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Subject: **Transmittal of ESBWR DCD Tier 2 Markups Related to GEH Corrective Action – Chapter 9**

The purpose of this letter is to submit markups to the ESBWR DCD Tier 2, Chapter 9, resulting from GEH corrective action.

The Chapter 9 markups clarify that the buffer pool in the Reactor Building contains storage space for exactly (not minimum) 476 new fuel assemblies.

Enclosure 1 provides the DCD Tier 2 markups to be incorporated into the DCD, Rev. 8.

Markups are provided for the following DCD sections:

Tier 2, Chapter 9, Section 9.1
Tier 2, Chapter 9, Subsection 9.1.1.2
Tier 2, Chapter 9, Subsection 9.1.1.3
Tier 2, Chapter 9, Subsection 9.1.1.6

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

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NRO

Enclosure:

1. Transmittal of ESBWR DCD Tier 2 Markups Related to GEH Corrective Action – Chapter 9 – DCD Markups

cc:	AE Cubbage	USNRC (with enclosure)
	JG Head	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	TL Enfinger	GEH/Wilmington (with enclosure)
	eDRF Section	0000-0117-4109 (Chapter 9 markups)

Enclosure 1

MFN 10-161

Transmittal of ESBWR DCD Tier 2 Markups Related to GEH Corrective Action
Chapter 9

DCD Markups

9. AUXILIARY SYSTEMS

9.1 FUEL STORAGE AND HANDLING

Upon receipt of the new fuel bundles at the reactor site, each fuel bundle container is uncrated from its shipping crate and the fuel bundle container is raised to the refueling floor in the Fuel Building (FB). The fuel bundles are removed from the container and moved to the new fuel inspection stand where the fuel bundles are inspected and the fuel channels are installed to create fuel assemblies.

The fuel assemblies are then placed in the Spent Fuel Pool for transfer to the Reactor Building (RB) Buffer Pool via the Inclined Fuel Transfer System (IFTS). The newly channeled fuel assemblies are then moved to the new fuel storage racks in the RB buffer pool until time to move them into the reactor. New fuel can be transferred through the IFTS during normal operation.

There are three areas where new and spent fuel are stored. In the FB there are spent fuel storage racks for storing new or spent fuel. In the RB there are new fuel storage racks for storing new fuel and a small array of spent fuel racks in a deep pit in the buffer pool for temporary storage of spent fuel.

The new fuel storage racks, located in the RB buffer pool, contain ~~can~~ stor~~e~~age space for ~~a minimum of~~ 476 new fuel assemblies. The fuel assemblies are stored in underwater storage racks located adjacent to the reactor well. The racks are side loading and are accessed using the refueling machine.

Spent fuel removed from the reactor vessel must be stored underwater. There are two locations containing spent fuel storage racks. Buffer racks in the deep pit area of the RB buffer pool are used to temporarily store discharged fuel or fuel to be returned to the reactor during fuel shuffles. Movement of spent fuel in the buffer pool or through the IFTS is limited to reactor shutdown. Spent fuel cannot be stored in the buffer pool during normal operation. Spent fuel racks for long-term storage of spent fuel are located in the FB. These spent fuel storage racks are located at the bottom of the storage pools at a depth sufficient to provide adequate radiological shielding. The spent fuel storage pool water is processed by the Fuel and Auxiliary Pools Cooling System (FAPCS), which provides cooling to the spent fuel and maintains the spent fuel storage pool water quality. The buffer pool deep pit storage area in the RB can store a maximum of 154 fuel assemblies. Together, the spent fuel storage racks provided in the spent fuel storage pool and buffer pool deep pit have the capacity to store the fuel assemblies resulting from ten calendar years of operation plus one full core offload. However, the structures (including pool size) and systems are designed for expansion to store spent fuel assemblies resulting from 20 years of operation plus one full core offload.

9.1.1 New Fuel Storage

9.1.1.1 Design Bases

Nuclear Design

The new fuel storage racks in the buffer pool are designed to assure that the fully loaded array is subcritical by at least 5% Δk.

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

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, located in the RB buffer pool, contain~~can~~ storage space for ~~a minimum of~~ 476 new fuel assemblies.

The new fuel storage rack design complies with the requirements of General Design Criterion (GDC) 2 by meeting the guidance of 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 American National Standards Institute/American Nuclear Society 57.3 (ANSI/ANS 57.3) and RG 1.13 and therefore meet the requirements of GDC 61 and GDC 62.

9.1.1.3 Mechanical and Structural Design

The new fuel storage racks, located in the RB buffer pool, contain~~can~~ storage space for ~~a minimum of~~ 476 new fuel assemblies. They are designed to withstand all credible static and dynamic loadings.

The racks are designed to protect the fuel assemblies and fuel bundles from excessive physical damage under normal and abnormal conditions as when struck by a dropped fuel assembly or other equipment.

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

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

9.1.1.4 Material Considerations

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 American Society for Testing and Materials (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.

9.1.1.5 Dynamic and Impact Analysis

A standard dynamic analysis, using the appropriate response spectra, is performed to demonstrate compliance to design requirements. Once the response spectrum analysis has been performed for each direction, the modal responses are combined according to the grouping method established in Regulatory Guide 1.92, Revision 1, as allowed by Regulatory Guide 1.92, Revision 2. The residual rigid response of the missing mass modes is addressed in Reference

9.1-1. The input excitation for these analyses utilizes the horizontal and vertical response spectra provided in Section 3.7.

Vertical impact analysis is performed because the fuel assembly is held in the storage rack by its own weight without any mechanical hold-down devices. Reference 9.1-1 provides the documentation for the dynamic and impact analyses.

9.1.1.6 Facilities Description (New Fuel Storage)

Pool Storage

The new fuel storage racks, located in the RB buffer pool, containcan storage space for a minimum of 476 new fuel assemblies. The racks have double rows of storage positions for assemblies that are side loaded into the storage racks. Because the racks are open on the side to allow side loading, the weight of the fuel assemblies placed in the storage position actuates a mechanism that restrains the assemblies in position. The racks are floor mounted.

9.1.1.7 Safety Evaluation

Criticality Control

The design of the new fuel storage racks provides for an k_{eff} for storage conditions equal to or less than 0.95. To ensure that design criteria are met, the following normal and abnormal new fuel storage conditions were analyzed:

- Racks are loaded with fuel of the maximum fuel assembly reactivity;
- Normal positioning in the new fuel array; and
- Eccentric positioning in the new fuel array.

The new fuel storage area accommodates fuel ($k_{inf} \leq 1.32$ at 20°C [68°F] in standard core geometry) with no safety implications.

New fuel storage racks criticality control meets the requirements of 10 CFR Part 50.68(b). Criticality analysis is documented in Reference 9.1-2.

Structural Design

The new fuel storage racks are designed to meet Seismic Category I requirements. Stresses in a fully loaded rack do not exceed stresses specified by the applicable American Society of Mechanical Engineers (ASME) Codes and Standards when subjected to seismic loads.

The storage rack structure is designed to withstand the impact resulting from a falling fuel assembly.

Procedural fuel handling requirements and equipment design dictate that no more than one bundle at a time can be handled over the storage racks. The structural arrangement is such that no lateral displacement of the fuel occurs; therefore, subcritical spacing is maintained. An irradiated fuel assembly is not to be placed in a new fuel storage rack. The Combined License (COL) applicant shall describe the programs that address fuel handling operations, including criticality safety (COL 9.1-4-A).

The racks are fabricated from material specified to ASTM standards.