HITACHI

GE Hitachi Nuclear Energy

Richard E. Kingston
Vice President, ESBWR Licensing

P.O. Box 780
3901 Castle Hayne Road, M/C A-65
Wilmington, NC 28402 USA

T 910.819.6192
F 910.362.6192
rick.kingston@ge.com

MFN 09-738, Revision 1

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Subject: **Revised Response to Portion of NRC Request for Additional Information Letter No. 380 Related to Design Control Document (DCD) Revision 6 - RAI Number 14.3-457**

The purpose of this letter is to submit the revised GE Hitachi Nuclear Energy (GEH) response to a portion of the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) Letter Number 380 sent by NRC letter dated October 28, 2009 (Reference 1). The revision to RAI Number 14.3-457, addressed in Enclosure 1, is a result of a January 14, 2010 telephone conversation with the staff regarding the original response (Reference 2).

Enclosure 2 contains the changes to DCD Tier 2 as a result of GEH's response to this RAI. All DCD changes are included for completeness including the new change to DCD Tier 1, Table 2.5.6-1.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

References:

1. MFN 09-684 Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, GEH, *Request For Additional Information Letter No. 380 Related to Design Control Document (DCD) Revision 6* dated October 28, 2009

2. MFN 09-738 Letter from Richard E. Kingston to the U.S. Nuclear Regulatory Commission, *Response to Portion of Request For Additional Information Letter No. 380 Related to Design Control Document (DCD) Revision 6 – RAI Number 14.3-457* dated December 5, 2009

Enclosures:

1. Revised Response to Portion of NRC Request for Additional Information Letter No. 380 Related to Design Control Document (DCD) Revision 6 - RAI Number 14.3-457

2. Revised Response to Portion of NRC Request for Additional Information Letter No. 380 Related to Design Control Document (DCD) Revision 6 - RAI Number 14.3-457 – DCD Markups

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	PM Yandow	GEH/Wilmington (with enclosures)
	EDRF Section	0000-0110-0767 R1 (RAI 14.3-457 R1)

Enclosure 1

MFN 09-738, Revision 1

Revised Response to Portion of NRC Request for Additional Information Letter No. 380 Related to ESBWR Design Certification Application

RAI Number 14.3-457

NRC RAI 14.3-457

The staff has identified certain parameters in the new and spent fuel pool criticality safety analyses that significantly affect the keff result and should be verified by the ITAAC. These include the rack spacing credited in the analyses (in-rack pitch, between rack pitch, wall separation, and separation between racks and equipment to be stored) and also the boron content of the steel plates which comprise the racks. Acceptance criteria for rack spacing should be nominal dimensions +/- tolerance. For the borated steel plates, the manufacturer's material certification report would satisfy the acceptance criteria. Also, the ITAAC should include tests, analyses, or test and analyses to show that the new fuel storage rack doors will remain closed during credible events. GEH should evaluate if additional parameters important to criticality should be included in the ITAAC.

Provide a list of the parameters important to criticality safety that should be included as Tier 1 ITAAC and specify the acceptance criteria to be considered.

Additionally, please designate the topical report, NEDC-33374P as a Tier 2 document.*

GEH Response (Unchanged)

The response to RAI 9.1-81 S02 revises LTR NEDC-33374P to summarize the design features, installation criteria and assumed performance functions that are essential to the conclusion that applicable subcriticality criteria are met. Since this information is proprietary to GEH, it cannot be added to the DCD. Therefore, Section 9.1.2.2 will be revised to state that fuel rack design criteria related to maintaining subcriticality are provided in NEDC-33374P. In addition, ITAAC will be added to Section 2.5.6 and Table 2.5.6-1 of Tier 1 to verify that these design criteria are met. NEDC-33373P demonstrates that new fuel racks remain intact when subjected to seismic loads, and ITAAC #1 in Table 2.5.6-1 addresses this design commitment. Therefore, a new ITAAC will not be added.

DCD Tier 2, Tables 1.6-1 and Section 9.1.7 will be revised to designate NEDC-33374P as a Tier 2* document.

During the investigation of this RAI, it was discovered that the revision number in Table 1.6-1 for NEDO-33274 should have been updated to Revision 4 in DCD Revision 6, as indicated in the DCD change list. This change will be made in Revision 7 of the DCD.

DCD Impact (Revised)

DCD Tier 1, Section 2.5.6 and Table 2.5.6-1, and Tier 2, Sections 9.1.2.2 and 9.1.7 and Table 1.6-1, will be revised as noted in the attached markups. Revision 1 of this response revises the markups to DCD Tier 1, Table 2.5.6-1, based on discussions with the NRC.

Enclosure 2

MFN 09-738, Revision 1

Revised Response to Portion of NRC Request for Additional Information Letter No. 380 Related to ESBWR Design Certification Application

RAI Number 14.3-457

DCD Markups

2.5.6 Fuel Storage Facility

New and spent fuel storage facilities are provided for fuel and associated equipment.

Design Description

(1) New fuel storage racks are designed to withstand a design bases seismic event.

(2) Spent fuel storage racks are designed to withstand a design bases seismic event.

(3) Deleted.

(4) Deleted.

(5) The maximum spent fuel rack water coolant flow temperature at the rack exit shall be ≤ 121°C (250°F).

(6) The maximum stresses in the spent fuel racks do not exceed ASME Code, Section III, design allowable during accident conditions.

(7) The Spent Fuel Racks are capable of maintaining fuel subcritical.

(8) New Fuel Racks are capable of maintaining fuel subcritical.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.5.6-1 provides a definition of the inspections, tests, and analyses, together with associated acceptance criteria for the new and spent fuel storage racks.

Table 2.5.6-1

ITAAC For The Fuel Storage Facility

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. New fuel storage racks are designed to withstand a design bases seismic event.	An inspection and analysis of the new fuel storage racks configuration will be performed to ensure the design conforms to the seismic analyses.	The new fuel racks can withstand seismic design basis dynamic loads, and that the as-built configuration conforms to the analyses.
2. Spent fuel storage racks are designed to withstand a design bases seismic event.	An inspection and analysis of the spent fuel storage racks configuration will be performed to ensure the design conforms to the seismic analyses.	The spent fuel racks can withstand seismic design basis dynamic loads and the as-built configuration conforms to the analyses.
3. (Deleted)		
4. (Deleted)		
5. The maximum spent fuel rack water coolant flow temperature at the rack exit shall be ≤ 121°C (250°F).	Analyses will be performed to determine the maximum temperature of the spent fuel racks.	Analyses confirm the maximum temperature in the spent fuel racks is ≤ 121°C (250°F) at rack exit under normal operating conditions.
6. The maximum stresses in the spent fuel racks do not exceed ASME Code, Section III, design allowable during accident conditions.	Analyses will be performed to confirm that maximum stresses in the spent fuel racks do not exceed ASME Code, Section III, design allowables during accident conditions.	Analysis records confirm that the maximum stresses in the spent fuel racks will not exceed ASME Code, Section III, design allowable during accident conditions.

Table 2.5.6-1

ITAAC For The Fuel Storage Facility

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. The Spent Fuel Racks are capable of maintaining fuel subcritical.	i. Inspections will be performed on the as-built Spent Fuel Racks and arrays.	i. The as-built Spent Fuel Racks dimensions are within the tolerances used in the Fuel Storage Racks Criticality Analysis for the following features: • Borated stainless steel rack pitch • Borated stainless steel rack wall thickness • Exterior stainless steel wall thickness • Inner fuel box width • Edge fuel box width • Rack array spacing
	ii. Inspections will be performed on the as-built Spent Fuel Racks and arrays.	ii. The as-built interlocking panels in the active fuel region that form the Spent Fuel Racks interior matrix conform to the design in the Fuel Storage Racks Criticality Analysis for the following features: • Panels are made of borated stainless steel • Borated stainless steel type • Boron content • Minimum density • Maximum gap between panels

Table 2.5.6-1

ITAAC For The Fuel Storage Facility

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	iii. Inspections will be performed on the as-built Spent Fuel Racks and arrays.	iii. The as-built interlocking panels that form the Spent Fuel Racks exterior walls conform to the design in the Fuel Storage Racks Criticality Analysis for the following features: • Stainless steel type • Minimum density
8. New Fuel Racks are capable of maintaining fuel subcritical.	i. Inspections will be performed on the as-built New Fuel Racks.	i. The as-built New Fuel Racks dimensions are within the tolerances used in the Fuel Storage Racks Criticality Analysis for the following features: • Between rack pitch • In-rack pitch • Rack array spacing • Rack inner fuel box width • Rack wall thickness • Four-sided bottom enclosure
	ii. Inspections will be performed on the as-built New Fuel Racks.	ii. The as-built New Fuel Rack walls conform to the design in the Fuel Storage Racks Criticality Analysis for the following design features: • Stainless steel type • Minimum density

9.1.2.2 Nuclear Design

New and spent fuel storage racks are capable of maintaining fuel subcritical. Key design features associated with maintaining subcriticality are documented in Reference 9.1-2. A full array in the loaded spent fuel rack is designed to be subcritical by at least 5% Δk/k. Neutron-absorbing material (borated stainless steel in accordance with ASTM A887-89), as an integral part of the design, is employed to assure that the calculated k_{eff}, including biases and uncertainties, does not exceed 0.95 under all normal and abnormal conditions.

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 (see Reference 9.1-2).

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

9.1.2.3 Storage Design

The fuel storage racks provided in the Spent Fuel Pool in the FB provide for storage of 3504 irradiated fuel assemblies, which is enough storage capacity for 10 calendar years of plant operation. The fuel storage racks in the RB buffer pool deep pit can hold a maximum of 154 spent fuel assemblies. Together, the spent fuel storage racks provided in the spent fuel pool and buffer pool deep pit, accommodate the spent fuel resulting from 10 calendar years of plant operation plus one full-core offload.

9.1.2.4 Mechanical and Structural Design

[*The spent fuel storage racks in the RB buffer pool and in the Spent Fuel Pool in the FB contain storage space for fuel assemblies. A standard dynamic analysis using the appropriate response spectra is performed to demonstrate compliance to design requirements. They are designed to withstand all credible static and dynamic loadings. The racks are designed to protect the fuel assemblies from excessive physical damage which may cause the release of radioactive materials in excess of RG 1.183 requirements, under normal and abnormal conditions caused by impact from fuel assemblies, or other equipment.*

*The Spent Fuel Pool and buffer pool are reinforced concrete structures with a stainless steel liner. Fuel storage racks and pool liners are designed to meet Seismic Category I requirements. Pool liner and anchorage are designed to the same loads and load combinations as the pool concrete structure in accordance with Table 3.8-15, except that load factors for all cases are equal to 1.0, and the acceptance criteria follow ASME Section III, Division 2, CC-3700. Pool liners are evaluated to ensure structural integrity under fuel handling accidents. The bottoms of the pool gates are at least 3.05 m (10.0 ft) above TAF to provide adequate shielding and cooling. Pool fill lines enter the pool above the safe shielding water level and overflow weirs are located above normal water level. Redundant anti-siphon*ing ~~vacuum breakers~~*provisions are* ~~*located*~~*included* ~~*at the high point of the*~~*on pool circulation lines to preclude a pipe break from siphoning the water from the pool and jeopardizing the safe water level of 3.05m (10.0 ft) above TAF.*

The racks include individual solid tube storage compartments, which provide lateral restraints over the entire length of the fuel assembly or bundle. The weight of the fuel assembly or bundle

The COL applicant will provide a description of the program governing heavy loads handling, and the schedule for implementation, that addresses the following:

- Heavy loads and heavy load handling equipment outside the scope of loads described in the referenced certified design, and the associated heavy load attributes (load weight and typical load path);
- Requirements for heavy load handling safe load paths and routing plans including descriptions of automatic and manual interlocks not described in the referenced certified design and safety devices and procedures to assure safe load path compliance;
- Summary description of requirements to develop heavy load handling equipment maintenance manuals and procedures;
- Requirements for heavy load handling equipment inspection and test plans;
- Requirements for heavy load personnel qualifications, training, and control programs;
- QA program requirements to monitor, implement, and ensure compliance with the heavy load handling program. (Subsection 9.1.5.8) (This includes the QA program elements described in Subsection 9.1.5.2); and
- Issues described in Regulatory Issue Summary (RIS) 2005-25, Supplement 1, Clarification of NRC Guidelines for Control of Heavy Loads, related to the use of non-metallic slings with single failure proof lifting devices. (Subsection 9.1.5.8)

9.1.7 References

9.1-1 GE Hitachi Nuclear Energy, "Dynamic, Load-Drop, and Thermal-Hydraulic Analyses for ESBWR Fuel Racks", NEDC-33373P, Class II (Proprietary), and NEDO-33373, Class I (Non-proprietary).

9.1-2 *[GE Hitachi Nuclear Energy, "Criticality Analysis for ESBWR Fuel Racks", NEDC-33374P, Class II (Proprietary), and NEDO-33374, Class I (Non-proprietary).]**

* References that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2*. Prior NRC approval is required to change Tier 2* information.

Table 1.6-1

Referenced GE / GEH Reports

Report No.	Title	Section No.
NEDO-33267	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Human Reliability Analysis Implementation Plan," NEDO-33267, Class I (Non-proprietary), Revision 3, May 2008.]* *	18.7
NEDE-33268P NEDO-33268	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Human-System Interface Design Implementation Plan," NEDE-33268P, Class III (Proprietary), and NEDO-33268, Class I (Non-proprietary), Revision 4, May 2009.]**	18.8
NEDO-33274	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Procedures Development Implementation Plan," NEDO-33274, Class I (Non-proprietary), Revision ~~3~~4, July 2009.]**	18.9
NEDO-33275	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Training Development Implementation Plan," NEDO-33275, Class I (Non-proprietary), Revision 3, May 2009.]**	18.10
NEDE-33276P NEDO-33276	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Verification and Validation Implementation Plan," NEDE-33276P, Class III (Proprietary), and NEDO-33276, Class I (Non-proprietary), Revision 3, July 2009.]**	18.11
NEDO-33277	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Human Performance Monitoring Implementation Plan," NEDO-33277, Class I (Non-proprietary), Revision 3, May 2008.]**	18.13
NEDO-33278	*[GE Hitachi Nuclear Energy, "ESBWR Human Factors Engineering Design Implementation Plan," NEDO-33278, Class I (Non-proprietary), Revision 3, May 2008.]**	18.12
NEDE-33279P NEDO-33279	GE Hitachi Nuclear Energy, "ESBWR Containment Fission Product Removal Evaluation Model," NEDE-33279P, Class III (Proprietary), and NEDO-33279, Class I (Non-proprietary), Revision 3, June 2009.	15.4, 15C

Table 1.6-1

Referenced GE / GEH Reports

Report No.	Title	Section No.
NEDO-33337	GE Hitachi Nuclear Energy, "ESBWR Initial Core Transient Analyses," NEDO-33337, Class I (Non-proprietary), Revision 1, April 2009.	4.4, 4D, 15.0, 15.2, 15.3, 15.5, 15D
NEDO-33338	GE Hitachi Nuclear Energy, "ESBWR Feedwater Temperature Operating Domain Transient and Accident Analysis," NEDO-33338, Class I (Non-proprietary), Revision 1, May 2009.	1.1, 4.4, 4D, 6.2, 6.3, 15.0, 15.2, 15.3, 15.5, 15D Chapter 16, Sect. 5.6.3
NEDC-33373P NEDO-33373	GE-Hitachi Nuclear Energy, "Dynamic, Load-Drop, and Thermal-Hydraulic Analyses for ESBWR Fuel Racks," NEDC-33373P, Revision 2, Class II (Proprietary), August 2009, and NEDO-33373, Revision 0, Class I (Non-proprietary), November 2007.	9.1
NEDC-33374P NEDO-33374	*[GE-Hitachi Nuclear Energy, "Safety Analysis Report for Fuel Storage Racks Criticality Analysis for ESBWR Plants," NEDC-33374P, Revision 2, Class II (Proprietary) August 2009, and NEDO-33374, Revision 1, Class I (Non-proprietary), December 2008.]**	9.1
(Deleted)		
NEDE-33391	GE Hitachi Nuclear Energy, "ESBWR Safeguards Assessment Report," NEDE-33391, Revision 2, July 2009 – Safeguards Information.	13.6
NEDC-33408P NEDO-33408	GE Hitachi Nuclear Energy, "ESBWR Steam Dryer – Plant Based Load Evaluation Methodology," NEDC-33408P, Class III (Proprietary), Revision 1, July 2009, and NEDO-33408, Class I (Non-proprietary), Revision 1, July 2009.	3L