GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 173 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-33 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 dated March 28, 2008, Reference 1. GEH response to RAI Number 9.1-33 S01 is addressed in Enclosure 1. The original response was transmitted via Reference 2 in response to Reference 3.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

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

References:

1. MFN 08-318, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 173 Related To ESBWR Design Certification Application*, dated March 28, 2008.
2. MFN 08-047, *Response to Portion of NRC Request for Additional Information Letter No. 100 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Numbers 9.1-33, 9.1-34,9.1-35, and 9.1-36*, dated January 25, 2008.
3. MFN 07-327, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, General Manager, *Request for Additional Information Letter No. 100 Related to the ESBWR Design Certification Application,* dated May 30, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 173 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.1-33 S01

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRF	0000-0083-8375, Revision 1

Enclosure 1

MFN 08-368

***Response to Portion of NRC Request for**

Additional Information Letter No. 173

Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.1-33 S01

***Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.**

For historical purposes, the original text of RAI 9.1-33 and the GEH response is included.

NRC RAI 9.1-33

Although fuel handling components are not required to function following an SSE, critical components of the fuel handling system are designed to Seismic Category II requirements so that they will not fail in a way that would result in unacceptable consequences, such as fuel damage or damage to safety-related equipment. GE stated that standard dynamic analyses using the appropriate response spectra are performed to demonstrate [sic demonstrate] compliance to the seismic design requirements. However, GE has not provided the dynamic analyses for staff review. Provide the dynamic analyses to demonstrate how the design satifies [sic satisfies] the requirements of general design criteria (GDC) 2 and the guidelines of RG 1.29, Rev. 2, Positions C.1 and C.2.

GEH Response

The dynamic analysis of Seismic Category I and II refueling equipment is not performed until the final structural configuration of the equipment has been determined. Determination of the final equipment configuration and the structural analysis of the equipment are done as part of the normal equipment delivery for the plant. The procurement specifications for the equipment include the requirements for analysis in accordance with the guidelines of RG 1.29. At the time of the design and delivery of the refueling equipment the dynamic analysis will be available for review to demonstrate the compliance with 10 CFR 50 General Design Criterion 2.

DCD Impact

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

NRC RAI 9.1-33 S01

The staff finds acceptable that the dynamic analyses are performed during equipment selection and procurement. However, there is currently no reference to RG 1.29 in Tier 1 nor Tier 2 sections related to the fuel handling components. Revise the DCD to include a reference to RG. 1.29 for meeting GDC 2 as related to fuel handling components. In addition, please confirm that ITAACs 5 and 6 described in DCD Tier 1, Rev. 4, Table 2.16.1-1 will demonstrate conformance to RG 1.29.

GEH Response

DCD Tier 2, Revision 5, subsections 9.1.1.2, 9.1.4.18, and 9.1.5.2 will be revised to include a reference to Regulatory Guide 1.29 for meeting General Design Criteria (GDC) 2 as related to fuel handling components.

The reactor and fuel building cranes described in DCD Tier 1, Revision 4, Table 2.16.1-1 ITAACs 5 and 6, have been re-classified from Seismic Category II to Seismic Category I and revised in DCD Tier 1 Revision 5. The Seismic Category I reactor and fuel building cranes described in Table 2.16.1-1 ITAACs 5 and 6 are designed to withstand the effects of a safe shutdown earthquake condition thus demonstrating conformance to Regulatory Guide 1.29.

DCD Impact

DCD Tier 2, Revision 5, subsections 9.1.1.2, 9.1.4.18, and 9.1.5.2 will be revised as noted in the attached markup.

Monte Carlo techniques are employed in the calculations performed to assure that k_{eff} does not exceed 0.95 under all normal and abnormal conditions.

The assumption is made that the storage array is infinite in all directions. Because no credit is taken for neutron leakage, the values reported as effective neutron multiplication factors are, in reality, infinite neutron multiplication factors.

The biases between the calculated results, experimental results, and the uncertainty in the calculation, are taken into account as part of the calculation procedure to assure that the specific k_{eff} limit is met.

9.1.1.2 Storage Design

The new fuel storage racks in the buffer pool can store ~~up to 60% of one full core fuel load~~a minimum of 476 new fuel assemblies.

The new fuel storage rack design complies with the requirements of General Design Criteria (GDC) 2 by meeting the guidance of Regulatory Guides (RGs) 1.13, 1.29, and 1.117. The new fuel storage racks are located within a Seismic Category I structure that is designed to withstand the effects of extreme wind and tornado missiles. In addition, the racks conform to the applicable provisions of industry standards ANSI/ANS 57.1 and RG 1.13 ~~ANS 57.3,~~ and therefore, meet the requirements of GDC 61 and GDC 62.

9.1.1.3 Mechanical and Structural Design

The new fuel storage racks contain storage space in the Reactor Building buffer pool ~~in the reactor for 60% of the RPV core capacity of~~ for a minimum of 476 new fuel assemblies ~~(with channels) or bundles (without channels)~~. They are designed to withstand all credible static and ~~seismic~~ dynamic loadings.

The racks are designed to protect the fuel assemblies and fuel bundles from excessive physical damage under normal and abnormal conditions caused by being struck by fuel assemblies, fuel bundles or other equipment.

The racks are constructed in accordance with the Quality Assurance Requirements of 10 CFR 50, Appendix B.

The racks are classified as nonsafety-related and Seismic Category I

9.1.1.4 Material Considerations

~~Structural m~~Material used in the fabrication of the new fuel storage racks is limited to the use of stainless steel in accordance with the latest issue of the applicable ASTM specifications at the time of equipment order. The new fuel racks are fabricated from Type 304L stainless steel, which conforms to ASTM A240/A240M. The appropriate weld wire for the Type 304L components (E308L or ER308L) is utilized in the fabrication process. Materials are chosen for their corrosion resistance and their ability to be formed and welded with consistent quality.

- Install ~~fuel pool gate~~chimney partitions;
- Install chimney head/separator and steam dryer assemblies;
- Remove nozzle plugs;
- ~~Remove and store equipment storage pool gate;~~
- ~~Install steam dryer and chimney head / separator assemblies;~~
- Install equipment storage pool gate;
- Drain reactor cavity;
- Install and tighten reactor vessel head;
- Install reactor vessel insulation;
- Perform in-service leak test (ISLT - Equipment is tagged out and inoperable during this test, which is a critical path item);
- Remove tags and restore valve lineups;
- Install drywell head;
- Flood reactor cavity;
- Perform startup operations check; and
- Check final drywell closeout.

9.1.4.18 Safety Evaluation of Fuel Handling System

Fuel servicing equipment is discussed in Subsection 9.1.4.6 and refueling equipment is discussed in Subsection 9.1.4.5. In addition, the summary safety evaluation of the fuel handling system is described in the following paragraphs.

The refueling machine and fuel handling machine are designed to prevent them from becoming unstable and toppling into pools during a SSE, and interlocks, as well as limit switches, are provided to prevent accidental movement of the grapple mast into pool walls.

The grapple on both the refueling machine and fuel handling machine is hoisted to its retracted position by redundant cables inside the mast and is lowered to full extension by gravity. The retraced position is controlled by both interlocks and physical stops to prevent raising the fuel assembly above the normal stop position required for safe handling of the fuel. The operator can observe the exact grapple position over the core by a display screen at the operator console.

The results of the rack load drop analysis are contained in Reference 9.1-1.

The fuel handling system complies with ~~General Design Criterion 61 of 10 CFR 50 as described in Subsection 3.1.6.2.~~ the guidance of RGs 1.13, 1.29, 1.117, and ANSI/ANS 57.1, Design Requirements for Light Water Reactor Fuel Handling Systems, in order to handle fuel units and control components in a safe and reliable manner, thus meeting the requirements of General Design Criteria 2, 61, and 62 of 10 CFR 50, Appendix A. The fuel handling system and its components are located within a Seismic Category I structure that is designed to withstand the effects of extreme wind and tornado missiles.

9.1.5.2 General

The equipment described in this subsection covers items considered as heavy loads that are handled under conditions that mandate critical handling compliance.

Critical load handling conditions relate to the moving of loads, the use of equipment and the performance of operations, which, by inadvertent operation or equipment malfunctions, either separately or in combination, could cause:

- A release of radioactivity;
- A criticality accident;
- The inability to cool fuel within the reactor vessel or within the Spent Fuel Pool; and
- Prevent a safe shutdown of the reactor.

This includes risk assessments of spent fuel and of storage pool levels, cooling of fuel pool water, or new fuel criticality. Critical load handling therefore includes all components and equipment used for moving loads weighing more than one fuel assembly with its associated handling devices.

The Reactor and Fuel Building cranes provide a safe and effective means for transporting heavy loads including the handling of new and spent fuel, plant equipment, service tools and fuel casks. Safe handling includes design considerations for maintaining occupational radiation exposure as low as practicable during transportation and handling.

Where applicable, the appropriate seismic category, safety classification, ASME, ANSI, industrial and electrical codes have been identified (refer to Tables 9.1-4 and 9.1-5). The designs conform to the relevant requirements of General Design Criteria 2, 4, and 61 of 10 CFR 50, Appendix A by meeting the guidance of RGs 1.13, 1.29, 1.115, 1.117, and ANSI/ANS 57.1. The fuel handling system is housed within a Seismic Category I structure that is designed to withstand the effects of extreme wind and tornado missiles.

The lifting capacity of each crane or hoist is designed to at least the maximum actual or anticipated weight of equipment and handling devices in a given area serviced. The hoists, cranes, or other lifting devices comply with the requirements of NRC Bulletin 96-02, NUREG-0554, ANSI N14.6, ASME/ANSI B30.9, ASME/ANSI B30.10 and NUREG-0612 Subsection 5.1.1(4) or 5.1.1(5). Cranes and hoists are also designed to criteria and guidelines of NUREG-0612 Subsection 5.1.1(7), ASME/ANSI B30.2 and CMAA-70 specifications for electrical overhead traveling cranes, including ASME/ANSI B30.11, and ASME/ANSI B30.16 as applicable.

9.1.5.3 Applicable Design Criteria for All OHLH Equipment

All handling equipment subject to heavy loads handling criteria has ratings consistent with lifts required and the design loading will be visibly marked. Cranes/hoists or monorail hoists pass over the centers of gravity of heavy equipment that is to be lifted. In locations where a single monorail or crane handles several pieces of equipment, the routing is such that each transported piece passes clear of other parts.

Pendant control is required for the bridge, trolley, and auxiliary hoist to provide efficient handling of fuel shipping containers during receipt and also to handle fuel during new fuel