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Subject: Additional Information Related to NRC Request for Additional Information Letter No. 394 Related to ESBWR Design Certification Application – Dose Rates – RAI Number 12.2-28

The purpose of this letter is to submit GE Hitachi Nuclear Energy (GEH) additional response information to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) 12.2-28, sent by NRC Letter No. 394, Reference 1.

On January 18, 2010, GEH sent letter MFN 09-786, Supplement 1 (Reference 2) to the NRC to provide a partial response to Question 2, only, of the RAI. Enclosure 2 of that letter provided markups to the ESBWR DCD, Tier 2, Table 2.0-1 and Table 12.2-15 indicating a reduction of the long-term dispersion X/Q and D/Q values. Additional discussion of this topic is provided in Enclosure 1 of this letter. No additional DCD markups are deemed necessary at this time.

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

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 09-744, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, *Request for Additional Information Letter No. 394 Related to ESBWR Design Certification Application*, November 24, 2009
2. MFN 09-786, Supplement 1, Partial Response (Part 2) to NRC Request for Additional Information Letter No. 394 Related to ESBWR Design Certification Application – Dose Rates – RAI Number 12.2-28, January 19, 2010

Enclosure:

1. Additional Information Related to NRC Request for Additional Information Letter No. 394 Related to ESBWR Design Certification Application – Dose Rates – RAI Number 12.2-28

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Enclosure 1

MFN 09-786, Supplement 3

**Additional Information Related to NRC Request for
Additional Information Letter No. 394
Related to ESBWR Design Certification Application**

Dose Rates

RAI Number 12.2-28

NRC RAI 12.2-28

Section 12.2 of the Tier 2 FSAR, "Plant Sources," states in part:

"Airborne sources are calculated using the source terms given in Section 11.1. . . ."

Table 11.1-3 was revised in Revision 6 of the Tier 2 FSAR to indicate that the ratio of condensate demineralizer flow to steam flow is 66.3%, versus the previous 100%. The staff was unable to determine the specific rationale for the change.

The staff noted that this change appears to result in greater buildup of radionuclides in liquid inventory, instantaneous liquid effluent release rates, and other aspects of plant operation potentially affecting worker and public dose. However, there did not appear to be a corresponding analysis of the change in dose estimations, in particular regarding whether and to what extent the radionuclide concentrations as listed in Tables 11.1-4a through 11.1-7b would be affected by the change in the ratio of condensate demineralizer versus steam flow rate. The staff needs to evaluate the effect on release rates and dose.

Please explain:

1. The rationale that addresses the change in the ratio of condensate demineralizer flow to steam flow.
2. The effects on liquid and gaseous concentrations in systems and effluents, including any changes in public and population dose, and dose to the maximally exposed individual.
3. The interaction between the design basis and normal source term values in Section 11.1, and the doses listed in Section 12.2.
4. The effect of the changes to system radionuclide inventory on sources of in-plant exposure as described in Section 12.2.
5. Any implications for radiation protection design considerations (section 12.1.2 of the Tier 2 FSAR). The changes made to Table 11.1-3 appear to have resulted in increases in most or all of component activities listed in Tables 12.2-6 through 12.2-14. For each of these radioactive components,
 - a. Verify that you have performed a detailed analysis on the affected components to determine the effects of the increased component activity on the expected component dose rates.
 - b. Describe what effect the increase in component activity has on the dose rate levels and radioactive zone designations in the vicinity of each of these components (provide verification for your response) and reference

appropriate Section 12.3 plant layout figures where radiation zone increases have been made.

- c. Describe what effect the increase in component activity will have on the doses to personnel performing maintenance on these components (in particular, describe how the doses associated with liquid and solid waste handling operations (such as condensate demineralizer maintenance) will be affected).*
- d. Describe what effect the potential increase in component doses will have on the total plant collective dose described in DCD Tables 12.4-1 through 12.4-7.*
- e. In describing the basis of the dose assessment for the ESBWR design, Section 12.4 of the DCD states the dose rates listed in Tier 2 Tables 12.4-2 through 12.4-7 are based on a combination of ESBWR radiation zoning levels and "experiential" data based on previous and current BWR plant designs. RG 8.19, "Occupational Radiation Dose Assessment in Light Water Reactor Power Plants- Design Stage Man-Rem Estimates" states that "to the extent possible, estimates should include consideration of the design of the proposed plant, including radiation field intensities calculated on the basis of the plant-specific shielding design, taking into account the effect of any dose-reducing design changes." Describe to what extent the estimated average dose rates listed in Tier 2 Tables 12.4-2 through 12.4-7 are based on the actual estimated ESBWR radiation zoning levels as depicted in Tier 2 Figures 12.3-1 through 12.3-22 and provide representative examples from Tables 12.4-2 through 12.4-7 where actual estimated ESBWR dose rates are used.*

In reviewing Tier 2 Section 12.4 of Revision 6 of the DCD, the staff noted that there are several references to the fact that 100% of the condensate water will be processed through the demineralizer instead of the 66.3% as listed in revised (Revision 6) Tier 2 Table 11.1-3.

- 6. Modify the following sections of Tier 2 Section 12.4 to reflect the revised condensate cleanup percentage as reflected in Tier 2 Table 11.1-3:*

(Section 12.4.6, paragraph 4 of "Drywell" section) "In addition, deposited activity in the feedwater lines is expected to be lower than typical BWRs owing to an enhanced condensate system with full cleanup of all condensate water ..."

(Section 12.4.6, paragraph 4 of "Turbine Building" section) "Low-pressure feedwater drains from the feedwater heaters are cascaded back to the condenser, thus, all corrosion products from these drains are filtered via condensate filter/demineralizers before returning to the RPV."

GEH Additional Information

Note: Partial responses to question 2 of this RAI were provided in Letter MFN 09-786, dated December 14, 2009; Letter MFN 09-786, Supplement 1, dated January 19, 2010; and Letter MFN 09-786, Supplement 2, dated January 29, 2010.

This letter provides additional information in regard to Letter MFN 09-786, Supplement 1.

Question/Comment:

2. The effects on liquid and gaseous concentrations in systems and effluents, including any changes in public and population dose, and dose to the maximally exposed individual.

Response, Part 2 (Reference MFN 09-786, Supplement 1, dated January 19, 2010):

As a result of changes in the reactor coolant design basis concentrations, the ESBWR long-term dispersion estimates (X/Q and D/Q) were revised to ensure 10 CFR 50 Appendix I dose limits were not exceeded. The effect of the changes to the X/Q and D/Q values is shown in the updated DCD Tables 2.0-1 and 12.2-15.

Additionally the text in DCD Subsection 12.2.2.1 is revised to clarify that the X/Q and D/Q values simply bound a significant majority of the compiled data points for the evaluated locations. A sentence is also added to emphasize the need for a specific site to use its site-specific values in the determination of airborne dose evaluations.

The revised offsite gaseous effluent releases are shown in Table 12.2-16.

The revised airborne releases and concentration values are shown in Table 12.2-17.

The revised annual average doses from airborne releases are shown in Table 12.2-18b.

Additional Information Provided in this Letter:

To provide reasonable assurance that the reduction in the ESBWR long-term dispersion estimates (X/Q and D/Q) would not impact a potential site's ability to remain within 10 CFR 50 Appendix I airborne dose limits, GEH Engineering performed site-specific dose calculations for three sites potentially considering an ESBWR plant. These sites are: Grand Gulf, Victoria County and North Anna. Fermi was identified as another potential ESBWR site, however verified calculations are not yet available for Fermi.

For three of the four potential ESBWR sites, the calculated doses are within 10 CFR 50 Appendix I airborne dose limits. These calculations, available to the NRC for audit, provide confirmation that the ESBWR can be sited on a significant majority of potential locations, as stated in the DCD.

DCD Impact

The following DCD impacts and markup pages were provided via Letter MFN 09-786, Supplement 1 dated January 19, 2010:

DCD Tier 2, Table 2.0-1 will be revised (Revision 7).

DCD Tier 2, Subsection 12.2.2.1 will be revised (Revision 7).

DCD Tier 2, Tables 12.2-15 through 12.2-17 and 12.2-18b will be revised (Revision 7).

No additional DCD impacts were identified in regard to the additional information provided in this letter.