



**HITACHI**

**GE Hitachi Nuclear Energy**

Richard E. Kingston  
Vice President, ESBWR Licensing

PO Box 780 M/C A-55  
Wilmington, NC 28402-0780  
USA

T 910 819 6192  
F 910 362 6192  
rick.kingston@ge.com

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Subject: **Response to Portion of NRC Request for Additional Information Letter Number 233 Related to ESBWR Design Certification Application – Siting Issues – RAI Number 2.3-9 S02**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Supplemental Request for Additional Information (RAI) sent by NRC Letter 233 dated August 15, 2008 (Reference 1). The response to RAI Number 2.3-9 S02 is addressed in Enclosure 1. The original RAI Number 2.3-9 was provided in Reference 2, to which the GEH response was provided in Reference 3. Supplement 1 to RAI Number 2.3-9 was provided in Reference 4, to which the GEH response was provided in Reference 5.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The markup pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markups may not be fully developed and approved for inclusion in DCD Revision .

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

Sincerely,

Richard E. Kingston  
Vice President, ESBWR Licensing

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NR0

References:

1. MFN 08-648, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GE, *Request for Additional Information Letter Number 233 Related to ESBWR Design Certification Application*, dated August 15, 2008.
2. MFN 06-201, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, GE, *Request for Additional Information Letter Number 37 Related to ESBWR Design Certification Application*, dated June 21, 2006.
3. MFN 06-455, *Response to Portion of NRC Request for Additional Information Letter Number 37 Related to ESBWR Design Certification Application – Siting Issues – RAI Number 2.3-9*, dated November 13, 2006.
4. NRC (A. Johnson) to GE, Request for Additional Information, RAI 2.3-9 S01, dated May 30, 2007.
5. MFN 06-455 S01, Revision 1, *Response to Portion of NRC Request for Additional Information Letter Number 37 Related to ESBWR Design Certification Application – Siting Issues – RAI Number 2.3-9 S01*, dated August 20, 2008.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 233 Related to ESBWR Design Certification Application – Siting Issues - RAI Number 2.3-9 S02

cc: AE Cabbage      USNRC (with enclosure)  
RE Brown      GEH/Wilmington (with enclosure)  
DH Hinds      GEH/Wilmington (with enclosure)  
eDRF      0000-0081-1706 R3

**MFN 08-906**

**Enclosure 1**

**Response to Portion of NRC Request for Additional  
Information Letter No. 233 Related to ESBWR Design**

**Certification Application**

**Siting Issues**

**RAI Number 2.3-9 S02**

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The markup pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markups may not be fully developed and approved for inclusion in DCD Revision 6.

**NRC RAI 2.3-9 S02**

1. *Justify why the control room X/Q values used to model LOCA releases from the main condenser (as shown in DCD Tier 2, Table 15.4-5a) assume the Turbine Building remains intact; that is, why the Turbine Building height (49.4 m) and width (111.6 m) as shown in DCD Tier 2, Table 2A-3 are used to determine the diffuse source initial lateral and vertical plume spread parameters for LOCA releases from the main condenser.*

*The ESBWR LOCA is initiated by a seismic event. The main steam lines, main steam drain lines, and condensers are designed to meet Safe Shutdown Earthquake (SSE) criteria whereas the Turbine Building is not designed to meet SSE criteria. Consequently, instead of assuming the LOCA releases from the main condenser are diffuse releases where the Turbine Building remains intact, the release pathway should be the more conservative of (1) a diffuse release from the 10-meter-by-10-meter main condenser or (2) a diffuse release from the intact Turbine Building.*

2. *Justify why the Reactor Building and Fuel Building diffuse area source models are used to evaluate the fuel handling accident.*

*EWBWR Technical Specification 3.6.3.1 does not require the Reactor Building to be operational during Mode 6 (refueling) and the response to RAI 2.3-9 S01, item d(iii) states that [[a preliminary analysis shows that the X/Q values associated with the doors on the east side of the Reactor Building and Fuel Building are not bounded by the Reactor Building or Fuel Building diffuse source X/Q values. If this preliminary analysis is correct, then]] the Reactor Building and Fuel Building diffuse area source models should not be used to evaluate the fuel handling accident. COL information Item 2A.2-2-A states that any door on the east sides of the Reactor Building and Fuel Building must be administratively controlled prior to and during the movement of irradiated fuel bundles such that these doors are promptly closed under conditions indicative of a fuel handling accident. However, Footnote 3 under Section 5.3 of Appendix B to RG 1.183 states that radiological analyses should generally not credit for such manual isolation of the containment (e.g., ESBWR Reactor Building and Fuel Building).*

*Because the Fuel Building and Reactor Building ventilation systems discharge to the Reactor Building/Fuel Building ventilation stack, the applicant should also discuss why this stack is not considered to be a potential release pathway for the fuel handling accident.*

3. *Revise Technical Specification 3.6.3.1 to include administrative controls to close the doors on the east side of the Reactor Building and Fuel Building within 30 minutes under conditions indicative of a fuel handling accident.*

*Section 5.3 of Appendix B to RG 1.183 states that if the containment (e.g., ESBWR Reactor Building or Fuel Building) is open during fuel handling operations, the technical specifications allowing such operations should include administrative controls to close the open penetrations within 30 minutes. Such administrative controls will generally require that a dedicated individual be present, with necessary equipment available, to restore containment closure should a fuel handling accident occur.*

**GEH Response:**

**(Item 1)**

The heights and widths of the Turbine Building diffuse source were determined as described in regulatory position 3.2.4.5 of Regulatory Guide 1.194, as detailed in the response to RAI 2.3-9 S01 (MFN 06-455 S01 sent on August 20, 2008).

It should be noted that the ESBWR design basis LOCA conservatively considers the combined effects of a LOCA and an SSE, but does not assume that a Seismic event initiates a LOCA as indicated in item 1 of this RAI (reference DCD Section 15.4.4.1). However, the Turbine Building has recently been re-classified as Seismic Category II, which alleviates the need to evaluate a diffuse release from the main condenser.

**GEH Response:**

**(Item 2)**

It should be noted that for DCD Revision 5 the identifier "Diffuse Source" was removed from the RB and FB X/Q sets in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1 because those values have been expressly selected to bound all postulated point or diffuse releases in those buildings. To confirm the DCD RB and FB CR X/Q values bound all potential releases from those buildings, GEH added subsections 2A.2.4 and 2A.2.5, and the associated COL items 2A.2-1-A and 2A.2-2-A to DCD Revision 5 Tier 2 Appendix 2A. In performing the confirmation of X/Q values described in those COL items with site-specific data, the COL applicant will demonstrate the building values are bounding.

GEH agrees that the ability to promptly close the doors on the East sides of the Reactor Building or Fuel Building does not comply with Footnote 3 under Section 5.3 of Appendix B of RG 1.183. To ensure the DCD RB and FB CR X/Q values comply with RG 1.183 Appendix B Footnote 3, GEH has modified the COL applicant instructions in DCD subsection 2A.2.5, as shown below (and in the Enclosure).

“The COL applicant shall confirm that during movement of irradiated fuel bundles none of the doors or personnel air locks on the East sides of the Reactor Building or Fuel Building could act as a point source with control room X/Q values that would result in doses greater than the bounding dose consequence reported for the FHA (Table 15.4-4). If the X/Q values for a release from any door or personnel air lock on the East sides of the Reactor Building or Fuel Building have X/Q values that generate dose consequences greater than the bounding dose consequence reported in Table 15.4-4, the affected doors or personnel air locks are administratively controlled to remain closed during movement of irradiated fuel bundles. (Section 2A.3, Item 2A.2-2-A)

GEH considers the RB/FB ventilation stack to be a potential release pathway. Appendix 2A Tables 2A-3 and 2A-4 of DCD Revision 5 includes point source cases for the potential RB ventilation stack source for the control room receptors. As directed by COL Item 2A.2-1-A, the COL applicant must confirm those cases are bounded by the ESBWR X/Q values as well as all other source/receptor pairs listed in Tables 2A-3 and 2A-4 using site-specific meteorological data. As stated in footnote 11 to DCD Tier 2 Table 2.0-1, if a selected site has a X/Q value that exceeds the ESBWR reference site value, the COL applicant will address how the radiological consequences associated with the controlling design basis accident continues to meet the dose reference values provided in 10 CFR 52.79(a)(1)(vi) and control room operator dose limits provided in General Design Criterion 19 using site-specific X/Q values (as provided in the response to RAI 2.0-2 sent as MFN 08-792 issued on 10/23/08).

**GEH Response:**  
**(Item 3)**

The aforementioned revision to DCD Appendix 2A subsection 2A.2.5 precludes revising Technical Specification 3.6.3.1 because the doors or personnel air locks on the East sides of the RB and FB will be required to be closed during movement of irradiated fuel bundles if the X/Q values for a release from those doors or personnel air locks on the East sides of the Reactor Building or Fuel Building have X/Q values that generate dose consequences greater than the bounding dose consequence reported in Table 15.4-4.

**DCD IMPACT**

DCD Tier 2, Appendix 2A will be revised in Revision 6 as noted in the attached markup.

**Distance**

These distances are the source-to-receptor distances and are the shortest horizontal distances between the release points and the intakes.

**Release Height**

For diffuse sources in Table 2A-1, the release height is set at the vertical center of the projected diffuse source plane above grade. For point sources the release heights are taken to be the vertical distance from plant grade to the center of the release points.

**Building Area**

Areas are provided for the buildings that have the largest impact on the building wakes within the wind direction window for a given source/receptor pair.

**Intake Height**

The actual intake heights are provided in Table 2A-1, and are taken to be the vertical distance from plant grade to the center of the intakes.

**Total Height**

The total heights are the above grade heights of the buildings where diffuse sources are modeled. Building heights are not directly used by ARCON96. They are used to calculate the initial vertical plume spread parameter ( $\sigma_{y0}$ ) as well as to determine the diffuse source area and release heights.

**Total Width**

The "total width" column of Table 2A-3 provides widths of the area sources that are the maximum horizontal dimensions of the above-grade building cross-sectional areas perpendicular to the lines of sight from the building centers to the closest emergency or normal air control room intakes. For point sources this parameter is not applicable (N/A).

 **$\sigma_{y0}$  and  $\sigma_{z0}$** 

These values are the initial lateral and vertical plume spread parameters calculated using Formulas 3 and 4 of RG 1.194.

**2A.2.4 Confirmation of the ESBWR X/Q Values**

When referencing the ESBWR DCD to confirm that site characteristics at a given site are bounded by the ESBWR DCD site parameter values per 10 CFR 52.79, the COL applicant shall perform ARCON96 determinations for all source/receptor pairs listed in Tables 2A-3 and 2A-4 using site-specific meteorological data (as defined in Regulatory Guide 1.23, Reference 2A-2). (Section 2A.3, Item 2A.2-1-A) Figure 2A-1 shows the locations of the sources and receptors for ESBWR Control Room determinations. The dimensions of the diffuse source planes provided in Table 2A-3 were determined as directed by Regulatory Position 3.2.4.5 of Regulatory Guide 1.194 for the nearest receptor locations.

**2A.2.5 Confirmation of the Fuel Building and Reactor Building X/Q Values**

The COL applicant shall confirm that during movement of irradiated fuel bundles ~~refueling~~ none of the doors or personnel air locks on the East sides of the Reactor Building or Fuel Building

could act as a point source ~~that could result in~~with control room X/Q values that would result in doses greater than the bounding dose consequence reported for the FHA (Table 15.4-4), ~~are higher than the ESBWR X/Q values for a release in the Reactor Building.~~ If the X/Q values for a release from any door or personnel air lock on the East sides of the Reactor Building or Fuel Building have X/Q values that generate dose consequences greater than the bounding dose consequence reported in Table 15.4-4, ~~are not bounded by the ESBWR X/Q values for a release in the Reactor Building,~~ the affected doors or personnel air locks ~~must be~~ administratively controlled ~~prior to movement of irradiated fuel bundles, and~~ to remain closed during movement of irradiated fuel bundles. ~~The administrative controls must be such that the doors and personnel air locks on the East sides of the Reactor Building or Fuel Building are promptly closed under conditions indicative of a fuel handling accident.~~ (Section 2A.3, Item 2A.2-2-A)

### 2A.3 COL Information

#### 2A.2-1-A Confirmation of the ESBWR X/Q Values

When referencing the ESBWR DCD to confirm that site characteristics at a given site are bounded by the ESBWR DCD site parameter values per 10 CFR 52.79, the COL applicant shall perform ARCON96 determinations for all source/receptor pairs listed in Tables 2A-3 and 2A-4 using site-specific meteorological data. (Subsection 2A.2.4)

#### 2A.2-2-A Confirmation of the Reactor Building X/Q Values

If the X/Q values for a release from any door or personnel air lock on the East sides of the Reactor Building or Fuel Building have X/Q values that would result in doses greater than the bounding dose consequence reported for the FHA (Table 15.4-4), ~~are not bounded by the ESBWR X/Q values for a release in the Reactor Building,~~ the affected doors or personnel air locks ~~must be~~ administratively controlled ~~prior to movement of irradiated fuel bundles, and~~ to remain closed during movement of irradiated fuel bundles. ~~The administrative controls must be such that the doors and personnel air locks on the East sides of the Reactor Building or Fuel Building are promptly closed under conditions indicative of a fuel handling accident.~~ (Subsection 2A.2.5)

### 2A.4 References

- 2A-1 US Nuclear Regulatory Commission, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," Regulatory Guide 1.194, Revision 0.
- 2A-2 US Nuclear Regulatory Commission, "Onsite Meteorological Programs," Regulatory Guide 1.23, Revision 0.