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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 275 Related to ESBWR Design Certification Application – RAI Number 14.3-447**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI originally transmitted via the Reference 1 letter. Enclosure 2 contains the DCD markups for this response.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box.

If you have any questions about the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 08-967, Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 275, Related To ESBWR Design Certification Application, dated December 11, 2008

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 275, Related to ESBWR Design Certification Application – RAI Number 14.3-447
2. Response to Portion of NRC Request for Additional Information Letter No. 275, Related to ESBWR Design Certification Application – RAI Number 14.3-447 - DCD Markups

cc:

AE Cubbage	USNRC (with enclosures)
RE Brown	GEH/Wilmington (with enclosures)
DH Hinds	GEH/Wilmington (with enclosures)
eDRF Section	0000-0098-7885

Enclosure 1

MFN 09-171

Response to Portion of NRC Request for

Additional Information Letter No. 275

Related to ESBWR Design Certification Application

RAI Number 14.3-447

NRC RAI 14.3-447:

Why aren't certain of the OHLHS design features in ITAAC or Tier 1?

10 CFR 52.47(b)(1), which requires that a design certification application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC regulations. Important to safety functions should be described in the DCD Tier 1.

Based on the review of DCD Tier 2 section 9.1, several apparent important to safety design features have been omitted from Tier 1. Please explain why the applicant did not include the following design features for the Overhead Heavy Load Handling System (OHLHS) in ITAAC or specify them as Tier 1 material:

- *Cranes and hoists, or monorail hoists pass over the centers of gravity of heavy equipment that is to be lifted.*
- *Because the Passive Containment Cooling (PCC) and Gravity Driven Cooling System (GDCS) piping and valves are spatially separated, an inadvertent load drop that breaks more than one pipe of valve in the PCC or GDCS is not credible.*
- *The arrangement of the refueling floor precludes transporting heavy loads, other than spent fuel handled by the refueling machine or fuel handling machine, over spent fuel stored in the spent fuel storage pool.*

GEH Response:

Response to First Bullet:

A design commitment and corresponding ITAAC will be added to DCD Tier 1 Sections 2.5.5 and 2.16.1 and Tables 2.5.5-1 and 2.16.1-1, requiring that the RB crane, FB crane, fuel handling machine and refueling machine pass over the centers of gravity of heavy equipment that is to be lifted.

Response to Second Bullet

The PCC system is not required to be operable during Refueling; therefore, DCD Tier 2, Section 9.1.5.6 will be revised to delete references to the PCC system in the context of protecting piping and valves from inadvertent load drops. For the GDCS system, an ITAAC will be added to DCD Tier 1 that the GDCS is not susceptible to a load drop that could result in the GDCS not being able to meet Technical Specifications for modes 5 and 6. DCD Tier 2 will be revised to indicate that load drop protection will be provided for each GDCS component in one of two ways. Either, the area above the component will be restricted for heavy loads by upper

drywell servicing equipment design or interlocks, or spatial separation will be provided.

Note that the response to RAI 14.3-441 (MFN Letter 09-172) added ITAAC to Tier 1 Tables 2.5.5-1 and 2.16.1-1 to ensure the RB and FB cranes and the hoists for the fuel handling machine and refueling machine are single failure proof. DCD Tier 2, Table 9.1-5 indicates that NUREG-0554 and ANSI N14.6 are applicable to the RB and FB cranes and the hoists for the fuel handling machine and refueling machine.

The above approach is consistent with Standard Review Plan 9.1.5, which states that one of the following three safety guidelines must be followed for heavy load handling equipment:

A. Movement of the OHLHS is restricted by design or interlocks to areas away from stored fuel and equipment necessary for the safe shutdown of the reactor.

B. The consequences of a load drop have been evaluated to ensure that it could neither damage stored irradiated fuel to the extent that a significant off-site release would occur nor preclude operation of sufficient equipment to achieve safe shutdown.

C. The probability for a load drop is minimized by an overhead handling system designed to comply with the guidelines of NUREG-0554 and lifting devices that comply with American National Standards Institute (ANSI) N14.6 or an alternative based on American Society of Mechanical Engineers (ASME) B30.9. An overhead handling system that complies with ASME NOG-1 criteria for Type 1 cranes is an acceptable method for compliance with the NUREG-0554 guidelines.

Response to Third Bullet

As discussed in Tier 2, Section 9.1.5.5 and Tier 1, Table 2.16.1-1, Items 3 and 4, the reactor building and fuel building cranes are interlocked to prevent movement of heavy loads over new or spent fuel. DCD Tier 2, Section 9.1.5.9 will be revised to indicate that crane interlocks, and not floor arrangement, preclude transporting heavy loads over fuel storage pools. An ITAAC will also be added to Tier 1 that heavy load handling equipment other than the RB and FB cranes and the refueling and fuel handling machines will be designed or interlocked such that movement of heavy loads is restricted to areas away from stored fuel.

DCD Impact:

DCD Tier 1, Sections 2.5.5 and 2.16.1 and Tables 2.5.5-1 and 2.16.1-1 and Tier 2, Sections 9.1.5.5, 9.1.5.6 and 9.1.5.9 and Table 9.1-5 will be revised as indicated in the attached markup, as shown in Enclosure 2.

Enclosure 2

MFN 09-171

Response to Portion of NRC Request for

Additional Information Letter No. 275

Related to ESBWR Design Certification Application

RAI Number 14.3-447
DCD Markups

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box.

2.5.5 Refueling Equipment

The ESBWR is supplied with a Reactor Building (RB) refueling machine for fuel movement and a fuel handling machine used for fuel servicing and transporting tasks in the Fuel Building (FB).

Design Description

The functional arrangement of the RB refueling machine is that it is a gantry-type crane that spans the reactor vessel cavity and fuel and storage pools to handle fuel and perform other ancillary tasks. It is equipped with a traversing trolley on which is mounted a telescoping mast and integral fuel grapple. The machine is a rigid structure built to ensure accurate and repeatable positioning during the refueling process.

The functional arrangement of the FB fuel handling machine is that it is equipped with a traversing trolley on which is mounted a telescoping mast and integral fuel grapple. The machine is a rigid structure built to ensure accurate and repeatable positioning while handling fuel.

(1) The functional arrangement of the RB refueling machine is as described in the Design Description of this Subsection 2.5.5.

(2) The RB refueling machine is classified as nonsafety-related, but is designed as Seismic Category I.

(3) The RB refueling machine has an auxiliary hoist with sufficient load capability.

(4) The RB refueling machine is provided with controls interlocks.

(5) The functional arrangement of the FB fuel handling machine is as described in the Design Description of this Subsection 2.5.5.

(6) The FB fuel handling machine is classified as nonsafety-related, but is designed as Seismic Category I.

(7) The FB fuel handling machine has an auxiliary hoist with sufficient load capability.

(8) The FB fuel handling machine is provided with controls interlocks.

(9) The RB refueling machine hoist is designed such that a single failure will not result in the loss of the capability to safely retain the load.

(10) The FB fuel handling machine hoist is designed such that a single failure will not result in the loss of the capability to safely retain the load.

(11) The FB fuel handling machine passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.

(12) The RB refueling machine passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.5.5-1 provides a definition of the inspection, test, and/or analyses, together with associated acceptance criteria for the refueling ~~machine~~equipment.

Table 2.5.5-1

ITAAC For The Refueling ~~Machine~~Equipment

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
10. The FB fuel handling machine hoist is designed such that a single failure will not result in the loss of the capability to safely retain the load.	Inspection of the FB fuel handling machine hoist design documents will be performed.	Report(s) exist and conclude the FB fuel handling machine hoist is designed so that a single failure will not result in the loss of the capability to safely retain the load.
11. The FB fuel handling machine passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.	Tests will be conducted of the as-built FB fuel handling machine.	Report(s) exist and conclude that the FB fuel handling machine passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.
12. The RB refueling machine passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.	Tests will be conducted of the as-built RB refueling machine.	Report(s) exist and conclude that the RB refueling machine passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.

2.16 STRUCTURES AND SERVICING SYSTEMS/EQUIPMENT

2.16.1 Cranes, Hoists and Elevators

Design Description

Cranes and hoists are used for maintenance and refueling tasks. The reactor building (RB) crane, fuel building (FB) crane and associated lifting devices, such as hoists, and elevators in various areas of the plant are nonsafety-related.

(1) The RB crane has a lifting capacity greater than its heaviest expected load.

(2) The FB crane has a lifting capacity greater than its heaviest expected load.

(3) The RB crane is interlocked to prevent movement of heavy loads over new or spent fuel in the RB.

(4) The FB crane is interlocked to prevent movement of heavy loads over spent fuel in the FB.

(5) The RB crane is classified as Seismic Category I to maintain crane structural integrity.

(6) The FB crane is classified as Seismic Category I to maintain crane structural integrity.

(7) The RB crane passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.

(8) The FB crane passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.

(9) Heavy load equipment other than the RB crane, FB crane, fuel handling machine and refueling machine are designed or interlocked such that movement of heavy loads is restricted to areas away from stored fuel.

(10) The RB crane is designed such that a single failure will not result in the loss of the capability of the crane to safely retain the load. These features are limited to the hoisting system and braking system for the trolley and bridge.

(11) The FB crane is designed such that a single failure will not result in the loss of the capability of the crane to safely retain the load. These features are limited to the hoisting system and braking system for the trolley and bridge.

(12) The GDCS system is not susceptible to a load drop that could result in the GDCS not meeting the Technical Specifications for modes 5 and 6.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.1-1 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria for the Cranes, Hoists and Elevators.

Table 2.16.1-1

ITAAC For ~~The~~ Cranes, Hoists and Elevators

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. The RB crane passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.	Tests will be conducted of the as-built RB crane.	Report(s) exist and conclude that the RB crane passes over the expected locations of the centers of gravity of heavy loads included in the certified design that are to be lifted.
8. The FB crane passes over the centers of gravity of heavy loads included in the certified design that are to be lifted.	Tests will be conducted of the as-built FB crane.	Report(s) exist and conclude that the FB crane passes over the expected locations of the centers of gravity of heavy loads included in the certified design that are to be lifted.
9. Heavy load handling equipment other than the RB crane, FB crane, fuel handling machine and refueling machine are designed or interlocked such that movement of heavy loads is restricted to areas away from stored fuel.	Inspections of as-built heavy load handling equipment will be performed.	Report(s) exist and conclude that heavy load handling equipment are designed or interlocked such that movement of heavy loads is restricted to areas away from stored fuel.
10. The RB crane is designed such that a single failure will not result in the loss of the capability of the crane to safely retain the load. These features are limited to the hoisting system and braking system for the trolley and bridge.	Inspection of the RB crane design documents will be performed.	Report(s) exist and conclude the RB crane is designed so that a single failure will not result in the loss of the capability of the crane to safely retain the load.

Table 2.16.1-1

ITAAC For ~~The~~ Cranes, Hoists and Elevators

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. The FB crane is designed such that a single failure will not result in the loss of the capability of the crane to safely retain the load. These features are limited to the hoisting system and braking system for the trolley and bridge.	Inspection of the FB crane design documents will be performed.	Report(s) exist and conclude the FB crane is designed so that a single failure will not result in the loss of the capability of the crane to safely retain the load.
12. The GDCS system is not susceptible to a load drop that could result in the GDCS not meeting the Technical Specifications for modes 5 and 6.	Inspection and analysis of the GDCS piping will be performed.	Report(s) exist and conclude that GDCS components are not susceptible to a load drop that could result in the GDCS not meeting the Technical Specification for modes 5 and 6.

The FB crane is designed to be single failure proof in accordance with NUREG-0554 and meets ASME NOG-1.

Reactor Building Crane

The Reactor Building (RB) is a reinforced concrete structure enclosing the Reinforced Concrete Containment Vessel (RCCV), the refueling floor, the new fuel storage buffer pool, buffer pool deep pit pool for spent fuel storage, the dryer and separator, and other equipment. The Reactor Building crane provides heavy load lifting capability for the refueling floor. The main hook (160-metric ton/176-ton capacity) is used to lift the drywell head, RPV head insulation, RPV head, dryer, separator strongback, chimney partitions, and RPV head stud tensioning equipment (refer to Table 9.1-7). The orderly placement and movement paths of these components by the RB crane preclude transport of these heavy loads over the spent fuel racks in the deep pit buffer pool or over the new fuel rack.

The RB crane is used during refueling/servicing as well as when the plant is on-line. Minimum crane coverage includes the RPV for shield block removal and vessel servicing RB refueling floor lay down areas, RB equipment storage, refueling floor and the equipment hatches. The RB crane is interlocked to prevent movement of heavy loads over the fuel pools.

The RB crane is designed to be single failure proof in accordance with NUREG-0554 and meets ASME NOG-1.

9.1.5.6 Other Overhead Load Handling System

Upper Drywell Servicing Equipment

The upper drywell arrangement provides servicing access for the main steam isolation valves (MSIVs), feedwater isolation valves; safety/relief valves (SRVs), depressurization valves (DPVs), Isolation Condenser System (ICS) valves, Gravity-Driven Cooling System (GDCS) valves, and drywell cooling coils, fans and motors. Access to the space is from the RB through either the upper drywell personnel lock or equipment hatch. Equipment is removed through the upper drywell equipment hatch. Platforms are provided for servicing the feedwater and main steam isolation valves, safety/relief valves, and drywell cooling equipment with the objective of reducing maintenance time and operator exposure. Items such as MSIVs, SRVs, DPVs, and feedwater isolation valves weigh in excess of a fuel assembly and its handling device and therefore are considered heavy loads.

Drywell maintenance activities are only performed during a plant outage, therefore, only the ~~PCCS and~~ GDCS piping and valves need to be protected from inadvertent load drops. This protection is provided for each GDCS component in one of two ways. Either the upper drywell servicing equipment that handles heavy loads is designed or interlocked such that movement of heavy loads above the component is restricted, or spatial separation is provided such that a single inadvertent load drop cannot result in the GDCS not meeting the Technical Specifications for modes 5 and 6.~~Because the PCCS and GDCS piping and valves are spatially separated, an inadvertent load drop that breaks more than one pipe or valve of the PCCS or GDCS is not credible.~~ In addition, a piping support structure and equipment platform separates and shields the ~~PCCS and~~ GDCS piping from heavy load transport paths.

This protection is such that no credible load drop can cause (a) a release of radioactivity, (b) a criticality accident, or (c) the inability to cool fuel within the reactor vessel or Spent Fuel Pool.

Other Servicing Equipment

Outside of the containment, the main steam tunnel, or the refueling floor there are no safety-related components of one division routed over any portion of a safety-related portion of another division at locations susceptible to heavy load drops capable of causing the loss of a safety-related component required to maintain the plant in a safe condition. Therefore, inadvertent load drops cannot cause (a) a release of radioactivity, (b) a criticality accident, (c) the inability to cool fuel within reactor vessel or Spent Fuel Pool, or (d) prevent the safe shutdown of the reactor. Therefore, the servicing equipment located outside the containment, the main steam tunnel, or the refueling floor is not subject to the requirements of Subsections 9.1.5.2 and 9.1.5.3.

9.1.5.7 Equipment Operating Procedures Maintenance and Service

Each item of equipment requiring servicing is described on an interface control diagram (ICD) delineating the space around the equipment required for servicing. This includes pull space for internal parts, access for tools, handling equipment, and alignment requirements. The ICD specifies the weights of large removable parts, shows the location of their centers of gravity, and describes installed lifting accommodations such as eyes and trunnions. An instruction manual describes maintenance procedures for each piece of equipment to be handled for servicing. Each manual contains suggestions for rigging and lifting of heavy parts, and identifies any special lifting or handling tools required.

Operating instruction and maintenance manuals are provided for reference and use by operations personnel for all major handling equipment components (cranes, hoist, etc.).

9.1.5.8 Operational Responsibilities

Critical heavy load handling in the plant includes the following key elements for the administration and implementation of heavy load handling systems:

- Heavy Load Handling System and Equipment Operating Procedures;
- Heavy Load Handling Equipment Maintenance Procedures and/or Manuals;
- Heavy Load Handling Equipment Inspection and Test Plans; NDE, Visual, etc.;
- Heavy Load Handling Safe Load Paths and Routing Plans;
- QA Program to Monitor and Assure Implementation and Compliance of Heavy Load Handling Operations and Controls (This includes the QA program elements described in Subsection 9.1.5.2); ~~and~~
- Personnel Qualifications, Training and Control Program; and~~.~~
- Heavy Load Handling System Guidelines regarding the use of non-metallic slings with single failure proof lifting devices.

The COL applicant will provide a description of the program governing heavy loads handling, and the schedule for implementation (COL 9.1-5-A).

9.1.5.9 Safety Evaluations

The RB and FB cranes are interlocked to prevent movement of heavy loads over fuel storage pools. The RB and FB cranes are designed to be single failure proof, in accordance with

NUREG-0554, and meet ANSI N14.6. Other heavy load handling systems are designed or interlocked such that movement of heavy loads is restricted to areas away from stored fuel and some GDCS system components. The remaining GDCS components are spatially separated such that a single inadvertent load drop cannot result in the GDCS not meeting the Technical Specifications for modes 5 and 6.~~The arrangement of the refueling floor precludes transporting heavy loads, other than spent fuel handled by the refueling machine or fuel handling machine, over spent fuel stored in the spent fuel storage pool.~~

The separation (arrangement, equipment interlocks, and routing) of redundant safety-related components in relation to heavy load paths minimizes the potential to cause failure of safety-related components. Administrative procedures further minimize the potential hazard from heavy loads.

9.1.5.10 Inspection and Testing

Qualification load and performance testing, including nondestructive examination (NDE) and dimensional inspection on heavy load handling equipment, is performed. Tests may include load capacity, safety overloads, life cycle, sequence of operations, and functional performance.

When load handling equipment is received at the site, it is inspected to ensure no damage has occurred during transit or storage. Prior to use and at periodic intervals, each piece of equipment is tested again to ensure the electrical and/or mechanical functions are operational including visual inspection and, if required, NDE inspection.

Crane inspections and testing comply with ASME/ANSI B30.2.

9.1.5.11 Instrumentation Requirements

The majority of the heavy load handling equipment is manually operated and controlled by the operator based on visual observations. This type of operation does not necessitate the need for a dynamic instrumentation system.

Load cells may be installed to provide automatic shutdown whenever threshold limits are exceeded for critical load handling operations to prevent overloading.

9.1.6 COL Information

9.1-1-H Dynamic and Impact Analyses of Fuel Storage Racks (Deleted)

9.1-2-H Fuel Storage Racks Criticality Analysis (Deleted)

9.1-3-H Fuel Racks Load Drop Analysis (Deleted)

9.1-4-A Fuel Handing Operations

The COL applicant will describe the programs that address the following:

- Fuel handling procedures.
- Maintenance manuals and procedures for equipment used to move fuel.
- Equipment inspection and test plans for equipment used to move fuel.
- Personnel qualifications, training, and control programs for fuel handling personnel.
- QA programs to monitor, implement, and assure compliance to fuel handling operations.

Table 9.1-5

Reference Codes and Standards

Number	Title	Device
ANSI-N14.6	Standard for Special Lifting Devices for Shipping Containers Weighing (5 tons) or More for Nuclear Materials	Applicable to any item carrying a heavy load such as the Reactor Building (RB) and Fuel Building (FB) overhead cranes and the refueling and fuel handling machine
ASME/ANSI B30.9	Slings	Applicable to the RPV dryer strongback slings.
ASME/ANSI B30.10	Hooks	Applicable to the RB and FB overhead cranes.
ASME/ANSI B30.2	Performance Standards for Overhead Electric Overhead Traveling Cranes	Applicable to the RB and FB overhead cranes.
ASME/ANSI B30.16	Performance Standards for Air Wire Rope Hoists	Applicable to the RB and FB overhead cranes.
ASME/ANSI B30.11	Overhead and Gantry Crane	Applicable to the RB and FB overhead cranes.
ANSI/ANS 57.1	Design Requirements for Light Water Reactor Fuel Handling Systems	Applicable to the RB and FB overhead cranes and the refueling and fuel handling machine equipment and tools used to handle fuel and fuel components.
ASME NOG-1	Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)	Applicable to the RB and FB overhead cranes. Applicable to the hoist on the refueling and fuel handling machines that handles the combined fuel support and control blade grapple. Typically, the combined weight of the equipment and tooling exceeds the weight of a fuel assembly.
CMAA70	Specifications for Electric Overhead Traveling Cranes	Applicable to the RB and FB overhead cranes and the refueling and fuel handling machines.
NUREG-0612	Control of Heavy Loads at Nuclear Power Plants	Applicable to the RB and FB overhead cranes. A portion of the NUREG is applicable to the RPV strongback or dryer strongback interface with the lifting device. Applicable to the hoist on the refueling and fuel handling machines that handles the combined fuel support and control blade grapple. Typically the combined weight of the equipment and tooling exceeds the weight of a fuel assembly.
NUREG-0554	Single Failure Proof Cranes for Nuclear Power Plants	Applicable to the RB and FB overhead cranes. Applicable to the hoist on the refueling and fuel handling machines that handles the combined fuel support and control blade grapple. Typically the combined weight of the equipment and tooling exceeds the weight of a fuel assembly.