Distribution System (LVDS). Otherwise, provide the basis for not including this system in Table 6 of NEDO-33411. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including LVDS in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-41	Hilsmeier T	Basis for not including RWCU/SDC in Table 6 of NEDO-33411	GEH did not include in Table 6 of NEDO-33411, Revision 0, the reactor water cleanup/shutdown cooling (RWCU/SDC) system. The evidence presented below suggests that the RWCU/SDC is risk-significant and should be included in RAP: - The internal events RAW for RWCU/SDC is about 350,000 (Tables 11.3-14 and 11.3-15 of NEDO-33201, Revision 2). - Basic events G31-XHE-FO-SDC (Operator Fails to Actuate RWCU/SDC Mode) and R-M6-G31 (Failure to Recover RWCU/SDC) are considered risk-significant operator actions in Table 17.1-3 of NEDO-33201, Revision 2, which may suggest that RWCU/SDC is risk-significant. - An important recovery action during shutdown is to recover at least one train after loss of both operating RWCU/SDCS trains. - The occurrence of a loss of RWCU/SDC during Mode 6 when the cavity is unflooded is risk-significant and has an internal events shutdown RAW of 479 (during Mode 6 with the vessel head removed, the ICS is not available for decay heat removal) (Table 16.6-4 of NEDO-33201, Revision 2). The staff requests that GEH include in Table 6 of NEDO-33411, Revision 0, the RWCU/SDC System. Otherwise, provide the basis for not including this system in Table 6 of NEDO-33411. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs), consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including RWCU/SDC in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-42	Hilsmeier T	Basis for not including the Leak Detection and Isolation System in Table 6 of NEDO-33411	The Leak Detection And Isolation System (LD&IS) is not considered risk-significant in Table 6 of NEDO-33411, Revision 0. The discussion presented below suggests that the LD&IS is risk-significant and should be included in RAP: - The ESBWR Internal Events Low-Power and Shutdown PRA did not assess breaks outside containment (BOCs); therefore, they are not included in the importance analyses. BOCs can originate only in the ICS, RWCU/SDC system, fuel and auxiliary pools cooling system (FAPCS) piping, or instrument lines, which are the only systems that remove reactor coolant from the containment during shutdown. The rest of the RPV vessel piping is isolated. The RWCU/SDC system, FAPCS, and ICS containment penetrations have redundant and automatic power-operated, safety-related containment isolation valves that close upon signals from the leakage detection and isolation system in Modes 5 and 6. The high reliability of the leakage detection and isolation system provides the basis for the screening of (1) shutdown LOCAs outside of containment and (2) operator-induced losses of reactor vessel inventory during shutdown. Therefore, the high reliability of the leakage detection and isolation systems is a key risk assumption. The staff requests that GEH provide the basis for considering the LD&IS system as not risk-significant. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs) as applicable, consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including LD&IS in RAP.
17.4-43	Hilsmeier T	Provide basis for not including Containment Isolation System in Table 6 of NEDO-33411	The Containment Isolation System (CIS) is not considered risk-significant in Table 6 of NEDO-33411, Revision 0. CIS provides: a) protection against release of radioactive materials to the environment as a result of accidents, and b) capability to isolate LOCAs outside containment due to breaks in ICS pipes, RWCU/SDC pipes, main steam pipes, and feedwater pipes (these are plausible breaks that could lead to a significant loss of RCS inventory outside of the containment building). The staff requests that GEH provide the basis for considering the CIS as not risk-significant. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs) as applicable, consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including CIS in RAP.

RAI Number	Reviewer	Question Summary	Full Text
17.4-44	Hilsmeier T	Provide basis for not including Main Control Room and Remote Shutdown Panels in Table 6 of NEDO-33411	The Main Control Room (e.g., 1E display and system controls) and Remote Shutdown Panels necessary to initiate important operator actions (e.g., valve position verifications, actuation of fire protection in low pressure coolant injection mode) are not considered risk-significant in Table 6 of NEDO-33411, Revision 0. The staff requests that GEH provide the basis for considering these SSCs as not risk-significant. Please include, in your discussion, the associated risk importance measures (e.g., RAWs and F-Vs) as applicable, consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including these components in RAP.
17.4-45	Hilsmeier T	Provide basis for not including ICS vent valves in Table 6 of NEDO-33411	Basic event B32-NONCONDENSE represents noncondensable gasses forming in ICS sufficiently to require venting (Section 4.2 of NEDO-33201, Revision 2). This is a phenomenological event and is assumed to occur with probability 1.0 in the ESBWR PRA. The ESBWR PRA fault trees show that this event can fail ICS if the ICS venting functions fail. The staff requests that GEH provide the basis for considering the ICS vent valves as not risk-significant. In your discussion, please provide the RAWs and F-Vs for operator action B32-OPERVENT (Operator fails to open vent). Also, discuss why common cause failures of the vent valves were not modeled across the vent lines. This common cause failure has the potential to fail multiple ICS loops, thus increasing the risk significance of these vent valves. Please include, in your discussion, the consideration of deterministic methods (e.g., defense-in-depth), and the expert panel's deliberation for not including ICS vent valves in RAP.
17.4-46	Hilsmeier T	Provide basis for not including SLC electrical heaters in Table 6 of NEDO-33411	The Standby Liquid Control System (SLC) electrical heaters are not included in Table 6 of NEDO-33411, Revision 0. The SLC electrical heaters provide defense-in-depth to ensure that the SLC room temperatures are maintained at or above the minimum required temperature in the event of the failure of the primary heating system. The staff requests that GEH provide the basis for considering the SLC electrical heaters as not risk-significant. Include, in your discussion, how the SLC electrical heaters are actuated (e.g., are the electrical heaters manually actuated or auto-actuated on low room temperature), and where is the SLC low room temperature alarmed (e.g., at a local panel, in the main control room).

RAI Number	Reviewer	Question Summary	Full Text
17.4-47	Hilsmeier T	Provide basis for not including risk-significant passive SSCs in Table 6 of NEDO-33411	In general, risk-significant passive SSCs (e.g., piping, tanks, fire barriers) were not included in Table 6 of NEDO-33411, Revision 0. The Reliability Assurance Program (RAP), in principle, applies to risk-significant active and passive systems, structures, and components (SSCs). During the design phase of RAP risk-significant SSCs are identified for inclusion in the program by using probabilistic, deterministic, and other methods (e.g., industry experience, expert panel). The purposes of RAP are to provide reasonable assurance that (SECY-95-132, May 22, 1995): 1) A reactor is designed, constructed, and operated in a manner that is consistent with the assumptions and risk insights for these risk-significant SSCs. 2) The risk-significant SSCs do not degrade to an unacceptable level during plant operations. 3) The frequency of transients that challenge SSCs are minimized. 4) These SSCs function reliably when challenged. The staff requests that GEH provide the basis for not including in Table 6 of NEDO-33411, Revision 0, these risk-significant passive SSCs (e.g., piping, tanks, fire barriers). Include, in your discussion, how the purposes of RAP are met through other programs/requirements (e.g., inspections, monitoring) for these risk-significant passive SSCs.

Enclosure

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