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Subject: **Transmittal of ESBWR DCD Tier 2 Markup Related to GEH Corrective Action – Chapter 1**

The purpose of this letter is to submit markups to ESBWR DCD Tier 2, Chapter 1, resulting from GEH corrective action.

Chapter 1 markup corrects the weight % from "18" to "25" to be consistent with the change made to the core average exit quality in Table 1.3-1 for DCD Rev 7. Also the text in S1.2.2.2.1 was modified to clarify that ARI and the motor run-in function are two distinct design features.

These changes were previewed by the staff in email comments to the draft SER on DCD Section 1.2.

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

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

Sincerely,

Richard E. Kingston

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Vice President, ESBWR Licensing

Enclosure:

1. MFN 10-200 - Transmittal of ESBWR DCD Tier 2 Markup Related to GEH Corrective Action – Chapter 1 – DCD Markups

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	eDRF Section	0000-0119-8773

MFN 10-200

Enclosure 1

Transmittal of ESBWR DCD Tier 2 Markup Related to GEH Corrective Action - Chapter 1

DCD Markups

Thermocouples are located in the discharge exhaust pipes of the SRVs. The temperature signals go to a multipoint recorder with an alarm, and are activated by any temperature in excess of a set temperature, signaling that one of the SRV seats has started to leak.

Control room indication and alarms are provided for the important plant parameters monitored by the NBS.

NBS ASME Code Requirements

The major NBS mechanical components are designed to meet ASME Code Requirements as listed in Section 5.2.

1.2.2.1.3 RPV Natural Circulation Process

The ESBWR uses natural circulation to provide core flow. Natural circulation in the ESBWR is established due to the density differences between the water in the vessel annulus (outside the shroud and chimney) and the steam/water mixture inside the shroud and chimney. The colder, higher density water in the annulus creates a higher pressure or a driving head when compared to the hotter, lower density fluid (steam/water) in the core and chimney. The energy produced in the core of the reactor heats the water entering at the bottom of the core, and begins converting it to a steam/water mixture. In the core, the subcooled water is first heated to the saturation temperature, and then as more heat is added boiling of the core coolant starts. As the coolant travels upward through the core, the percent of saturated steam increases until, at the exit of the core, the average percent of saturated steam is approximately ~~18~~25 weight %. This steam/water mixture travels upward through the chimney to the steam separators, where centrifugal force separates the steam from the water. The separated, saturated water returns to the volume around the separators, while the slightly "wet" steam travels upward to the steam dryer and eventually out the main steamline nozzles and piping to the turbine.

Cooler feedwater re-enters the vessel at the top of the annulus, where it mixes with the saturated water around the separators and subcools this water. The resulting mixture is subcooled only a few degrees below the saturation temperature. The cooler mixture then travels downward through the annulus to re-enter the core. The water therefore forms a recirculation loop within the vessel. The mass of steam leaving the vessel is matched by the mass of feedwater entering.

The chimney adds height to this density difference, in effect providing additional driving head to the circulation process. A forced circulation BWR acts in the same basic manner but uses the internal or external pumps to add driving head to this recirculation flow instead of the elevation head provided by the chimney.

1.2.2.2 Controls and Instrumentation

1.2.2.2.1 Rod Control and Information System

The Rod Control and Information System (RC&IS) is to safely and reliably provide:

- The capability to control reactor power level by controlling the movement of control rods in the reactor core in manual, semiautomatic, and automated modes of plant operations.
- Display of summary information about control rod positions and status in the main control room.

- Transmission of fine motion control rod drive (FMCRD) status and control rod positions and status data to other plant systems (e.g., the Nonsafety-Related Distributed Control and Information System).
- Automatic control rod run-in function of all operable control rods following a scram (scram follow function).
- Automatic enforcement of rod movement blocks to prevent potentially undesirable rod movements. These rod blocks do not have an effect on the scram insertion function.
- Manual and automatic insertion of all control rods by an alternate and diverse method [alternate rod insertion (ARI) and motor run-in function, respectively].
- The capability to enforce a pre-established sequence for control rod movement when reactor power is below the low power setpoint.
- The capability to enforce fuel operating thermal limits when reactor power is above the low power setpoint.
- The capability to provide for Selected Control Rod Run In (SCRRI) function for mitigating a loss of feedwater heating event or for reducing power after a load rejection event or a turbine trip (that does not result in scram).

The RC&IS is classified as a nonsafety-related system, only has a nonsafety-related control design basis, and is not required for the safe shutdown of the plant. A failure of the RC&IS does not result in gross fuel damage. However, the rod block function of RC&IS is used in limiting the effects of a rod withdrawal error, and prevention of local fuel operating thermal limits violations during normal plant operations. Therefore, the RC&IS is designed to be single-failure proof and highly reliable.

The RC&IS consists of several different types of cabinets (or panels), which contain special electronic/electrical equipment modules, and a dedicated operator interface on the main control panel in the MCR.

The RC&IS is a dual redundant system consisting of two independent channels for normal control rod position monitoring and control rod movements. The two channels receive the same but separate input signals and perform the same functions. For normal functions of the RC&IS, the two channels must always be in agreement and any disagreement between the two channels results in rod block. However, the protective function logic of the RC&IS (i.e., rod block) is designed such that the detection of a rod block condition in only one channel of RC&IS would result in a rod block.

In addition, the RC&IS includes a fiber-optic dual-channel multiplexing network that is used for transmission of rod position and status data from Remote Communication Cabinets (RCCs) to the Rod Action and Position Information (RAPI), and rod block/movement command from RAPI to RCCs. A summary description of each of the above functions is provided below.

Rod Action Control Subsystem (RACS):

The RACS consists of rod action and position information (RAPI) panels and Automated Thermal Limit Monitor (ATLM)/Rod Worth Minimizer (RWM) panel that provide for a dual redundant architecture. These panels are located in the back-panel area of the control room.