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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 245 Related to ESBWR Design Certification Application - Containment Systems - RAI Number 6.2-195**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1 letter.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-658, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 245 Related to ESBWR Design Certification Application*, August 20, 2008

Enclosure:

1. MFN 08-928 - Response to Portion of NRC Request for Additional Information Letter No. 245 Related to ESBWR Design Certification Application - Containment Systems - RAI Number 6.2-195

cc:

AE Cubbage	USNRC (with enclosure)
DH Hinds	GEH/Wilmington (with enclosure)
RE Brown	GEH/Wilmington (with enclosure)
eDRF	0000-0093-0819

Enclosure 1

MFN 08-928

Response to Portion of NRC Request for Additional Information Letter No. 245 Related to ESBWR Design Certification Application

Containment Systems

RAI Number 6.2-195

NRC RAI 6.2-195:

1. *In reviewing TRACG nodalization for the ESBWR in Chapter 6 of the DCD/Tier 2, the following differences were noted between Figure 6.2-7 and Figure 6B-2:*
   - A. *The definition of Levels is different. Why does Figure 6B-2 begin at L0 and end at L18; while Figure 6.2-7 begins at L21 and ends at L42?*
   - B. *Why has the radius nodalization been labeled differently between Figure 6.2-7 and Figure 6B-2?*
   - C. *The Dryer/Separator Storage Pool is shown in Figure 6.2-7 but not in Figure 6B-2. Please explain why.*
   - D. *Why are 2 PCCs in R3 & R4 labeled in Figure 6.2-7 but not shown in Figure 6B-2?*
   - E. *Why are 4 PCCs in R6 &7 shown in Figure 6.2-7 and not in Figure 6B-2?*
   - F. *Why are PIPES 81 and 82 horizontal in Figure 6.2-7 but vertical in Figure 6B-2?*
   - G. *Where has the Heat Exchanger labeled by PIPE91, PIPE95, TEE21, and TEE25 been accounted for in Figure 6.2-7?*
   - H. *What is the significance of not including PUMP 520, PUMP 850, TEE 52, and TEE 85 in Figure 6B-2?*
   - I. *Why is the GDCS outlined on the left side between L32 and L35 of Figure 6.2-7 but not outlined in Figure 6B-2?*
   - J. *What are the differences between DPV12 in Figure 6.2-7 and VLVE12, 13, 19 in Figure 6B-2?*
   - K. *What is the difference between SRV192 and SRV193 located between L24 and L26 in Figure 6.2-7 and VLVE24, 28 located between L1 and L0 in Figure 6B-2?*
   - L. *Why is the direction of VLVE07 changed between Figures 6.2-7 and Figure 6B-2?*
   - M. *Why are TEE62 and TEE63 and associated PIPES and VLVEs placed on both sides of Figure 6B-2 but are not included in Figure 6.2-7?*
   - N. *Why is TEE35 located on the bottom of Figure 6B-2, but not in Figure 6.2-7?*
   - O. *Explain the differences in labeling the RPV nodalization (i.e. DW HEAD AIR SPACE vs. STEAM DOME).*
   - P. *VSSL is not labeled in the bottom left corner of Figure 6.2-7 while it is labeled in the bottom left corner of Figure 6B-2. Please explain the reason for its placement and its necessity between each figure.*
2. *In reviewing TRACG nodalization for the ESBWR in Chapter 6 of the DCD/Tier 2 the following differences were noted between Figures 6.2-7 and 6B-3:*
   - A. *The definition of Levels is different. Why does Figure 6B-3 begin at L21 and end at L39; while Figure 6.2-7 begins at L21 and ends at L42?*

B. *Why is the radius nodalization labeled differently between Figure 6.2-7 and 6B-3?*

C. *The Dryer/Separator Storage Pool is shown in Figure 6.2-7 but not in Figure 6B-3. Please explain why.*

D. *Why are 2 PCCs in R3 & R4 labeled in Figure 6.2-7 but not shown in Figure 6B-3?*

E. *Why are 4 PCCs in R6 &7 shown in Figure 6.2-7 and not in Figure 6B-3?*

F. *Why are PIPES 81 and 82 horizontal in Figure 6.2-7 but vertical in Figure 6B-3?*

G. *Why are heat exchangers labeled PIPE91 and TEE25 shown in Figure 6B-3 but not in Figure 6.2-7?*

H. *Why is the labeling of the RPV different between Figures 6B-3 and 6.2-7?*

I. *What are the differences between DPV12 in Figure 6.2-7 and VLVE12, 13, 19 in Figure 6B-3?*

J. *What is the difference between SRV192 and SRV193 located between L24 and L26 in Figure 6.2-7 and VLVE24, 28 located between L22 and L24 in Figure 6B-3?*

K. *Why is the RPV labeled below 0.00m in Figure 6B-3 from L1 to L21?*

L. *Valve 282 and 281 have been labeled in Figure 6.2-7, please explain why they are not labeled in Figure 6B-3.*

M. *What are the differences between VLVE7 in Figure 6B-3 and Figure 6.2-7?*

N. *Why is TEE35 labeled on L21 in Figure 6B-3, however not in Figure 2.2-7?*

3. *In reviewing TRACG nodalization for the ESBWR in Chapter 6 of DCD/Tier 2, the following differences were noted between Figures 6.2-7 and 6B-4:*

A. *The Dryer/Separator Storage Pool is shown in Figure 6.2-7 but not in Figure 6B-4. Please explain why.*

B. *Why are heat exchangers labeled PIPE 91, TEE21, PIPE 95, and TEE25 included in Figure 6B-4 but not in Figure 6.2-7?*

C. *Pump 850 and TEE85 are labeled in Figure 6.2-7, however they are not shown in Figure 6B-4. Please explain the reasoning for these differences.*

D. *Pump 520 and TEE52 are also labeled in Figure 6.2-7, however they are not shown in Figure 6B-4. Please explain the reasoning for these differences.*

E. *Why are PIPES 81 and 82 horizontal in Figure 6.2-7 and vertical in Figure 6B-4?*

F. *What are the differences between the representations of the RPV in Figure 6B-4 and Figure 6.2-7? Why is the RPV below L21 as well?*

G. *What is the difference between SRV192 and SRV193 located between L24 and L26 in Figure 6.2-7 and the unlabeled valve located between L24 and L26 in Figure 6B-4?*

H. What are the differences between VLVE7 in Figure 6B-4 and Figure 6.2-7.

I. What are the differences between the VLVE 12, 13, 19 labeled in Figure 6B-4 and DPV 12 labeled in Figure 6.2-7.

GEH Response:

The nodalization figures found in DCD Tier 2, Revision 5, Appendix 6B (Figures 6B-2, 6B-3, and 6B-4) are provided as tieback illustrations to the approved Licensing Topical Report (LTR) NEDC-33083P-A, March 2005 (Reference 1). During the development and evolution of the ESBWR design, changes have been made to the original nodalization presented in that LTR. In order to accurately analyze the ESBWR for reactor pressure vessel level and containment pressure responses after a loss-of-coolant accident (LOCA), the TRACG model must be updated to reflect the most current design. Due to this fact, the nodalization diagrams produced for Reference 1 will not remain representative of the ESBWR during the certification process.

DCD Tier 2, Figures 6B-3 and 6B-4 show, respectively, the first and second combined nodalization of the Emergency Core Cooling Systems (ECCS)/LOCA nodalization (Figure 6B-1) and the coarse long-term containment nodalization (Figure 6B-2). Figures 6B-3 and 6B-4 represent a departure from the nodalization presented in Reference 1. DCD Tier 2, Appendix 6B presents the tieback calculations conducted to compare the combined nodalization to the original nodalizations presented in Reference 1.

All subsequent design changes have been incorporated into these combined nodalization schemes and the results of analyses using the updated model are presented in the DCD and supporting LTRs.

Letter MFN 08-545 (Reference 2) provides a list of design changes, since the approval of TRACG for ESBWR LOCA analysis (Reference 1), that impact LOCA analysis. DCD Tier 2, Table 6.2-6a also provides a list of TRACG model changes which account for differences in the figures found in Appendix 6B and Figure 6.2-7. Table 6.2-195-1 provides a brief answer to each of the questions presented in this RAI and a cross reference to the items found in DCD Table 6.2-6a, Reference 2, or both. If the noted change in the Figure is not found in these references, an appropriate note is given.

References:

1. GE Nuclear Energy, "TRACG Application of ESBWR," NEDC-33083P-A, Class III, (Proprietary), March 2005, and NEDO-33083-A, Class I (non-proprietary), October 2005.
2. GE Hitachi Nuclear Energy, MFN 08-545, *Response to Portion of NRC Request for Additional Information Letter No. 85 – Related to ESBWR Design Certification Application – RAI Number 21.6-98*, dated August 29, 2008.

Table RAI 6.2-195-1

Question Number:		Response Categories *					Comments	Table 6.2-6a Item No.	MFN 08-545 Item No.
		Model Enhancement	Detailed Modeling	Error Correction	Design Change	Other			
1	A	X	X				Number of levels increased in Fig. 6.2-7 to improve fine nodalization. Fig. 6B-2 uses 18 Axial levels and 6 rings to model both the reactor pressure vessel (RPV) and containment. Fig. 6.2-7 uses L0 to L21 (Rings 1 to 4) to model the RPV, L21 to L42 (Rings 1 to 8) to model the containment.	15 & 18	N/A
	B	X	X				Figure 6B-2 represents the containment and coarse RPV nodalization from Reference 1. The fine RPV nodalization resides in Rings 1-4 in Fig. 6.2-7. When adding the RPV nodalization, the ring numbering was changed to accommodate the new model.	15	N/A
	C				X		See Table 6.2-6a Item 21.	21	N/A
	D				X		Change from 1 Passive Containment Cooling (PCC) condenser to 2 PCC condensers to reflect the design change. Total number of PCC condensers is changed from 4 to 6.	7	7
	E				X		Change from 3 PCC condensers to 4 PCC condensers to reflect the design change. Total number of PCC condensers is changed from 4 to 6.	7	7
	F				X		See Table 6.2-6a Items 5 and 6.	5 & 6	6
	G					X	The heat exchanger is still being modeled but has been presented in DCD Figure 6.2-8a.	N/A	N/A
	H				X		Passive Containment Cooling System (PCCS) vent fans added for DCD Revision 5. See DCD Section 6.2.2.2.2. The PCCS vent fan reduces containment drywell (DW) pressure when in service at 72 hours following a loss-of-coolant accident (LOCA).	N/A	26
	I				X		Outline represents a drain pan in the Gravity-Driven Cooling System (GDCS) pool. This drain pan provides a gas seal after the GDCS pools drain. (DCD Section 6.2.2.2.2)	N/A	26

Table RAI 6.2-195-1 (Continued)

Question Number:		Response Categories					Comments	Table 6.2-6a Item No.	MFN 08-545 Item No.
		Model Enhancement	Detailed Modeling	Error Correction	Design Change	Other			
1	J				X		Depressurization valve (DPV) TRACG component names have changed from VLVE0013 and VLVE0019 to VLVE0190 and VLVE0191 respectively. VLVE0012 remains the same. Component names changed when DPVs moved to the main steam lines.	N/A	23
	K				X		See Table 6.2-6a, Item 9.	9	9
	L		X				Figure 6.2-7 more accurately represents the equalizing line orientation. There is no change in the actual model.	N/A	N/A
	M				X		Components TEE62 and TEE63 in Figure 6B-2 model the PCC condenser drain tanks. These drain tanks were removed for simplification. See DCD Appendix 6B, Paragraph 12, and Item 23 in DCD Table 6.2-6a.	23	13
	N	X	X				TEE35 (Fig. 6B-2) originally modeled the lower drywell. With the additional levels (L21 to L23 in Fig. 6.2-7) introduced in subsequent nodalizations, it is no longer necessary to model the lower drywell with a TEE component. See Table 6.2-6a Item 18.	18	17
	O	X					Figure 6B-2 represents the coarse RPV + containment nodalization from Reference 1. In this coarse nodalization, the RPV is modeled in Levels 1-11, Rings 1 and 2 of Figure 6B-2; the "STEAM DOME" label indicates where the steam dome is in this nodalization. The nodalization represented in Figure 6.2-7 includes the fine modeling of the RPV in Levels 1-21, Rings 1-4. Therefore, the label "DW HEAD AIRSPACE" in Figure 6.2-7 correctly indicates the containment space above the RPV. See Table 6.2-6a, Item 19.	19	N/A
	P					X	Figure 6B-2 is taken directly from Reference 1. There is no reason to include this label in Figure 6.2-7.	N/A	N/A

Table RAI 6.2-195-1 (Continued)

Question Number:		Response Categories					Comments	Table 6.2-6a Item No.	MFN 08-545 Item No.
		Model Enhancement	Detailed Modeling	Error Correction	Design Change	Other			
2	A	X	X				Number of levels increased to improve fine nodalization.	15 & 18	N/A
	B	X	X				Both Fig. 6B-3 and Fig. 6.2-7 use 8 rings. Figure 6B-3 (L21 to L39) represents the containment only nodalization from Reference 1. The fine RPV nodalization resides in Rings 1-4 (L0 to L21). When adding the RPV nodalization, the ring numbering was changed to accommodate the new model.	15	N/A
	C				X		See Table 6.2-6a Item 21.	21	N/A
	D				X		Change from 1 PCC condenser to 2 PCC condensers to reflect the design change. Total number of PCC condensers is changed from 4 to 6.	7	7
	E				X		Change from 3 PCC condensers to 4 PCC condensers to reflect the design change. Total number of PCC condensers is changed from 4 to 6.	7	7
	F				X		See Table 6.2-6a Items 5 and 6.	5 & 6	6
	G					X	The heat exchanger is still being modeled but has been presented in DCD Figure 6.2-8a	N/A	N/A
	H					X	The labeling of the RPV is removed from Figure 6.2-7 in order to improve the clarity of the figure. Figure 6.2-6 provides a detailed nodalization of the RPV.	N/A	N/A
	I				X		DPV TRACG component names have changed from VLVE0013 and VLVE0019 to VLVE0190 and VLVE0191 respectively. VLVE0012 remains the same. Component names changed when DPVs moved to the main steam line.	N/A	23
	J				X		See Table 6.2-6a, Item 9.	9	9

Table RAI 6.2-195-1 (Continued)

Question Number:		Response Categories					Comments	Table 6.2-6a Item No.	MFN 08-545 Item No.
		Model Enhancement	Detailed Modeling	Error Correction	Design Change	Other			
2	K	X	X				The modeling of the RPV in Figure 6B-3 and Figure 6.2-7 are the same, the RPV is modeled in Levels 1 through 21. The lower part of the Figure 6B-3 is not included in Figure 6.2-7 because the nodalization of the RPV is presented in Figure 6.2-6.	N/A	N/A
	L				X		VLVE0282 and VLVE0281 model the spillover holes connecting the DW annulus and the suppression pool. These two components were simplified and removed in DCD Revision 5.	N/A	22
	M		X				Figure 6.2-7 more accurately represents the equalizing line orientation. There is no change in the actual model.	N/A	N/A
	N	X	X				TEE35 originally modeled the lower drywell. With the additional levels introduced in subsequent nodalizations, it is no longer necessary to model the lower drywell with a TEE component. See Table 6.2-6a Item 18.	18	17
3	A				X		See Table 6.2-6a Item 21.	21	N/A
	B					X	The heat exchanger is still being modeled but has been presented in DCD Figure 6.2-8a	N/A	N/A
	C				X		PCCS vent fans added for DCD Revision 5. See DCD Section 6.2.2.2.2.	N/A	26
	D				X		PCCS vent fans added for DCD Revision 5. See DCD Section 6.2.2.2.2.	N/A	26
	E				X		See Table 6.2-6a Items 5 and 6.	5 & 6	6
	F	X	X				The modeling of the RPV in Figure 6B-4 and Figure 6.2-7 are the same, the RPV is modeled in Levels 1 through 21. The lower part of the Figure 6B-4 is not included in Figure 6.2-7 because the nodalization of the RPV is presented in Figure 6.2-6.	N/A	N/A

Table RAI 6.2-195-1 (Continued)

Question Number:		Response Categories					Comments	Table 6.2-6a Item No.	MFN 08-545 Item No.
		Model Enhancement	Detailed Modeling	Error Correction	Design Change	Other			
3	G				X		See Table 6.2-6a, Item 9.	9	9
	H		X				Figure 6.2-7 more accurately represents the equalizing line orientation. There is no change in the actual model.	N/A	N/A
	I				X		DPV TRACG component names have changed from VLVE0013 and VLVE0019 to VLVE0190 and VLVE0191 respectively. VLVE0012 remains the same. Component names changed when DPVs moved to the main steam line.	N/A	23

DCD Impact:

No DCD changes will be made in response to this RAI.