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Subject: Response to Portion of NRC Request for Additional Information Letter No. 96 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.2-112

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1. DCD markups related to this response are provided in Enclosure 2.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

Reference:

1. MFN 07-231, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 96 Related to ESBWR Design Certification Application*, April 12, 2007

Enclosures:

1. MFN 08-329 - Response to Portion of NRC Request for Additional Information Letter No. 96 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.2-112
2. MFN 08-329 - DCD Tier 2 Chapter 16 and 16B Markups for RAI Number 16.2-112

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	RE Brown	GEH (with enclosures)
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Enclosure 1

MFN 08-329

Response to Portion of NRC Request for

Additional Information Letter No. 96

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Number 16.2-112

NRC RAI 16.2-112:

Revise the surveillance requirement for drywell bypass leakage to be consistent with guidance. DCD Tier 2, Revision 3, Section 16, surveillance requirement (SR) 3.6.1.1.3 requests to "[v]erify the combined leakage rate through all vacuum breaker lines is $\leq$ {0.1 cm^2 (1.0 x 10-4 ft^2) (A/√K)} when tested at $\geq$ { kPaD (psid)}." This is inconsistent with the corresponding SR (SR 3.6.5.1.1) in NUREG-1434, "Standard Technical Specifications [STS] General Electric Plants, BWR/6," Revision 3.1, and inconsistent in itself:

A. *The DCD SR applies only to the leakage through the vacuum breaker lines, while the STS SR applies to 10 percent of the total bypass leakage between drywell and wetwell, which was used in calculating peak containment pressure in DCD Tier 2, Revision 3, Section 6.2.*

   Please explain how you ensure that the assumed total bypass leakage between the drywell and wetwell will not be exceeded during operation of the reactor.

B. *The left side of the first inequality sign ($\leq$) refers to a "leakage rate" but the expression on the right side of the sign has numbers with dimensions of area, which is inconsistent with the former.*

   Please fix the inconsistency.

GEH Response:

A. The original RAI for this item was on DCD Tier 2, Revision 3, and Section 16. However, DCD Tier 2, Revision 4 was also revised to answer this RAI.

   The maximum allowable suppression pool bypass leakage that is assumed in the analysis to support that containment design pressure will not be exceeded will be assured by satisfactory performance of Technical Specifications Surveillance Requirements (SRs) 3.6.1.1.3 and 3.6.1.1.4 (at 24 month frequency) and SR 3.6.1.1.5 (at the Integrated Leakage Rate Test (ILRT) frequency).

   SR 3.6.1.1.5 measures the leakage past the drywell diaphragm floor and through the vacuum breakers to ensure that, if an event were to occur, the steam produced by an event will be directed through the pressure suppression vent system into the suppression pool. The performance of the SR ensures that the leakage paths that would bypass the suppression pool are within leakage limits.

   Since there are very few penetrations through the drywell diaphragm floor, the only credible leakage paths are through the vacuum breakers. SR 3.6.1.1.3 and SR 3.6.1.1.4 require that individual and total vacuum breaker/vacuum breaker isolation valve leakages are within the defined limits as described in detail below.

   Satisfactory performance of these SRs can be achieved by performing a leakage test in conjunction with the ILRT, and performing the local leakage rate testing of the vacuum breakers and vacuum breaker isolation valves every 24 months.

The ILRT frequency for the overall bypass test is prudent, since the ILRT instrumentation is used to determine the bypass area and the valve alignments needed for the bypass test are very similar to those required for the ILRT. Due to the limited number of penetrations through the diaphragm floor between the drywell and the wetwell, the only credible leakage path is through the vacuum breakers. Since, as discussed below, the vacuum breakers and vacuum breaker isolation valves will be local leakage rate tested every 24 months, the ILRT frequency is appropriate for the suppression pool bypass test. The 24-month frequency for the local leakage rate testing of the vacuum breakers and vacuum breaker isolation valves is appropriate, since a unit shutdown is required to perform the testing.

SR 3.6.1.1.5 will reflect the overall bypass test frequency coincident with the ILRT frequency. The test calculates the volumetric flow rate based on the weight change of air in the wetwell over time and the flow velocity based on changes in the drywell pressure. The effective bypass area is calculated by dividing the volumetric flow rate by the flow velocity. The acceptance criterion for the suppression pool bypass test is 50% of the maximum allowable bypass leakage area from the drywell into the wetwell that is assumed in the analysis without exceeding containment design pressure.

SR 3.6.1.1.3 will require local leakage rate testing of the vacuum breakers and vacuum breaker isolation valves on a 24-month frequency. Test methodology will be similar to the 10 CFR 50 Appendix J local leakage rate testing methodology used for containment isolation valves. SR 3.6.1.1.3 requires that the individual vacuum breaker and vacuum breaker isolation valve leakages be less than or equal to 15% of the equivalent leakage through the maximum allowable suppression pool bypass leakage area that is assumed in the analysis without exceeding containment design pressure. The maximum allowable suppression pool bypass leakage area is equal to 2.0 cm^2 (2.16E-03 ft^2).

SR 3.6.1.1.4 requires summation of the individual wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve leakage rates from SR 3.6.1.1.3, respectively, and verifying that the combined pathway leakage is less than or equal to 35% of the equivalent leakage through the maximum allowable suppression pool bypass leakage area that is assumed in the analysis without exceeding containment design pressure. The maximum allowable suppression pool bypass leakage area is equal to 2.0 cm^2 (2.16E-03 ft^2). Even with the maximum allowable combined vacuum breaker and vacuum break isolation valve leakage rate, a margin of 65% remains for potential passive structural leakage. Previous suppression pool bypass leakage rate test data for existing Mark II containments indicates that the suppression pool bypass leakage through the passive structural components will be an extremely small fraction of the remaining 65% margin. The vacuum breaker and vacuum breaker isolation valve leakage rate limits, combined with negligible leakage from the passive structural area, ensures that the suppression pool bypass leakage rate limit is met for those outages in which an overall suppression pool bypass test is not performed.

B. RAI 16.2-112(B) has been addressed by the GEH response to RAI 16.2-112(A) above. The leakage rate equation for the RAI has been deleted and replaced. The ESBWR overall suppression pool bypass leakage test will actually measure the effective bypass leakage area across the diaphragm floor. This is a common test measurement method for bypass leakage used in the industry. The effective bypass area ($A/\sqrt{K}$) is calculated by dividing Q, the volumetric flow rate (cm^3/min), by v, the flow velocity (cm/min).

$$A/\sqrt{K} = Q/v$$

More details of the ESBWR suppression pool bypass leakage testing and analysis method can be found in "Testing Criteria for Bypass Leakage Testing of Drywell-to-Wetwell Interface for ESBWR Nuclear Power Plants," Revision 0, issued by ILRT, Inc. on 2/8/2008. This report was provided to the staff at the March 5, 2008 meeting at the GEH offices in Washington held to discuss ESBWR Containment issues.

DCD Impact:

DCD Tier 2, Chapter 16 Specification 3.6.1.1, Containment, will be revised as noted in the enclosed markup.

DCD Tier 2, Chapter 16 BASES, Specification 3.6.1.1, Containment, will be revised as noted in the enclosed markup.

Enclosure 2

MFN 08-329

DCD Tier 2 Chapter 16 and 16B Markups for RAI Number 16.2-112

SURVEILLANCE		FREQUENCY
SR 3.6.1.1.3	------------------------------- **- NOTE -** ------------------------------- Performance of SR 3.6.1.1.5 satisfies this surveillance. ---	
	Verify each wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve leakage is ≤ 15% of design basis A/√K.	24 months
SR 3.6.1.1.4	------------------------------- **- NOTE -** ------------------------------- Performance of SR 3.6.1.1.5 satisfies this surveillance. ---	
	Verify total wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve pathway leakage is ≤ 35% of design basis A/√K.	24 months

SURVEILLANCE		FREQUENCY
SR 3.6.1.1.5~~3~~	Verify ~~the combined leakage rate through all vacuum breaker lines is less than or equal to the maximum established design~~overall suppression pool bypass leakage is ≤ 50% of design basis A/√K.	~~24 months~~10 years AND 48 months following a test with leakage greater than the leakage limit AND 24 months following two consecutive tests with leakage greater than the leakage limit until two consecutive tests are less than or equal to the leakage limit

BASES

LCO	Containment OPERABILITY is maintained by limiting leakage to ≤ 1.0 L_a, except prior to the first startup after performing a required Containment Leakage Rate Testing Program leakage test. At this time the applicable leakage limits must be met. Additionally, the drywell to wetwell-gas space leakage must be within acceptance criteria to ensure the pressure suppression function. Compliance with this LCO will ensure a containment configuration, including equipment hatches, that is structurally sound and that will limit leakage to those leakage rates assumed in the safety analysis. Individual leakage rates specified for the containment air locks are addressed in LCO 3.6.1.2.
APPLICABILITY	The containment is required to be OPERABLE in MODES 1, 2, 3, and 4 because a DBA could cause a release of radioactive material to containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, containment is not required to be OPERABLE in MODES 5 and 6 to prevent leakage of radioactive material from containment.
ACTIONS	A.1 If the containment is inoperable, a DBA could cause a release of radioactive material to containment. Therefore, the containment must be restored to OPERABLE status within 1 hour. The 1 hour Completion Time provides a period of time to correct the problem commensurate with the importance of maintaining containment OPERABILITY during MODES 1, 2, 3, and 4. This time period also ensures that the probability of an accident (requiring containment OPERABILITY) occurring during periods where containment is inoperable is minimal.

The Frequency is required by the Containment Leakage Rate Testing Program.

SR 3.6.1.1.2

{This SR measures inleakage past the feedwater flow isolation valves into the containment to ensure that leakage past the feedwater isolation valves is within allowable limits.

Limiting the leakage from the feedwater system outside containment into the containment is necessary to limit mass water additions to the containment during and following a design basis feedwater line rupture inside containment.}

The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and has been shown to be acceptable by Reference 6.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.1.1.3

Maintaining the pressure suppression function of the containment requires limiting the leakage from the drywell to the wetwell. Thus, if an event were to occur that pressurizes the drywell, the steam would be directed through the horizontal vent pipes into the wetwell. This SR measures the wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve pathway leakage to ensure that these leakage paths are within allowable limits.

Satisfactory performance of this SR can be achieved by establishing a known initial differential pressure (≥ 2.0 psid) between the drywell side and the wetwell side of the vacuum breaker and isolation valve and verifying that the measured leakage for each is ≤ 15% of the equivalent leakage through an acceptable design basis value $A/\sqrt{K}$ of 2.0 cm^2 (2.16E-03 ft^2). The leakage test is performed every 24 months. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage.

The SR is modified by a Note stating that performance of SR 3.6.1.1.5 satisfies this Surveillance Requirement. This is acceptable since SR 3.6.1.5 ensures margin to the design basis pressure suppression function, including the wetwell-to-drywell vacuum breaker leakage. Excluding the isolation valve leakage measurement when performing SR

BASES

3.6.1.1.5 introduces minimal added uncertainty based on its role as a backup isolation device and its reliability.

SR 3.6.1.1.4

Maintaining the pressure suppression function of the containment requires limiting the leakage from the drywell to the wetwell. Thus, if an event were to occur that pressurizes the drywell, the steam would be directed through the horizontal vent pipes into the wetwell. This SR determines the total wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve pathway leakage (maximum pathway) to ensure that these leakage paths are within allowable limits.

SURVEILLANCE REQUIREMENTS (continued)

For those outages where the overall drywell to wetwell-gas space leakage test is not conducted, the vacuum breaker and vacuum breaker isolation valve leakage test verifies that even with the maximum allowable total leakage, a margin of 65% remains for potential passive structural leakage. Historical industry drywell to wetwell-gas space test data indicates that the leakage through the passive structural components is a small fraction of the remaining 65% margin. The total vacuum breaker leakage limit, combined with negligible leakage from the passive structural area, ensures that the drywell to wetwell-gas space leakage limit is met for those outages in which the overall drywell to wetwell-gas space leakage test is not performed.

Satisfactory performance of this SR is achieved by summing the individual wetwell-to-drywell vacuum breaker/vacuum breaker isolation valve pathway leakages (from SR 3.6.1.3) on a maximum pathway basis and verifying that the total measured drywell to wetwell-gas space leakage is ≤ 35% of the equivalent leakage through an acceptable design basis value $A/\sqrt{K}$ of 2.0 cm^2 (2.16E-03 ft^2). This Surveillance is performed every 24 months. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage.

The SR is modified by a Note stating that performance of SR 3.6.1.1.5 satisfies this Surveillance Requirement. This is acceptable since SR 3.6.1.5 ensures margin to the design basis pressure suppression function, including the wetwell-to-drywell vacuum breaker leakage. Excluding the isolation valve leakage measurement when performing SR 3.6.1.1.5 introduces minimal added uncertainty based on its role as a backup isolation device and its reliability.

BASES

SR 3.6.1.1.5~~3~~

Maintaining the pressure suppression function of the containment requires limiting the leakage from the drywell to the wetwell. Thus, if an event were to occur that pressurized the drywell, the steam would be directed through the horizontal vent pipes into the wetwell. This SR determines effective overall suppression pool bypass leakage area to ensure that the leakage paths that would bypass the wetwell pressure suppression function are within allowable limits.

SURVEILLANCE REQUIREMENTS (continued)

Satisfactory performance of this SR can be achieved by establishing a known initial differential pressure (≥ 2.0 psid) between the drywell and the wetwell and verifying that the suppression pool bypass leakage equivalent to an area ≤ 50% of the bounding design basis value A/√K of 2.0 cm^2 (2.16E-03 ft^2).

The overall suppression pool bypass leakage test is performed every 10 years. The Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the desire to perform the test in conjunction with the 10 CFR 50, Appendix J, Type A test. One test failure increases the Surveillance frequency to 48 months. Two consecutive test failures, however, would indicate unexpected degradation; in this event, increasing the Frequency to 24 months is required until the situation is remedied as evidenced by satisfactory completion of two consecutive tests.~~This SR measures leakage past the wetwell-to-drywell vacuum breakersto ensure that the leakage paths that would bypass the suppression pool are within maximum established A/√K design value of 2 cm² (2.16E-03 ft²) assumed in the safety analyses (Ref. 4).~~

~~Limiting the leakage from the drywell to the wetwell is necessary for the functioning of the pressure suppression function of the containment. This ensures that the steam produced by an event that pressurized the drywell will be directed through the pressure suppression vent system into the suppression pool.~~

~~The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and has been shown to be acceptable by Reference 6.~~