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Subject: **Response to NRC Request for Additional Information Letter No. 303 Related to ESBWR Design Certification Application – RAI Number 3.11-26 S01**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI originally transmitted via the Reference 1 letter. Enclosure 2 contains DCD markups associated with this response. Changes on the enclosed DCD pages that are associated with this RAI response are indicated by enclosing them with a box.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-121, Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 303, Related To ESBWR Design Certification Application, dated February 10, 2009
2. MFN 08-316, Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 166, Related To ESBWR Design Certification Application, dated March 28, 2008
3. MFN 08-606, Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application - Design of Structures, Components, Equipment, and Systems - RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27, dated October 31, 2008

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 303, Related to ESBWR Design Certification Application – RAI Number 3.11-26 S01
2. Response to Portion of NRC Request for Additional Information Letter No. 303, Related to ESBWR Design Certification Application – RAI Number 3.11-26 S01 - DCD Markup

cc:	AE Cubbage	USNRC (with enclosures)
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Enclosure 1

MFN 09-164

Response to NRC Request for

Additional Information Letter No. 303

Related to ESBWR Design Certification Application

RAI Number 3.11-26 S01

For historical purposes, the original text of RAI 3.11-26 and the GE response is included. The historical responses do not include any attachments or DCD mark-ups.

NRC RAI 3.11-26:

Revise Table 3H-5 to correct the integrated dose value listed for the Wetwell and describe how the equipment in the drywell will be protected from the high integrated doses listed for normal operating conditions.

In DCD Tier 2, Rev. 4, Table 3H-5 lists the operating dose rate and the 60-year integrated dose for various zones within the containment vessel.

a) The 60-year integrated dose of 1.7 E+2 R listed for the Wetwell appears to be in error since it is not a factor of 7.4 E+5 (number of hours in 60 years) greater than the operating dose of <1.4 R/hr listed in this table for the Wetwell. Revise this table to provide the correct integrated dose value in the Wetwell.

b) The 60-year integrated gamma doses listed in Table 3H-5 for the upper and lower drywell areas (plant zones b-1 through b-3) exceed the equipment qualification values for both electronic equipment (1E+4 rads) and other equipment (1E+6 rads) as stated in the footnote for Table 3H-6.

Describe the plant design features which will be used in these drywell areas to ensure that the radiation qualification limits of the equipment in these areas will not be exceeded.

GEH Response:

a) *Table* 3H-5 has been revised in DCD Revision 5 to correct the integrated dose for plant zone b-4, Wetwell.

b) *Specific* plant design features to maintain radiation exposure to equipment less than the equipment qualification levels inside the containment during normal operations will be evaluated during the detailed design process and in accordance with DCD Tier 1, Table 3.8-1. These analyses will evaluate each specific equipment location and determine design features needed to maintain integrated doses less than the qualification criteria for electronic equipment. If the integrated dose exceeds the equipment qualification values after the detailed calculations, shielding or other methods (e.g., equipment replacement program) to reduce the dose will be incorporated during the detailed design.

   A detailed description of the radiation environment qualification process is addressed in DCD Subsection 3.11.3 and in regard to equipment exceeding integrated dose levels. (MFN 08-086 S42)

DCD Impact:

DCD Tier 2, Subsection 3.11.6, Appendix 3H Subsection 3H.3.1, and Appendix 3H Table 3H-5 were revised and changes incorporated in Revision 5 of the DCD.

NRC RAI 3.11-26 S01:

Modify the DCD to describe what steps the applicant will take to reduce doses to equipment in the event that the calculated integraded dose to the equipment exceeds the equipment integraded dose qualification criteria for normal operating conditions.

In RAI 3.11-26, the staff requested that the applicant describe the plant design features which will be used in the drywell area listed in Table 3H-5 to ensure that the integraded dose equipment qualification criteria of the equipment in these areas will not be exceeded for normal operating conditions.

As part of the response to RAI 3.11-26, the applicant described the process of performing detailed calculations (in accordance with the ITAAC listed in DCD Tier 1 Table 3.8-1) to determine the integrated doses to mechanical and electrical equipment in different areas of the plant which are subject to various environmental conditions, including radiation. For those cases where the integrated dose to a piece of equipment exceeds the integrated dose qualification criteria for that piece of equipment, the applicant stated that it will commit to evaluate and incorporate specific plant design features, such as shielding or other methods (e.g., equipment replacement program), to reduce the integrated dose to that piece of equipment to levels below the equipment qualification criteria.

Although this process is clearly described in the response to RAI 3.11-26, it does not appear to be addressed in the DCD. In the January 27,2009 telecom with the GEH, GEH referenced the following sentence in Tier II Section 3.11.3.1 of the DCD as describing this process, "Plant-specific analysis is used to justify any reductions in dose or dose rate resulting from component location or shielding." The staff interprets this as stating that, during the detailed dose analysis, the component/equipment location and any adjacent shielding will be factored into the analysis when determining the integrated dose to that component or piece of equipment. This is not the same as saying that the applicant will consider the use of shielding or component relocation as a means of reducing the integrated dose to the component if the calculated integrated dose to the component exceeds the component qualification criteria. Please modify Section 3.11.3.1 of the DCD to more clearly address what steps the applicant will take to reduce the dose to equipment in the event that the integrated dose to equipment (determined as a result of the detailed calculations) exceeds the equipment integrated dose qualification criteria for normal operating conditions.

GEH Response:

DCD Section 3.11.3.1 is modified to more clearly address steps in the design process to reduce the dose to equipment in the event that the integrated dose to equipment (determined as a result of the detailed calculations) exceeds the equipment integrated dose qualification criteria for normal operating conditions, by adding the following:

"Specific plant design features to maintain radiation exposure to equipment less than the equipment qualification levels inside the containment during normal operations will

be evaluated during the detailed design process. These analyses will evaluate each specific equipment location and determine design features needed to maintain integrated doses less than the qualification criteria for electronic equipment. If the integrated dose exceeds the equipment qualification values after the detailed calculations, shielding or other methods (e.g., equipment replacement program) to reduce the dose will be incorporated during the detailed design."

DCD Impact:

DCD Tier 2, Section 3.11.3.1 will be revised in Revision 6, as noted in the attached markup, shown in Enclosure 2.

Enclosure 2

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Response to NRC Request for

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RAI Number 3.11-26 S01
DCD Markup

For EQ safety-related electrical equipment in mild environments, including computer based I&C, the qualification methods for humidity are by test or analysis. This ensures that EQ equipment is qualified for the worst-case humidity conditions per the requirements of IEEE 323.

Chemical effects

The assumed composition of chemicals is at least as severe as that resulting from the most limiting mode of plant operation (e.g., normal operation and borated water from the Standby Liquid Control System (SLCS)). There is no caustic containment spray in an ESBWR. The qualification for chemical exposure for EQ equipment in harsh environments is by test. This chemical exposure test ensures that EQ equipment is qualified for the worst-case chemical conditions per the requirements of IEEE 323. The EQ safety-related electrical equipment, including computer based I&C, in mild environments is not exposed to chemicals.

Radiation

The radiation environment is based on the type of radiation, the total dose expected during normal operation over the installed life of the equipment, and the radiation environment associated with the most severe DBA during or following which the equipment is required to remain functional, including the radiation resulting from recirculating fluids for equipment located near recirculating lines and including dose rate effects. Radiation exposure simulates radiation degradation for the total integrated dose applicable for the normal radiation dose. Accident dose may be added to the normal dose and a single radiation total dose applied by test. Equipment that has accident dose rate sensitivity is tested at the most degrading dose rate. EQ equipment is qualified for radiation. The qualification for radiation for EQ equipment in harsh environments is by test. The qualification radiation total integrated accident dose is 10% higher, to comply with margin requirements, than the maximum accident total integrated dose to which the equipment is exposed for the worst-case DBA.

EQ equipment that could be exposed to radiation is environmentally qualified to a radiation dose that simulates the calculated radiation environment (normal and accident) that the equipment should withstand prior to completion of its required safety-related functions. Such qualification considers that equipment damage is a function of total integrated dose and can be influenced by dose rate, energy spectrum, and particle type. The radiation qualification includes doses from all potential radiation sources at the equipment location. Specific plant design features to maintain radiation exposure to equipment less than the equipment qualification levels inside the containment during normal operations will be evaluated during the detailed design process. These analyses will evaluate each specific equipment location and determine design features needed to maintain integrated doses less than the qualification criteria for electronic equipment. If the integrated dose exceeds the equipment qualification values after the detailed calculations, shielding or other methods (e.g., equipment replacement program) to reduce the dose will be incorporated during the detailed design. Plant-specific analysis is used to justify any reductions in dose or dose rate resulting from component location or shielding. The foregoing defines how the qualification environment at the equipment location is established.

Shielded components are qualified only to the gamma radiation environment provided it can be demonstrated that the sensitive portions of the component or equipment are not exposed to significant beta radiation dose rates or that the effects of beta radiation, including heating and secondary radiation, have no deleterious effects on component performance. If, after considering