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Subject: **Response to Portion of NRC Request for Additional Information Letter Nos. 63 and 90 Related to ESBWR Design Certification Application – Reactor Building HVAC- RAI Numbers 15.4-26 and 16.2-50S01**

Enclosure 1 contains GHNEA's responses to the subject NRC RAIs transmitted via References 1 and 2.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. MFN 06-375– Letter from US Nuclear Regulatory Commission (NRC) to David H. Hinds, *Request for Additional Information Letter No. 63 Related to ESBWR Design Certification Application,* dated October 4, 2006
2. MFN 07-084– Letter from US Nuclear Regulatory Commission (NRC) to David H. Hinds, *Request for Additional Information Letter No. 90 Related to ESBWR Design Certification Application,* dated January 29, 2007

Enclosures:

1. Response to NRC Request for Additional Information Letter Nos. 63 and 90 Related to ESBWR Design Certification Application – Reactor Building HVAC - RAI Numbers 15.4-26 and 16.2-50S01

cc:	AE Cubbage	USNRC (with enclosures)
	GB Stramback	GHNEA /San Jose (with enclosures)
	RE Brown	GHNEA /Wilmington (with enclosures)
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Enclosure 1

MFN 07-299

Response to NRC Request for Additional Information Letter Nos. 90 and 63 Related to ESBWR Design Certification Application

Reactor Building HVAC (RBVS)

RAI Numbers 15.4-26, 16.2-50 S01

NRC RAI 15.4-26:

Question Summary: Provide the flow paths used to verify the leak rate and include the leakage rate as a TS and ITAAC

Full Text: Section 4.5, "Containment and Reactor Building Leakage Paths," of the General Electric Licensing Topical Report, NEDE-33279, "ESBWR Containment Fission Product Removal Evaluation Model, October 2006,"(LTR) stated that your radiological consequence analysis assumed an overall reactor building leakage rate of 50 percent per day.

(A) Provide the flow paths to be isolated and the method to be used to verify the leak rate.

(B) State whether the leakage rate test to meet the 50 percent per day limit is specified in the ESBWR Technical Specification (TS).

(C) Include this leak rate verification in Tier 1 as an ITAAC item to be confirmed at the COL stage. Section 6.2.3.1, "Design Bases" stated that "The RB is capable of periodic testing to assure that the leakage rates assumed in the radiological analyses are met."

GHNEA Response:

Item (A): The flow paths to be isolated are the building ventilation duct boundary penetrations, which are specified safety-related building isolation dampers. The flow paths for reactor building leakage are the hatch, door and pipe/electrical penetration seals.

The method to be use to verify the RB exfiltration rate will be implemented by pressurizing the RB air volume with a fan located outside the RB boundary via an existing pipe penetration (testing penetration) normally closed. The fan will have the capacity to pressurize the RB air volume and to measure its flow rate for at least three different pressures versus flow performance operating points for the selected fan and its certified performance curve. This fan selection and performance curve will have adequate range flexibility to match the RB structure for measuring the out leakage. This test method will ensure actual reactor building leakage remains below the 50% per day assumption. If leakage is >50% per day, seals can be visually inspected in order to detect any degradation.

Item (B): The leakage rate test is specified in the ESBWR Technical Specifications. Technical Specification 3.6.3.1.4 currently states: *Verify Reactor Building exfiltration rate within limits.* Technical Specification Bases 3.6.3.1 states: *The RB leaks to the environment at 50% by weight of RB air per 24 hours.*

Item (C): A DCD Tier 1 ITAAC will be created to perform this leak rate test.

DCD Impact:

DCD Tier 1 Section 2.16.5 and Table 2.16.5-2 will be updated to reflect this RAI response (see enclosed DCD Tier 1 markup).

NRC RAI 16.2-50:

TS SR 3.6.3.1.4 has no analogous surveillance in the BWR/4 secondary containment and secondary containment isolation valve specifications in NUREG-1433, Rev 3.1. Discuss the flow paths to be isolated and the method to be used for conducting the test and the justification for the 60-month Frequency.

GHNEA Original Response:

ESBWR Design Control Document (DCD), Tier 2, Revision 1, Chapter 16, Technical Specification (TS) Surveillance Requirement (SR) 3.6.3.1.4, requires verification that the Reactor Building exfiltration rate is within limits, once every 60 months. DCD, Tier 2, Revision 1, Subsection 6.2.3.1 states that the Reactor Building is capable of periodic testing to assure that the leakage rates assumed in the radiological analyses are met.

DCD, Tier 2, Revision 1, Chapter 16, SR 3.6.3.1.4 is consistent with this intent to perform testing to assure that the containment fission product removal evaluation model assumptions for Reactor Building leakage are met. The construction level design details necessary to fully describe the flow paths to be isolated and the methods to be used to conduct the testing are not available at this time. Actual plant procedure development program is described in DCD Section 13.5. Final plant surveillance testing procedures will be required to be in place and satisfactorily completed prior to operations crediting the Reactor Building operability.

The Reactor Building provides an added holdup volume for fission products released from the containment in the event of an accident. Unlike the comparison to secondary containment designs represented by NUREG-1434 testing, there is no active ventilation nor significant differential pressure generated in response to an accident condition. Any leakage would simply be a result of adiabatic building heatup, and minimal out leakage from primary containment. The vast majority of adiabatic heatup is via the Passive Containment Cooling (PCC) pools, where heat rejection by boiling results in vapor release to the steam space above each pool where it is released to the atmosphere through large-diameter discharge vents. The remainder of Reactor building leakage would not be expected to be significant, and general building integrity inspections along with a 60-month in-depth confirmatory evaluation is expected to provide adequate assurance that the assumptions remain valid.

DCD Impact:

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

NRC RAI 16.2-50 S01:

Although "construction level design details" are not currently available, respond to the original question to the extent permitted by currently available information.

GHNEA Response:

See the response to RAI 15.4-26 (part A), which addresses the Reactor Building flow paths to be isolated and the method to be used to verify the leak rate.

DCD Impact:

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

2.16.5 Reactor Building

Design Description

The Reactor Building (RB) (equivalent to as shown in Figures 2.16.5-1 through 2.16.5-11) houses the reactor system, reactor support and safety systems, concrete containment, essential power supplies and equipment, steam tunnel, and refueling area. On the upper floor of the RB are the new fuel pool and small spent fuel storage area, dryer/separator storage pool, refueling and fuel handling systems, the upper connection to the incline fuel transfer system and the overhead crane. The Isolation Condenser/Passive Containment Cooling System pools are below the refueling floor. The critical dimensions are provided in Table 2.16.5-1.

The Reactor Building structure is integrated with that of a right circular cylindrical reinforced concrete containment vessel (RCCV); the RCCV is located on a common basemat with the RB. The RB is a rigid box type shear wall building. The external walls form a box surrounding a large cylindrical containment. The RB shares a common wall and sits on a large common basemat with the Fuel Building. The RB is a safety-related, Seismic Category I structure. The building is partially embedded.

The RB offers some holdup and decay of fission products that may leak from the containment after an accident. Assuming a LOCA, the offsite dose limits are met based on a 50 wt% per day leakage rate from the RB. This holdup capability decreases releases to the atmosphere. The building and systems are also arranged to separate clean and potentially contaminated areas, with separate stairway and elevator service for each area.

The RB provides three-hour fire barriers for separation of the four independent safe shutdown divisions.

The RB is protected against external and internal floods. In regards to external flooding, the RB incorporates structural provisions into the plant design to protect the structures, systems and components from postulated flood and groundwater conditions.

This approach provides:

- Wall thicknesses below flood level designed to withstand hydrostatic loads;
- Water stops provided in all expansion and construction joints below flood and groundwater levels;
- Waterproofing of below flood and groundwater levels external surfaces;
- Water seals at pipe penetrations below flood and groundwater levels; and
- Roofs designed to prevent pooling of large amounts of water in accordance with Regulatory Guide 1.102.

Protective features used to mitigate or eliminate the consequences of internal flooding are:

- Structural enclosures or barriers;
- Curbs and sills;
- Leakage detection components; and

- Drainage systems.

The RB is protected against pressurization effects associated with postulated rupture of pipes containing high-energy fluid that occur in subcompartments of the RB.

The RB is designed and constructed to accommodate the dynamic and static loading conditions associated with the various loads and load combinations, which form the structural design basis. The loads are (as applicable) those associated with:

- Natural phenomena—wind, floods, tornados (including tornado missiles), earthquakes, rain and snow.
- Internal events—floods, pipe breaks and missiles.
- Normal plant operation—live loads, dead loads, temperature effects and building vibration loads.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.5-2 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the RB.

Table 2.16.5-2

ITAAC For The Reactor Building

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4. The RB leakage rate is ≤ 50 wt% per day.	4. Test(s) with analysis will confirm that the RB leakage rate is ≤ 50 wt% per day.	4. Test/analysis report(s) conclude that the RB leakage rate is ≤ 50 wt% per day.