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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 302 Related to the ESBWR Design Certification – Containment Systems – RAI Number 6.2-190 S01**

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 NRC letter No. 302 (Reference 1). GEH response to RAI Number 6.2-190 S01 is addressed in Enclosure 1. DCD Tier 1 and Tier 2 markups associated with this response are provided in Enclosure 2.

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 09-150, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 302 Related To Design Control Document (DCD) Revision 5*, dated February 5, 2009

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 302 Related to ESBWR Design Certification Application – Containment Systems– RAI Number 6.2-190 S01
2. Response to Portion of NRC Request for Additional Information Letter No. 302 Related to ESBWR Design Certification Application – Containment Systems– RAI Number 6.2-190 S01 – DCD Tier 1 and Tier 2 Markups

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Enclosure 1

MFN 08-718, Supplement 1

Response to Portion of NRC Request for Additional Information Letter No. 302 Related to the ESBWR Design Certification

Containment Systems

RAI Number 6.2-190 S01

NRC RAI 6.2-190 S01:

Part (A) of GEH's response to RAI 6.2-190 states that the detailed design of drywell gas recirculation fans is in process and characteristics required for the PCCS vent fan system to ensure the containment pressures remain below design pressure is described in the response. DCD Tier 1, Revision 5, Table 2.15.4-2, Item 11 provides design characteristics for the fans.

Provide an ITAAC to confirm the system characteristics conform to the fan characteristics. For example, confirm that the system head loss under the conditions DCD Tier 1, Revision 5, Table 2.15.4-2, Item 11 will be less than or equal to the head across fan of 5.50 Kpa (0.80 psi)

GEH Response:

A system flow rate ITAAC for the PCCS vent fan system can accomplish the verification that system losses will not overcome the head provided by the fan. The flow rate measured will be a product of fan performance and system losses in the as-built system. Therefore, ITAAC Item 11 in Tier 1, Table 2.15.4-2 will be changed to a flow rate system ITAAC. The measured flow rate of the as-built system will be analyzed and compared to the flow rates of the design basis LOCA containment analysis model at containment pre-operational ambient conditions. This will assure the as-built system losses are less than or equal to those assumed in the model.

The PCCS Vent Fan performance requirements will be provided in response to RAI 6.2-140 S04 in the form of a DCD revision. The submergence of PCCS Vent Fan line in the GDCS pool will be added to DCD Tier 1 Table 2.15.4-2 and Tier 2 Subsection 6.2.2.2.2.

DCD Impact:

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

Enclosure 2

MFN 08-718, Supplement 1

Response to Portion of NRC Request for Additional Information Letter No. 302 Related to the ESBWR Design Certification

Containment Systems

RAI Number 6.2-190 S01

DCD Tier 1 and Tier 2 Markups

(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.~~ (Deleted)

(9) The elevation of the PCCS vent line discharge point is submerged in the Suppression Pool at an elevation below low water level and above the uppermost horizontal vent.

(10) The PCCS will be designed to limit the fraction of containment leakage through the condensers to an acceptable value.

(11) The PCCS vent fans flow rate is sufficient to the meet beyond 72 hours containment cooling requirements following a design basis LOCA.

(12) The PCCS vent fans can be remotely operated from the MCR.

(13) The PCCS drain piping is installed to allow venting of non-condensable gases from the PCCS drain lines to the PCCS condenser vent lines to prevent collection in the PCCS drain lines.

(14) The elevation of the PCCS vent fan discharge point is submerged within the drain pan located in the GDCS pool at an elevation below the lip of the drain pan.

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
11. The PCCS vent fans flow rate is sufficient to meet the beyond 72 hours containment cooling requirements following a design bases LOCA.	For each PCCS vent fan line, a flow rate test will be performed with the containment at pre-operational ambient conditions. Flow measurements will be taken on flow to the GDCS pools. An analysis of the test configuration will be performed.~~Flow rate will be measured. A type test of the vent fan to be installed.~~	Report(s) exist and conclude that, based on analysis and test data, the observed flow rates are greater than or equal to the flow rates of the design basis LOCA containment analysis model for the PCCS vent fan lines at containment pre-operational ambient conditions.~~Test and Analyses show that the PCC vent fans can provide a flow rate of 0.271 m^3/s (575 CFM) under the following conditions:~~ ~~□Pressusre 299 KPa (43.4 psi)~~ ~~□Density 2.29 Kg/m^3 (0.143 Lbs/ft^3)~~ • ~~Head across fan 5.50 KPa (0.80 psi)~~
12. The PCCS vent fans can be remotely operated from the MCR.	PCCS vent fans will be started using manually initiated signals from the MCR.	Report(s) exist and conclude that the PCCS vent fans start when manually initiated signals are sent from the MCR.
13. The PCCS drain piping is installed to allow venting of non-condensable gases from the PCCS drain lines to the PCCS condenser vent lines to prevent collection in the PCCS drain lines.	Inspection(s) will be conducted of as-built PCCS drain piping to ensure there are no elevated piping loops or high-point traps in piping runs to the GDCS pools.	Report(s) document(s) that based on inspection(s) of as-built PCCS drain piping, the as-built piping conforms to a design that allows venting of non-condensable gases from the PCCS drain lines to the PCCS condenser vent lines.

Table 2.15.4-2

ITAAC For The Passive Containment Cooling System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
14. The elevation of the PCCS vent fan discharge point is submerged within the drain pan located in GDCS pool at an elevation below the lip of the drain pan.	A visual inspection will be performed of the PCCS vent fan discharge point relative to the lip of the drain pan.	The elevation of the discharge on the PCCS vent fan line is > 0.22 m (9 in) and < 0.25 m (10 in) below the top of the drain pan lip.

The PCCS condensers do not have valves, so the system is always available.

6.2.2.2.2 Detailed System Description

The PCCS maintains the containment within its pressure limits for DBAs. The system is designed as a passive system with no components that must actively function in the first 72 hours after a DBA, and it is also designed for conditions that equal or exceed the upper limits of containment reference severe accident capability.

The PCCS consists of six, low pressure, independent sets of two steam condenser modules (Passive Containment Cooling Condensers), as shown Figure 6.2-16. Each PCCS condenser is designed for 11 MWt capacity and is made of two identical modules. Together with the pressure suppression containment (Subsection 6.2.1.1), the PCCS condensers limit containment pressure to less than its design pressure. The Equipment Storage pool and Reactor Well are designed to have sufficient water volume to provide makeup water to the IC/PCC pools for at least the initial 72 hours after a LOCA without makeup. Long-term effectiveness of the PCCS (beyond 72 hours) credits pool makeup and an active gas recirculation system, which uses in-line fans to pull DW gas through the PCC condensers.

The PCCS condensers are located in a large pool (IC/PCC pool) positioned above the ESBWR DW.

Each PCCS condenser is configured as follows (Figures 3G.1-71a and 3G.1-71b).

A central steam supply pipe is provided which is open to the DW airspace at its lower end. The open end of this pipe is provided with a debris filter with holes no greater than 25 mm (1 inch). The maximum inlet velocity during a LOCA is estimated to be no greater than 106 m/s (348 ft/s). The steam supply feeds two horizontal headers through two branch pipes at its upper end. Steam is condensed inside vertical tubes and the condensate is collected in two lower headers.

The vent and drain lines from each lower header are routed through the DW through a single passage per condenser module as shown on the figures.

The condensate drains into an annular duct around the vent pipe and then flows in a line that connects to a large common drain line, which also receives flow from the other header. The vent line goes to the suppression pool and is submerged below the water level.

A Passive Containment Cooling vent fan is teed off of each PCCS vent line and exhausts to the GDCS pool. The fan aids in the long-term removal of noncondensable gas from the PCCS for continued condenser efficiency. The fans are operated by operator action and are powered by a reliable power source which has a diesel generator backed up by an ancillary diesel if necessary without the need to enter the primary containment. The discharge of each PCC vent fan is submerged below the GDCS pool water level to prevent backflow that could otherwise interfere with the normal venting of the PCCS. The vent fan discharge line terminates in a drain pan within the GDCS pool so that the gas seal is maintained after the GDCS pool drains. The vent fan discharge line is > 0.22 m (9 in) and < 0.25 m (10 in) below the top of the drain pan lip. To further prevent reverse flow through an idle fan, a ball check is installed at the end of the fan discharge line.

The PCCS condensers receive a steam-gas mixture supply directly from the DW. The PCCS condensers are initially driven by the pressure difference created between the DW and the