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Subject: **Transmittal of ESBWR DCD Tier 2, Chapter 19 Markups Related to GEH Internal Corrective Action**

The purpose of this letter is to submit markups to the ESBWR DCD, Tier 2, Chapter 19, Revision 6, which are the result of GEH internal review. These markups will be incorporated into the DCD, Revision 7. The markup pages are contained in Enclosure 1. Changes associated with these corrective actions are enclosed within boxes on the markup pages. The changes are summarized below.

| Affected Section | Description of Change |
|---|---|
| Subsection 19A.4.3, 1st paragraph | Revised wording to clarify risk significance threshold per discussion with NRC staff. |
| Subsection 19A.4.3.3, 1st paragraph | Revised wording to reflect updated results of PRA initiating event contributions to CDF. |
| Subsection 19A.4.3.4, 1st paragraph, 1st sentence | Added phrase “(including switchyard faults)” after “grid disturbances” for clarification. |
| Subsection 19A.4.3.4, 2nd paragraph, last sentence | Revised wording to clarify risk significance of plant-controlled electrical faults versus external faults. |
| Subsection 19A.4.3.4, 3rd paragraph, former 1st and 2nd sentences | Deleted first sentence. Clarified second sentence by adding phrase “Other than plant centered faults”. |
| Subsection 19A.4.3.6, 1st paragraph | Revised wording to clarify risk significance of plant-controlled electrical faults versus external faults. |
| Subsection 19A.4.3.7, 3rd paragraph, | Revised wording to account for updated PRA which includes RWCU/SDC common cause failures in the initiating event frequency, and to clarify risk significance. |

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Enclosure:

1. Transmittal of ESBWR DCD Tier 2, Chapter 19 Markups Related to GEH Internal Corrective Action – 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)
CW Bagnal GEH/Wilmington (with enclosure)
eDRF Section 0000-0112-8398
0000-0112-8398 R1

# Enclosure 1

# MFN 10-063

# Transmittal of ESBWR DCD Tier 2, Chapter 19 Markups Related to GEH Internal Corrective Action

# DCD Markups

HVAC (to cool the FAPCS pumps), Nuclear Island Chilled Water (to cool HVAC), and Plant Service Water System (PSWS) (to cool the RCCWS). These support systems are in scope for RTNSS Criterion C and their design basis capacity is sufficient to accommodate the beyond design basis performance of FAPCS described above. The FAPCS trains are physically and electrically separated such that no single active component failure can fail the function. This provides the CDF and LRF reduction needed to address the PRA uncertainty concerns associated with the performance of passive system components.

### 19A.4.3 PRA Initiating Events Assessment

The At-Power and Shutdown PRA models have been reviewed to determine whether non-safety-related SSCs could have a significant effect on the estimated frequency of initiating events. An SSC failure that is a dominant contributor to an initiating event is significant if the initiating event contributes 10% or more to at-power or shutdown internal events CDF. The following screening criteria are imposed on the at-power and shutdown initiating events:

(1) Are nonsafety-related SSCs considered in the calculation of the initiating event frequency?

(2) Does the unavailability of the nonsafety-related SSCs significantly affect the calculation of the initiating event frequency?

(3) Does the initiating event significantly affect CDF or LRF for the baseline PRA?

If the answer to all three of these questions is "Yes," then the non-safety SSC is a RTNSS candidate. The results are discussed below.

#### *19A.4.3.1 At-Power Generic Transients*

Initiating events that are considered Generic Transients are listed in Subsection 19.2.3.1. Because several initiating events in this group are caused by the failures of nonsafety-related SSCs, screening questions 1, 2, and 3 are answered "Yes." However, this category of transient initiating events includes various failures of components or operator errors. No specific nonsafety-related systems have a significant effect on risk, and there are no RTNSS candidates from this category.

#### *19A.4.3.2 At-Power Inadvertent Opening of a Relief Valve*

SRVs are safety-related. Therefore, they are not RTNSS candidates.

#### *19A.4.3.3 At-Power Transient with Loss of Feedwater*

The initiating events in this group begin with a prompt and total loss of feedwater and require the success of other mitigating systems for reactor vessel level control. The SSCs related to feedwater and condensate are nonsafety-related, and thus Questions 1~~,~~ and 2~~, and 3~~ are answered "Yes." Because of design improvements, t~~T~~he loss of feedwater initiating event is not a significant contributor to CDF, so ~~the feedwater and condensate systems are RTNSS candidates.~~ Question 3 is answered "No." ~~However, s~~Several features in the advanced design of the new generation feedwater level control system add significant reliability and, thus, a lower failure probability for loss of feedwater initiating events. The feedwater level control system is implemented on a triplicated, fault-tolerant digital controller. Therefore, a control failure is much less likely to occur in the ESBWR than in the design of current generation of reactors.

Also, due to the capacity of the pumps and the digital control system capability, loss of a single feedwater pump does not cause a turbine trip or scram.

The dominant contributors to a total loss of feedwater are a loss of control power to the feedwater controllers and loss of AC power to the pumps. Only a total and immediate loss of all feedwater flow is included in the Loss of Feedwater initiating event category. A controller failure that results in reduced feedwater flow is much less significant than a complete loss of feedwater.

Therefore, due to the conservative treatment of the condensate and feedwater systems in the PRA, their risk significance does not warrant additional regulatory oversight.

### *19A.4.3.4 At-Power Loss of Preferred Power*

Loss of Preferred Power (LOPP) occurs as a result of severe weather, grid disturbances (including switchyard faults), plant-centered failures, or switchyard faults. LOPP is assumed to cause a plant trip and a loss of feedwater, with longer-term effects on other mitigating systems requiring AC power.

The associated systems and components that comprise the plant-centered failures, such as the onsite AC power distribution system are nonsafety-related, and thus, Questions 1, and 2 are answered "Yes." However, those plant-centered components, such as substations, breakers, motor control centers, and protective relays, are much less risk-significant and the contribution of plant-centered LOPP is below the threshold for ~~RTNSS consideration~~significance, so Question 3 is answered "No."

~~Although the cumulative effects of LOPP are significant contributor to CDF and LRF with respect to the other initiating events for at-power and shutdown risk, but are not significant relative to the NRC safety goal guidelines.~~ Other than plant-centered faults, t~~T~~he dominant risk contributions are from the loss of incoming AC power from the utility grid and weather related faults. These types of faults are caused by components that are not controlled by the site organization. Questions 1 and 2 are answered "No" for these components because they are not controllable by the plant. Therefore, the SSCs within the ESBWR design scope for preventing a LOPP initiating event are not risk significant and do not warrant additional regulatory oversight. The standby diesel generators and PIP buses have RTNSS controls due to other criteria.

### *19A.4.3.5 At-Power LOCA*

Loss of coolant accidents are initiated by piping leaks, valve leaks, or breaks. LOCAs are postulated to initiate in systems, such as RWCU/SDC and Main Steam. However, general design considerations require that all piping and components within the reactor coolant pressure boundary be safety-related. The RWCU/SDC and Main Steam piping have redundant safety-related isolation valves that automatically close on a LOCA signal. Questions 1, 2, and 3 are answered "No."

In addition, Safety Relief Valves are safety-related. Therefore, there are no RTNSS candidates from this category.

### *19A.4.3.6 Shutdown Loss of Preferred Power*

The causes and effects of loss of preferred power initiating event during shutdown are similar to at-power conditions, which were discussed previously. Loss of preferred power, during shutdown, initiates a loss of shutdown cooling and affects the availability of active mitigation systems. The higher contributions to loss of preferred power during shutdown are plant-centered and switchyard faults. Questions 1, and 2 are answered "Yes." Switchyard components and pPlant-centered components, such as substations, breakers, motor control centers, and protective relays, are not risk-significant and below the threshold for RTNSS consideration, so Question 3 is answered "No." For losses of incoming AC power due to grid or weather-related faults, Questions 1, 2 and 3 are answered "No" because they are caused by equipment or conditions that are not controlled by the site organization. Therefore, the nonsafety-related SSCs that contribute to shutdown LOPP do not warrant additional regulatory oversight.

### *19A.4.3.7 Loss of Shutdown Cooling*

The decay heat removal function during shutdown modes of operation is provided by the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDCS) system operating in shutdown cooling mode. Shutdown risk is dominated by loss of coolant events. Therefore, RWCU/SDC components have a relatively low importance and it is unlikely that their performance would degrade to the point where there is a measurable effect on Core Damage Frequency.

During Mode 5, in addition to RWCU/SDC, decay heat removal can be provided by safety-related ICS. During Mode 6, FAPCS may be used as an alternative. FAPCS suppression pool cooling and low pressure injection functions can remove decay heat, and they are in the RTNSS category with regulatory oversight in the form of availability controls.

With the reactor well unflooded, it is assumed that both RWCU/SDC trains are in service and that one train is sufficient to remove decay heat while maintaining stable reactor coolant temperature. Therefore, if one RWCU/SDC pump were to trip in this configuration, it would not initiate a loss of shutdown cooling event, and Questions 1, and 2, and 3 are answered "No.Yes" because common mode failures of RWCU components are considered in the initiating event frequency. Question 3 is answered "No" because RWCU component failures leading to a loss of shutdown cooling do not meet the threshold for significance.

There are no RTNSS candidates for regulatory oversight.

### *19A.4.3.8 Shutdown LOCA*

The frequency of Shutdown LOCA events is lower than at full power, due to the reduced vessel pressure and temperature. Also, the fact that control rods are fully inserted, the reduced pressure and temperature of the reactor coolant, and the lower decay heat level allow for longer times available for recovery actions.

Breaks outside containment can be originated only in ICS, RWCU/SDC or FAPCS piping, or instrument lines, because these are the only systems that remove reactor coolant from the containment during shutdown. The rest of the RPV vessel piping is isolated. The RWCU/SDC and FAPCS containment penetrations have redundant and automatic power-operated safety-related containment isolation valves that close on signals from the leak detection and isolation system and the reactor protection system. The ICS lines have redundant power operated safety-