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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 100 Related to ESBWR Design Certification Application - Containment Systems - RAI Number 6.2-169**

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,

James C. Kinsey

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Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-327, Letter from U.S. Nuclear Regulatory Commission to Robert Brown, *Request for Additional Information Letter No. 100 Related to ESBWR Design Certification Application*, May 30, 2007

Enclosure:

1. MFN 08-066 - Response to Portion of NRC Request for Additional Information Letter No. 100 Related to ESBWR Design Certification Application - Containment Systems - RAI Number 6.2-169

cc:

AE Cubbage	USNRC (with enclosures)
DH Hinds	GEH/Wilmington (with enclosures)
GB Stramback	GEH/San Jose (with enclosures)
RE Brown	GEH/Wilmington (with enclosures)
eDRF	0000-0078-5979

Enclosure 1

MFN 08-066

Response to Portion of NRC Request for Additional Information Letter No. 100 Related to ESBWR Design Certification Application

Containment Systems

RAI Number 6.2-169

NRC RAI 6.2-169:

Concerning the DCD Tier 2, Revision 3, Section 6.2.2, in the pressure differential mode, a pressure build-up in the drywell (DW), caused by insufficient steam condensation inside the passive containment cooling (PCC) condenser, will force flow through the passive containment cooling system (PCCS) pushing the non-condensable gases and the non-condensed steam into the suppression pool and potentially reestablishing the condensing mode of operation. This pressure build up has to be greater than the submergence of PCCS vent pipes, but not sufficient to clear the main vents. For that reason, the elevation of the PCC vent line relative to the upper horizontal main vents is a critical elevation.

A. State this elevation and its importance in the DCD, Chapter 6.2.2.

B. Provide an ITAAC to verify the elevation of the PCC vent line relative to the upper horizontal main vents.

GEH Response:

A. The Passive Containment Cooling System (PCCS) vent line discharges to the suppression pool at a depth below low water level, and 0.85 m above the top of the uppermost horizontal vent. DCD Tier 2, Subsection 6.2.2.2.2, will be revised to include this information.

B. The information added to DCD Tier 2, Subsection 6.2.2.2.2, as a result of the response to Part A above, will be added to the Design Description in DCD Tier 1, Subsection 2.15.4. Verification of the elevation of the PCCS vent line relative to the upper horizontal main vents will be required by a new DCD Tier 1, Table 2.15.4-2, Item 9, Inspections, Tests, Analyses and Acceptance Criteria (ITAAC).

DCD Impact:

DCD Tier 1, Subsection 2.15.4 and Table 2.15.4-2, and DCD Tier 2, Subsection 6.2.2.2.2, will be revised as shown in the attached markups.

2.15.4 Passive Containment Cooling System

Design Description

The Passive Containment Cooling System (PCCS), in conjunction with the suppression pool, maintains the containment within its pressure limits for DBAs such as a LOCA, by condensing steam from the Drywell atmosphere and returning the condensed liquid to the Gravity Driven Cooling System (GDCS) pools. The system is entirely passive, with no moving parts.

The PCCS consists of six low pressure, independent sets of two steam condenser modules (passive containment cooling condensers) that condense steam on the tube side and transfer heat from the drywell to water in a large cooling pool (IC/PCC pool) located outside the primary containment, which is vented to atmosphere.

Each PCCS condenser is located in a subcompartment of the IC/PCC pool. The IC/PCC pool subcompartments on each side of the reactor building communicate at their lower ends to enable full use of the collective water inventory, independent of the operational status of any given PCCS condenser.

Each condenser, which is an integral part of the containment, contains a drain line to one of the three GDCS pools, and a vent discharge line the end of which is submerged in the pressure suppression pool.

The PCCS condensers loops are driven by the pressure difference created between the containment drywell and the suppression pool during a LOCA, and as such require no sensing, control, logic or power actuated devices for operation.

(1) The functional arrangement for the PCCS is as described in the Design Description in this Section 2.15.4, Table 2.15.4-1 and Figure 2.15.4-1.

(2) a. The components identified in Table 2.15.4-1 as ASME Code Section III are designed and constructed in accordance with ASME Code Section III requirements.

b. The piping identified in Table 2.15.4-1 as ASME Code Section III is designed and constructed in accordance with ASME Code Section III requirements.

(3) a. Pressure boundary welds in components identified in Table 2.15.4-1 as ASME Code Section III meet ASME Code Section III requirements.

b. Pressure boundary welds in piping identified in Table 2.15.4-1 as ASME Code Section III meet ASME Code Section III requirements.

(4) The pressure boundary of the PCCS retains its integrity under the design pressure of 310 kPa gauge (45 psig).

(5) a. The seismic Category I equipment identified in Table 2.15.4-1 can withstand seismic design basis loads without loss of safety function.

b. Each of the lines identified in Table 2.15.4-1 for which functional capability is required is designed to withstand combined normal and seismic design basis loads without a loss of its functional capability.

(6) Each mechanical train of the PCCS (A, B, C, D, E & F)* is physically separated from the other trains. *As indicated on Figure 2.15.4-1. Physical separation is not required in the Primary Containment.

(7) The PCCS together with the pressure suppression containment system will limit containment pressure to less than its design pressure for 72 hours after a LOCA.

(8) The equipment qualification of PCCS components is addressed in Tier 1 Section 3.8.

(9) In order to ensure the PCCS can maintain the drywell to wetwell differential pressure to a limit less than the value that causes pressure relief through the horizontal vents, the vent line discharge point is submerged at an elevation below low water level but above the uppermost horizontal vent.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.15.4-2 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria for the Passive Containment Cooling System.

Table 2.15.4-2
ITAAC For The Passive Containment Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. Each mechanical train of the PCCS (A, B, C, D, E & F)* is physically separated from the other trains. *As indicated on Figure 2.15.4-1. Physical separation is not required in the Primary Containment.	Inspections of the as-built PCCS will be performed.	Report(s) document that the each mechanical train of the PCCS is physically separated from other mechanical trains of the system by structural and/or fire barriers (with the exception of portions in Primary Containment).
7. The PCCS together with the pressure suppression containment system will limit containment pressure to less than its design pressure for 72 hours after a LOCA.	An analysis will be performed using similar or more conservative performance characteristics than those of a test unit of established performance capability.	Analyzed containment pressure for 72 hours after a LOCA is less than containment design pressure.
8. The equipment qualification of PCCS components is addressed in Tier 1 Section 3.8.	See Tier 1 Section 3.8.	See Tier 1 Section 3.8.
9. The elevation of the PCCS vent discharge point is submerged in the suppression pool at an elevation below low water level and above the uppermost horizontal vent.	A visual inspection will be performed of the PCCS vent discharge point relative to the horizontal vents.	The elevation of the discharge on the PCCS vent line is > 0.85 m (33.5 in) and < 0.90 m (35.4 in) above the top of the uppermost horizontal vent.

The PCCS loops receive a steam-gas mixture supply directly from the DW. The PCCS loops are initially driven by the pressure difference created between the containment DW and the suppression pool during a LOCA and then by gravity drainage of steam condensed in the tubes, so they require no sensing, control, logic or power-actuated devices to function. In order to ensure the PCCS can maintain the drywell to wetwell differential pressure to a limit less than the value that causes pressure relief through the horizontal vents, the vent line discharge point is set at an elevation submerged below low water level and at least 0.85 m (33.5 in) above the top of the uppermost horizontal vent. The PCCS loops are an extension of the safety-related containment and do not have isolation valves.

Spectacle flanges are included in the drain line and in the vent line to conduct post-maintenance leakage tests separately from Type A containment leakage tests.

Located on the drain line and submerged in the GDCS pool, just upstream of the discharge point, is a loop seal: it prevents back-flow of steam and gas mixture from the DW to the vent line, which would otherwise short circuit the flow through the PCCS condenser to the vent line. It also provides long-term operational assurance that the PCCS condenser is fed via the steam supply line.

Each PCCS condenser is located in a subcompartment of the IC/PCC pool, and all pool subcompartments communicate at their lower ends to enable full use of the collective water inventory independent of the operational status of any given IC/PCCS sub-loop.

A valve is provided at the bottom of each PCC subcompartment that can be closed so the subcompartment can be emptied of water to allow PCCS condenser maintenance.

Pool water can heat up to about 102°C (216°F); steam formed, being non-radioactive and having a slight positive pressure relative to station ambient, vents from the steam space above each PCCS condenser where it is released to the atmosphere through large-diameter discharge vents.

A moisture separator is installed at the entrance to the discharge vent lines to preclude excessive moisture carryover and loss of IC/PCC pool water.

IC/PCC expansion pool makeup clean water supply for replenishing level is normally provided from the Makeup Water System (Subsection 9.2.3).

Level control is accomplished by using a pneumatic powered or equivalent Power Operated Valve (POV) in the make-up water supply line. The valve opening and closing is controlled by water level signal sent by a level transmitter sensing water level in the IC/PCC expansion pool.

Cooling and cleanup of IC/PCC pool water is performed by the FAPCS (Subsection 9.1.3).

The FAPCS provides safety-related dedicated makeup piping, independent of any other piping, which provides an attachment connection at grade elevation in the station yard outside the RB, whereby a post-LOCA water supply can be connected.

6.2.2.2.3 System Operation

Normal Plant Operation

During normal plant operation, the PCCS loops are in "ready standby."