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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 197 Related to ESBWR Design Certification Application - Containment Systems - RAI Numbers 6.2-145 S02, 14.2-63 S02, and 14.3-229 S01**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) responses to the subject NRC RAIs originally transmitted via the Reference 1, 2, and 3 letters, respectively, and supplemented by NRC requests for clarification in Reference 4.

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

Sincerely,

Lee F. Dougherty for

Richard E. Kingston
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 07-054, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 85 Related to ESBWR Design Certification Application*, January 19, 2007
2. MFN 07-106, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, *Request for Additional Information Letter No. 93 Related to ESBWR Design Certification Application*, January 31, 2007
3. MFN 07-718, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 126 Related to ESBWR Design Certification Application*, December 20, 2007
4. MFN 08-493, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 197 Related to ESBWR Design Certification Application*, May 22, 2008

Enclosure:

1. MFN 08-612 - Response to Portion of NRC Request for Additional Information Letter No. 197 Related to ESBWR Design Certification Application - Containment Systems - RAI Numbers 6.2-145 S02, 14.2-63 S02, and 14.3-229 S01

cc:	AE Cubbage	USNRC (with enclosure)
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	RE Brown	GEH/Wilmington (with enclosure)
	eDRF	0000-0088-1708

Enclosure 1

MFN 08-612

Response to Portion of NRC Request for Additional Information Letter No. 197 Related to ESBWR Design Certification Application

Containment Systems

RAI Numbers 6.2-145 S02, 14.2-63 S02, and 14.3-229 S01

NRC RAI 6.2-145 S02:

(A) *In response to RAI 6.2-145, Supplement 1, GEH states the following:*

> *"Suppression pool bypass leakage may be quantified and measured by performing a local leakage rate test on a 24 month frequency and an overall suppression pool bypass leakage test on the same frequency as the Integrated Leakage Rate Test (ILRT). These test frequencies are similar to the following operating BWRs with Mark II containments: Columbia Generating Station, Nine Mile Point Unit 2, Susquehanna Units 1 and 2 and Limerick Units 1 and 2."*

The loss-of-coolant-accident generated containment pressure in the ESBWR is sensitive to the suppression pool bypass leakage. Please (1) compare ESBWR sensitivity to the suppression pool bypass leakage with that for the above plants; and (2) explain how plant-specific experience of the above plants is applicable to ESBWR.

(B) *In its response, GEH also proposes acceptance criteria for the suppression pool bypass leakage test for ESBWR as less than or equal to 50 percent of the design basis suppression pool bypass leakage of 2.0 cm^2 (2.16E-03 ft^2) (A/√K) (i.e., 1.0 cm^2 (1.08E-03 ft^2) (A/√K)). The Standard Review Plan, Appendix A recommends that Mark II and Mark III acceptance criteria for suppression pool bypass leakage tests shall be a measured bypass leakage which is less than 10 percent of the capability of the containment. GEH states that the proposed criteria "allows a 50 percent margin to the design basis suppression pool bypass leakage area, which ensures an adequate margin to account for bypass leakage increases between tests while not imposing an undue regulatory burden on plant owners."*

However, Testing Criteria for Bypass Leakage Testing of Drywell-to-Wetwell Interface for ESBWR Nuclear Power Plants (R080208A, Rev. 0, ILRT Inc., Palm Harbor, Florida, February 8, 2008) reports historical data for Mark II containments showing measured bypass leakages as low as 0.0114 cm^2 (1.22E-05 ft^2) (A/√K). Using the SRP recommendation of 10 percent value would give acceptance criteria of 0.2 cm^2 (2.16E-04 ft^2) (A/√K), which is an order of magnitude higher than the measuring capability.

Please explain how using the SRP guidance would impose an undue regulatory burden on plant owners.

(C) *Verify that vacuum breaker leak detection is adequate to detect a leakage exceeding the vacuum breaker design leakage value.*

(D) *Surveillance Requirement SR 3.6.1.6.5 states that "[a] system functional test is performed to ensure that each vacuum breaker flow path isolation function operates as required." Verify that the vacuum breaker isolation valve is designed to limit leakage through a closed isolation valve to a value below the vacuum breaker design leakage. Please add this condition for the operation of "vacuum breaker flow path isolation function operates as required."*

(E) *Please make the responses to RAIs 6.2-146, 6.2-148, and 16.2-112 consistent with the response to this RAI. GEH has responded to RAIs 6.2-148 and 16.2-112 but the staff will hold reviewing these responses until GEH resolves RAI 6.2-145.*

GEH Response:

(A) The mentioned Mark II containments have an allowable steam bypass in the order of 46.5 cm^2 (.05 ft^2), which is greater than ESBWR by a factor of about 23. Since the absolute value of the acceptable tolerances for the mentioned Mark II containments are much larger than the ESBWR, there was little to no concern during the licensing of BWRs with these containments over these relatively large bypass leakage testing tolerances, and a 24-month testing interval was justified. However, the actual performance of bypass leakage testing on these BWRs has historically shown very little increase in absolute leakage rates between surveillance testing on a 24-month basis.

The extent of applicability of the mentioned plants relates to this minimal increase in bypass leakage between testing intervals. Since the ESBWR design has fewer penetrations through the diaphragm floors than the comparison plants, the same bypass leakage test interval is conservative since there is greater potential for leakage at the comparison plants. In addition, these full penetration welds will undergo preservice and inservice inspections to ensure leak tightness. Therefore, it is expected that the ESBWR will experience no or a relatively small increase in bypass leakage rates over a 24-month testing interval.

(B) In ESBWR Technical Specifications, the total allowed vacuum breaker pathway leakage is less than or equal to 35% of the design basis bypass leakage of 2 cm^2 (A/vK). This allows a 30% margin to the acceptance criteria of 1 cm^2 and margin to account for any other leakage that might exist that is not accounted for by the vacuum breaker pathway leakage test. If the 10% acceptance criteria were used, 70% of 0.2 (0.2 = 2 cm^2 x 10%) would result in a testing acceptance criteria of 0.14 cm^2 for the total of the vacuum breaker pathway leakage. While the report, "Testing Criteria for Bypass Leakage Testing of Drywell-to-Wetwell Interface for ESBWR Nuclear Power Plants" (R080208A, Rev. 0, ILRT Inc., Palm Harbor, Florida, February 8, 2008) cited in the question referenced a single test with an extremely low bypass leakage value of 0.0114 cm^2, all of the remaining three tests for this limited sample over a period of less than 10 years resulted in bypass leakage values of approximately 0.05 to 0.10 cm^2. Thus, the bypass leakage typically ranges very close to the 0.14 cm^2 limit that would be imposed by the SRP guidance. The resulting operating margin of ~0.04 cm^2 is less than the normal variability historically experienced, and thus is an unacceptable risk to plant operations and will greatly increase the occurrences of test failures while negligibly improving the margin of safety. These test failures would result in outage delays, higher operating costs, increased wear on valve components, and higher personnel radiation dose and industrial safety challenges to perform maintenance with a minimal improvement in leak tightness. Establishing the test acceptance limit based on 50% of the design basis bypass leakage that would result in post-accident pressures approaching the containment design pressure value provides a more appropriate operating margin, while conservatively maintaining the relatively large margin of safety to the containment ultimate capability, which is approximately seven times the containment design pressure.

(C) The detection of bypass leakage during a loss-of-coolant accident (LOCA) is accomplished by detecting a change in temperature on the upstream side of the vacuum breaker (i.e., between the isolation valve and vacuum breaker) with respect to temperatures in close proximity to the vacuum breaker and isolation valve assembly on the drywell and wetwell sides. Temperature sensors will be located in close proximity to the vacuum breaker on the drywell side near the outlet screens, on the wetwell side near the inlet to the isolation valve, and inside the cavity between the isolation valve and vacuum breaker. The setpoint to close the isolation valve will be set such that the change in temperature is less than the allowed bypass leakage for a vacuum breaker, with the minimal tolerance necessary to prevent inadvertent actuation of the isolation logic.

(D) The Technical Specification Surveillance Requirement (SR) 3.6.1.1.4 ensures that both the vacuum breaker and its isolation valve meet the same total leakage requirements by specifying testing on a 24-month interval of the pathway.

(E) The responses to RAIs 6.2-146, 6.2-148, and 16.2-112 are consistent with the response to this RAI, and no further action is required.

DCD Impact:

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

NRC RAI 14.2-63 S02:

In response to RAI 14.2-63, Supplement 1, GEH proposes to update ESBWR DCD Tier 2 Section 14.2.8.1.32 to include that the "test method used will form the basis for use during subsequent leakage rate tests conducted at the same frequency as the ILRT."

In RAI 6.2-145, Supplement 2, the staff requested GEH to provide additional justification for this proposed change. Please make the responses to RAIs 14.2-63 and 6.2-145 consistent.

GEH Response:

See the response to RAI 6.2-145 S02 for the response to this RAI.

DCD Impact:

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

NRC RAI 14.3-229 S01:

In response to RAI 14.3-229, GEH proposes to update ESBWR DCD Tier 1 Table 2.15.1-2 to include that the acceptance criteria for drywell to wetwell bypass leakage tests as that "[r]eport(s) document that the results of the drywell to wetwell bypass leakage is less than or equal to 50 percent of the assumed value in the containment capability design basis containment response analysis." In RAI 6.2-145, Supplement 2, the staff requested GEH to provide additional justification for this proposed change. Please make the responses to RAIs 14.3-229 and 6.2-145 consistent.

GEH Response:

DCD Tier 1, Section 2.15.1-2 was revised in Revision 5 to be consistent with the bypass leakage acceptance criteria described in the response to RAI 6.2-145.

DCD Impact:

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