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Subject: **Response to Portion of NRC Request for Additional Information  
Letter No. 37 Related to ESBWR Design Certification Application –  
Siting Issues – RAI Numbers 2.1-2, 2.3-7, 2.3-8, 2.3-10, 14.3-23, 14.3-  
24, 14.3-25, and 15.3-2**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the  
Reference 1 letter.

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

Sincerely,

*Kathy Sedney for*

David H. Hinds  
Manager, ESBWR

Reference:

1. MFN 06-201, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application*, June 21, 2006

Enclosure:

1. MFN 06-396 – Response to Portion of NRC Request for Additional Information Letter No. 37 Related to ESBWR Design Certification Application – Siting Issues – RAI Numbers 2.1-2, 2.3-7, 2.3-8, 2.3-10, 14.3-23, 14.3-24, 14.3-25, and 15.3-2

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**ENCLOSURE 1**

**MFN 06-396**

**Response to Portion of NRC Request for  
Additional Information Letter No. 37  
Related to ESBWR Design Certification Application  
Siting Issues**

**RAI Numbers 2.1-2, 2.3-7, 2.3-8, 2.3-10, 14.3-23,  
14.3-24, 14.3-25, and 15.3-2**

NRC RAI 2.1-2

*Why is the exclusion area boundary defined as “an area whose boundary has a Chi/Q of less than or equal to  $1.0 \times 10^{-3} \text{ s/m}^3$ ”? The X/Q values for the instrument line break accident and spent fuel cask drop accident are larger than this value. Further, some of the values in the GESTAR report, DCD reference 15.3-3, are also larger.*

GE Response

The exclusion area boundary (EAB) original definition as “an area whose boundary has a Chi/Q of less than or equal to  $1.0 \times 10^{-3} \text{ s/m}^3$ ” was merely to provide the EAB definition in terms of the X/Q value. It is proposed that the EAB original definition be deleted from Table 2.0-1.

The EAB X/Q value is being revised to  $2.00\text{E-}03 \text{ s/m}^3$  (taken from NEDE-33279P, “ESBWR Containment Fission Product Removal Evaluation Model”), as discussed in the response to RAI 2.3-8. GE is aware that the X/Q values in some of the design basis accident (DBA) analyses in DCD Tier 2, Chapter 15 are greater than this X/Q value. These DBA analyses will be revised to incorporate the new EAB X/Q value, and the revised results will be provided in Revision 3 of DCD Tier 2.

Discussion of the X/Q with respect to the GESTAR report is provided in the response to RAI 15.3-2.

NRC RAI 2.3-7

*Please confirm that the short-term exclusion area boundary, low population zone and control room X/Q values are reference values and not a function of any of the design features of the ESBWR. The DCD should state that the COL applicant will compare the site-specific X/Q values with the reference X/Q values in the DCD and state what the COL applicant should do if the site-specific X/Q values exceed the reference X/Q values in the DCD.*

GE Response

It is confirmed that the short-term exclusion area boundary (EAB), low population zone (LPZ) and control room X/Q values are reference values and not a function of any of the design features of the ESBWR.

With respect to the statement that the DCD should state that the COL applicant will compare the site-specific X/Q values with the reference X/Q values in the DCD and state what the COL applicant should do if the site-specific X/Q values exceed the reference X/Q values in the DCD, a revision to the ESBWR DCD will be made. The following statement will be added to Revision 3 of DCD Tier 2, Chapter 2:

“For a site selected that exceeds the bounding X/Q values, the COL applicant will address how the radiological consequences associated with the controlling design basis accident continue to meet the dose reference values provided in 10 CFR 50.34 and control room operator dose limits provided in General Design Criterion 19 using site-specific X/Q values.”

NRC RAI 2.3-8

*Exclusion area boundary X/Q values for the 0-2 hour time period and low population zone X/Q values for the 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods should be provided in DCD Tier 2, Table 2.0-1. Control room X/Q values for the 0-2 hour, 2-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods should also be provided in Table 2.0-1. Table 2.0-1 should also reference Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants." Regulatory Guide 1.145 which addresses generation of EAB and LPZ X/Q values is cited in the table, but does not address generation of control room X/Q values.*

GE Response

Exclusion area boundary (EAB) X/Q values for the 0-2 hour time period and low population zone (LPZ) X/Q values for the 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods will be provided in Revision 3 of DCD Tier 2, Table 2.0-1. Control room X/Q values for the 0-2 hour, 2-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods will also be provided in the revised Table 2.0-1. Table 2.0-1 will also reference Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants."

The current format of DCD Tier 2, Chapter 2 is being revised. In lieu of providing a marked-up copy of Table 2.0-1, the revised EAB, LPZ, and control room X/Q values are taken from Tables 5 and 6 of NEDE-33279P, "ESBWR Containment Fission Product Removal Evaluation Model," and provided below.

EAB X/Q:

0-2 hours: 2.00E-03 s/m<sup>3</sup>

LPZ X/Q:

0-8 hours: 1.90E-04 s/m<sup>3</sup>

8-24 hours: 1.40E-04 s/m<sup>3</sup>

1-4 days: 7.50E-05 s/m<sup>3</sup>

4-30 days: 3.00E-05 s/m<sup>3</sup>

Control Room X/Q:

Reactor Building Leakage East Wall Diffuse Release

0-2 hours: 2.10E-03 s/m<sup>3</sup>

2-8 hours: 1.70E-03 s/m<sup>3</sup>

8-24 hours:	5.80E-04 s/m <sup>3</sup>
1-4 days:	5.70E-04 s/m <sup>3</sup>
4-30 days	5.20E-04 s/m <sup>3</sup>

Reactor Building Roof Point Release

0-2 hours:	4.00E-03 s/m <sup>3</sup>
2-8 hours:	3.30E-03 s/m <sup>3</sup>
8-24 hours:	1.40E-03 s/m <sup>3</sup>
1-4 days:	1.20E-03 s/m <sup>3</sup>
4-30 days	1.00E-03 s/m <sup>3</sup>

Turbine Building Condenser Diffuse Release

0-2 hours:	1.80E-03 s/m <sup>3</sup>
2-8 hours:	1.60E-03 s/m <sup>3</sup>
8-24 hours:	6.20E-04 s/m <sup>3</sup>
1-4 days:	5.70E-04 s/m <sup>3</sup>
4-30 days	4.20E-04 s/m <sup>3</sup>

Similarly, because the current format of DCD Tier 2, Chapter 2 is being revised, the text in DCD, Tier 2 Table 2.0-1 Revision 1 (item 2.3.4 of the table) will be revised as follows.

“COL applicant to supply site-specific information in accordance with the SRP 2.3.4 to show that the site meteorological dispersion values as calculated in accordance with Regulatory Guides 1.145 and 1.194, and compared to dose values given in Chapter 15, result in doses less than stipulated in 10 CFR 50.34(a) and the applicable portions of SRP Sections 11 and 15.”

This revised text will be provided in Revision 3 of DCD, Tier 2.

NRC RAI 2.3-10

*Confirm that the long-term dispersion estimates are reference values only and are not a function of the ESBWR design and list them in DCD Tier 2, Table 2.0-1. The DCD should state that the COL applicant will compare the site-specific X/Q and relative deposition (D/Q) values with the reference X/Q and D/Q values in the DCD and state what the COL applicant should do if the site-specific X/Q or D/Q values exceed the reference X/Q or D/Q values in the DCD.*

GE Response

The long-term dispersion estimates are reference values only and are not a function of the ESBWR design. A discussion of the generation of these values is provided in DCD Tier 2, Subsection 12.2.2.1. These long-term dispersion estimates will be listed in DCD Tier 2, Table 2.0-1.

The long-term dispersion estimates are as follows:

X/Q:  $2.0E-06 \text{ s/m}^3$

D/Q:  $4.0E-09 \text{ m}^{-2}$

With respect to the statement that the DCD should state that the COL applicant will compare the site-specific X/Q and D/Q values with the reference X/Q and D/Q values in the DCD and state what the COL applicant should do if the site-specific X/Q or D/Q values exceed the reference X/Q or D/Q values in the DCD, a revision to the ESBWR DCD will be made. The following statement will be added to Revision 3 of DCD Tier 2, Chapter 2:

“If a selected site has a X/Q value that exceeds the ESBWR reference site value, the release concentrations in Table 12.2-17 would be adjusted proportionate to the change in X/Q. In addition, for a site selected that exceeds the bounding X/Q or D/Q values, the COL applicant will address how the resulting annual average doses (Table 12.2-18b) continue to meet the dose reference values provided in 10 CFR 50 Appendix I using site-specific X/Q and D/Q values.”



NRC RAI 14.3-23

*Why is the exclusion area boundary defined in DCD Tier 1, Table 5.5-1 as “an area whose boundary has a  $Chi/Q$  of less than or equal to  $1.0 \times 10^{-3} \text{ s/m}^3$ ”? The  $X/Q$  values for the instrument line break accident and spent fuel cask drop accident are larger than this value.*

GE Response

As stated in the response to RAI 2.1-2, the exclusion area boundary (EAB)  $X/Q$  values for the instrument line break accident and spent fuel cask drop accident are larger than  $1.0\text{E-}03 \text{ s/m}^3$ . The  $X/Q$  values for these accidents (and the resulting doses) will be modified DCD Tier 2, Revision 3 to be consistent with the new revised EAB  $2.00\text{E-}03 \text{ s/m}^3$  value (taken from NEDE-33279P, “ESBWR Containment Fission Product Removal Evaluation Model”).

NRC RAI 14.3-24

*Low population zone X/Q values for the 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods should be should be provided in DCD Tier 1, Table 5.1-1. Control room X/Q values for the 0-2 hour, 2-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods should also be provided in Table 5.1-1.*

GE Response

Low population zone X/Q values for the 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods will be provided in Revision 3 of DCD Tier 1, Table 5.1-1. Control room X/Q values for the 0-2 hour, 2-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods will also be provided in the revised Table 5.1-1.

The proposed additions to Tier 1, Table 5.1-1 , taken from Tables 5 and 6 of NEDE-33279P, "ESBWR Containment Fission Product Removal Evaluation Model," are provided on the following 3 pages.

**Table 5.1-1**  
**Site Parameters**

Parameter	Value
Exclusion Area Boundary (EAB):	0-2 hours: 2.00E-03 s/m <sup>3</sup>
Low Population Zone (LPZ) X/Q:	0-8 hours: 1.90E-04 s/m <sup>3</sup>
	8-24 hours: 1.40E-04 s/m <sup>3</sup>
	1-4 days: 7.50E-05 s/m <sup>3</sup>
	4-30 days: 3.00E-05 s/m <sup>3</sup>
Control Room X/Q:	<b>Reactor Building Leakage East Wall Diffuse Release</b>
	0-2 hours: 2.10E-03 s/m <sup>3</sup>
	2-8 hours: 1.70E-03 s/m <sup>3</sup>
	8-24 hours: 5.80E-04 s/m <sup>3</sup>
	1-4 days: 5.70E-04 s/m <sup>3</sup>
	4-30 days: 5.20E-04 s/m <sup>3</sup>
	<b>Reactor Building Roof Point Release</b>
	0-2 hours: 4.00E-03 s/m <sup>3</sup>
	2-8 hours: 3.30E-03 s/m <sup>3</sup>
	8-24 hours: 1.40E-03 s/m <sup>3</sup>
	1-4 days: 1.20E-03 s/m <sup>3</sup>
	4-30 days: 1.00E-03 s/m <sup>3</sup>
	<b>Turbine Building Condenser Diffuse Release</b>
	0-2 hours: 1.80E-03 s/m <sup>3</sup>
	2-8 hours: 1.60E-03 s/m <sup>3</sup>
	8-24 hours: 6.20E-04 s/m <sup>3</sup>
	1-4 days: 5.70E-04 s/m <sup>3</sup>
	4-30 days: 4.20E-04 s/m <sup>3</sup>

**Table 5.1-1**  
**Site Parameters**

<b>Parameter</b>	<b>Value</b>
Extreme Wind: Basic Wind Speed:	49.2 m/s <sup>(1)</sup> / 62.6 m/s <sup>(2)</sup>
Design Ambient Temperatures: 1% Exceedance Values Maximum: Minimum: 0% Exceedance Values (Historical Limit) Maximum: Minimum:	37.8°C dry bulb/26.1°C wet bulb (coincident), 27.8°C wet bulb (non-coincident) -23.3°C 46.1°C dry bulb/26.7°C wet bulb (coincident), 29.4°C wet bulb (non-coincident) -40.0°C
Precipitation (for Roof Design): Maximum rainfall rate: Maximum snow load:	49.3 cm/hr <sup>(3)</sup> 2.39 kPa
Tornado: Maximum tornado wind speed: Translational velocity Radius: Maximum pressure drop: Rate of pressure drop: Missile Spectra:	147.5 m/s 31.3 m/s 45.7 m 16.6 kPa 11.7 kPa/s Spectrum I of SRP 3.5.1.4
Maximum Ground Water Level:	0.61 m below grade
Maximum Flood (or Tsunami) Level:	0.30 m below grade or less
Seismology <sup>(4)</sup> : SSE Response Spectra:	See Figures 5.1-1 and 5.1-2

**Table 5.1-1**  
**Site Parameters**

<b>Parameter</b>	<b>Value</b>
Soil Properties:	
Minimum Static Bearing Capacity:	718 kPa
Minimum Shear Wave Velocity:	300 m/s <sup>(5)</sup>
Liquefaction Potential:	None at the site-specific SSE level

NRC RAI 14.3-25

*DCD Tier 2, Chapter 14.3, states that the site parameters represent a bounding envelop of site conditions for license applications referencing the ESBWR. Does this include the X/Q values? NRC staff notes that some of the X/Q values listed (e.g., a single control room X/Q value of  $1.0 \times 10^{-3} \text{ sec/m}^3$ ) may not be bounding when compared with the X/Q values for some of the currently operating reactors. However, NRC staff also notes that the resultant calculated doses for the ESBWR DCD are not as high as the regulatory limits. Thus, the X/Q values used at the COL stage could be somewhat higher than those presented in the DCD and still meet regulatory limits if other inputs to the dose assessment are not changed. Please address what the COL applicant should do if the X/Q values for a specific site are higher than the reference X/Q values given in the DCD.*

GE Response

Directions for the COL applicant if the site-specific X/Q values are higher than the DCD reference X/Q values are provided in the responses to RAIs 2.3-7 and 2.3-10.

NRC RAI 15.3-2

*The GESTAR topical report references X/Q values that are more limiting than that in DCD Tier 2, Tables 2.0.1 and 14.5.3. Why is it acceptable to use the less limiting X/Q value as the reference value?*

GE Response

The X/Q value in the GESTAR report (DCD reference 15.3-3) of  $1.67E-03$  s/m<sup>3</sup> reflects the X/Q that results in the 30 Rem thyroid dose regulatory limit. This is reflected in section B.4.1.3 of the GESTAR report. It should not be compared to the revised ESBWR  $2.00E-03$  s/m<sup>3</sup> EAB bounding X/Q (taken from NEDE-33279P, "ESBWR Containment Fission Product Removal Evaluation Model"). The X/Q value in the GESTAR report was used to calculate the bounding non-alternate source term (AST) (10 CFR 100) offsite thyroid dose, while the ESBWR X/Q value was used to calculate the AST (10 CFR 50.34(a)) offsite TEDE dose. These X/Qs should not be directly compared to one another for this reason, as the doses being compared are completely different and are based on different regulatory criteria.

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