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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 293 - Related to ESBWR Design Certification Application – RAI Number 21.6-106 Supplement 2**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by the Reference 1 NRC letter. GEH response to RAI Number 21.6-106 Supplement 2 is addressed in Enclosure 1.

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

Sincerely,

Richard E. Kingston

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Vice President, ESBWR Licensing

Reference:

1. MFN 09-020, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 293 Related to the ESBWR Design Certification Application*, dated January 8, 2009.

Enclosure:

1. MFN 09-202 – Response to Portion of NRC Request for Additional Information Letter No. 293 - Related to ESBWR Design Certification Application – RAI Number 21.6-106 S02

cc:	AE Cubbage	USNRC (with enclosure)
	JG Head	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0098-5501

Enclosure 1

MFN 09-202

Response to Portion of NRC Request for

Additional Information Letter No. 293

Related to ESBWR Design Certification Application

RAI Number 21.6-106 S02

NRC RAI 21.6-106 S02

Tracking the design of the PCC vent submergence length in the DCD; and applicability of the experimental condensation data used.

(A) In DCD Rev. 05 the selection of the PCC vent submergence length is not documented, or in the related GEH LTRs References [1, 2]. It is only discussed in "Supplemental Information for RAI 314.1" (MFN 03-115), which includes many relevant technical details regarding the PCCS performance during blowdown. It presents a dimensional analysis of the condensation efficiency data from Reference [3] to compute the submergence length to be around 0.75-1.00 m. It discusses PANTHERS test data to estimate the steam flow rates expected in ESBWR PCCS vents during the blowdown transient. It also describes that the PCCS vent submergence should be deep enough to avoid stratification, but not so deep that it would stop the vent function. GEH had to reproduce many of these details in their responses to RAI 21.6-106 and in RAI 21.6-106 S01, mainly because they are not documented elsewhere. Considering the critical nature of the PCCS vent submergence dimension, its design should be tracked within the DCD. Include the related details either in the DCD; or in a LTR and reference it in the DCD.

(B) A key publication Reference [3] is only referenced in "Supplemental Information for RAI 314.1," but not in DCD, or in the LTRs References [1, 2]. The authors of the paper concluded that "one cannot guarantee the efficiency of condensation for much higher flow rates and vent diameters", and "the data obtained from the present medium scale facility cannot be directly applied to full-size suppression pools." The authors also observed that "Owing to the current lack of knowledge of the complex flow induced by venting of air and steam through large-diameter pipes, no proper scaling of the condensation process, in relation to a reference prototype is readily achievable." The maximum steam flow rate condensed in the LINX facility, used by the authors, was 50 gm/s through a 40 mm ID pipe, as compared to about 6 kg/s anticipated for ESBWR PCCS vents of 250 mm ID. In this backdrop, please justify using the dimensional analysis ("Supplemental Information for RAI 314.1" and RAI 21.6-106 response) to scale the LINX data up for ESBWR PCC vent design.

(C) Reference [2], Section 7.11.5, reports "four" PCC heat exchanger units, which is incorrect. GEH should ensure that the related LTRs are consistent with the DCD.

[1 NEDC-33083P, "TRACG Application for ESBWR," March 2005.

[2] NEDE-32176P, Revision 4, "TRACG Model Description", January 2008 (MFN 08-072).

[3] C. De Walsche and F. de Cachard, "Experimental Investigation of Condensation and Mixing during Venting of a Steam/Non-condensable Gas Mixture into a Pressure Suppression Pool," ICONE-8565, Proceedings of ICONE 8, 8th International Conference on Nuclear Engineering, April 2-6, 2000, Baltimore, MD, USA.

GEH Response

(A) It is more appropriate to verify the elevation of the Passive Containment Cooling System (PCCS) vent line relative to the upper horizontal main vent than the submergence length. The elevation of the PCCS vent line relative to the upper horizontal main vent is a critical elevation and was requested to be included in the DCD and ITAAC per RAI 6.2-169, MFN 08-066. In the response to RAI 6.2-169, the ESBWR DCD Tier 2 Subsection 6.2.2.2.2 was revised and DCD Tier 1 Table 2.15.4-2 Item 9 was added to verify the elevation of the PCCS vent line relative to the upper horizontal main vent. Although the submergence length is not explicitly described in the DCD, it can be derived from the elevation of the PCCS vent line relative to the upper horizontal main vent presented in the DCD. Based on the information provided in DCD Tier 2 Subsection 6.2.2.2.2 and Table 6.2-4, the submergence length is 0.75 m (2.5 ft) below normal water level when the vent line discharge point is set at an elevation 0.85 m (2.8 ft) above the top of the uppermost horizontal vent.

(B) The purpose of the dimensional analysis to scale the LINX data up for ESBWR PCCS vent submergence length is to provide a road map demonstrating the PCCS with adequate submergence length to condense the steam in the suppression pool if the PCCS cannot condense 100% of the steam. This dimensional analysis is not part of the design process. The ESBWR PCCS design follows the tested SBWR PCCS design, but with more heat exchangers of similar dimensions with more tubes and lower steam mass flow rate after accounted for reactor power increase. For the long term PCCS operation, results from the current computer analysis show that there is no bypass of uncondensed steam to the suppression pool (reported in part A of response to RAI 21.6-96 S01, MFN 08-644).

(C) No change will be made in the LTR NEDE-32176P. During the development and evolution of the ESBWR design, changes have been made to the original design presented in NEDE-32176P. Due to this fact, the descriptions presented in NEDE-32176P were provided to facilitate the initial review of the models developed for safety analysis. The ESBWR design is presented in the DCD, therefore, it is not required to maintain NEDE-32176P up to date with ESBWR design information. The ESBWR DCD Tier 2, Table 6.2-6a presents the ESBWR TRACG nodalization changes resulted from the design changes; item 7 stated the PCCS design change.

DCD Impact

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

No changes to the subject LTR will be made in response to this RAI.