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Subject: **Revision to Response to Portion of NRC Request for Additional Information Letter No. 377 Related to ESBWR Design Certification Application –DCD Tier 2 Section 8 – Electrical Power: RAI Number 8.2-17**

The purpose of this letter is to submit a revision to the GE Hitachi Nuclear Energy (GEH) response to a portion of the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) letter number 377 sent by GEH dated November 11, 2009 (Reference 2). This revision is a result of verbal comments by the NRC. A revision to the original response to RAI Number 8.2-17 is in Enclosure 1.

Enclosure 2 contains the changes to DCD Tier 2 as a result of this revision.

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

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-645 Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, GEH, *Request For Additional Information Letter No. 377 Related to ESBWR Design Certification* Application dated October 13, 2009

2. MFN 09-702 Response to Portion of NRC Request for Additional Information Letter No. 377 Related to ESBWR Design Certification Application –DCD Tier 2 Section 8 – Electrical Power: RAI Number 8.2-17 dated November 11, 2009

Enclosures:

1. Revision to Response to Portion of NRC Request for Additional Information Letter No. 377 Related to ESBWR Design Certification Application - DCD Tier 2 Section 8 – Electrical Power; RAI Number 8.2-17

2. Revision to Response to Portion of NRC Request for Additional Information Letter No. 377 Related to ESBWR Design Certification Application - DCD Tier 2 Section 8 – Electrical Power; DCD Markups for RAI 8.2-17

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 Sections	0000-0109-3201 (Original RAI 8.2-17)
		0000-0109-3201 Rev 1 (Revised RAI 8.2-17)

Enclosure 1

MFN 09-702, Revision 1

Revision to Response to Portion of NRC Request for Additional Information Letter No. 377 Related to ESBWR Design Certification Application DCD Tier 2 Section 8 – Electrical Power

RAI 8.2-17

NRC RAI 8.2-17

1. SRP Sections 8.2, 8.3.1, 8.3.2 include GDC 33, "Reactor coolant makeup," GDC 34, "Residual heat removal," GDC 35, "Emergency core cooling," GDC 38, "Containment heat removal," GDC 41, "Containment Atmosphere cleanup," and GDC 44, "Cooling water." DCD Tier 2, Table 1.9-8 does not discuss above SRP sections or GDCs. Revise DCD Tier 2, Table 1.9-8 to address SRP Sections 8.2, 8.3.1, 8.3.2, specifically considering SRP 8.2 Section II, #4; SRP 8.3.1, Section II, #6; and SRP 8.3.2, Section II, #6.

2. While MFN 09-384, the response to RAI 7.1-140, clarified that the ESBWR requires power supplies, sensors, control logic, and power-actuated devices to perform its safety-related containment heat removal (GDC 38) and cooling water (GDC 44) functions for 72 hours, this is not clearly described in DCD Tier 2, Sections 3.1.4.9 (GDC 38) and 3.1.4.15 (GDC 44).

DCD Tier 2, Sections 3.1.4.9 states,
"The PCCS [passive containment cooling system] does not require power supplies, sensors, control logic, power-actuated devices or operator actions to function in the first 72 hours after a LOCA."

DCD Tier 2, Sections 3.1.4.15 states,
"The PCCS has no active components and requires no electrical motive power or control and instrumentation functions to perform its safety-related function of transferring heat to the ultimate heat sink. The initial IC/PCCS pool volume, combined with the Equipment Storage Pool and Reactor Well, provides sufficient water volume for at least 72 hours after a LOCA without external make-up to the IC/PCCS pools."

While these statements may be consistent with the ESBWR equipment classification approach, they incompletely describe the systems and functions needed to meet the GDC. As described in MFN 09-384, the PCCS relies on water in the Equipment Storage Pool and Reactor Well to perform its safety functions for 72 hours, which requires safety-related power supplies, sensors, control logic, and power-actuated devices to connect the pools. This includes the safety-related Uninterruptible Power System, Fuel and Auxiliary Cooling System (FAPCS) water level sensors, Q-DCIS control logic, and safety related active components (air operated and squib pool cross-connect valves). Revise DCD Tier 2 Sections 3.1.4.9 and 3.1.4.15 to describe the systems and functions needed to meet GDC 38 and 44.

Revised GEH Response

Part 1:

GDC 17 (as described in Section II, item 2) encompasses the requirements of GDCs 33, 34, 35, 38, 41 and 44. Section II, item 6 in both SRP 8.3.1 (Draft Rev 3, April 1996) and SRP 8.3.2 (Draft Rev 4, April 1996) mentions that the requirements of GDC 17 (as described in Section II, item 4) encompass the requirements of GDCs 33, 34, 35, 38, 41 and 44. Thus, compliance with the requirements of GDC 17 ensures compliance with the electrical power supply requirements of GDCs 33, 34, 35, 38, 41 and 44.

DCD Tier 2 Table 1.9-8 will be updated to acknowledge compliance with these GDC requirements. The SRP Section column of that table will also be updated to list all SRP sections to which each acceptance criterion applies. In accordance with the staff's verbal request Table 1.9-8 has been modified to reflect SRP 8.3.1 separately for GDCs 17, 33, 34, 35, 38, 41 and 44.

A minor typographical error was also found on the original DCD Section 3.1.4.9 markup, and it has been corrected in the attached Enclosure 2.

Part 2:

GEH will clarify the statements in Tier 2 Subsections 3.1.4.9 and 3.1.4.15 to indicate that although the pool cross-connect valves are classified as part of the ICS (not the PCCS), the function they provide is essential to the 72-hour passive heat removal function performed by the PCCS.

DCD Impact

DCD Tier 2, Table 1.9-8 and Subsections 3.1.4.9 and 3.1.4.15 will be revised as noted in the attached markups.

Enclosure 2

MFN 09-702, Revision 1

Revision to Response to Portion of NRC Request for Additional Information Letter No. 377 Related to ESBWR Design Certification Application DCD Tier 2 Section 8 – Electrical Power

DCD Markups for RAI Number 8.2-17

pool during a LOCA. The PCCS does not require power supplies, sensors, control logic, power-actuated devices or operator actions to function in the first 72 hours after a LOCA. During normal plant operation, the PCCS condensers are in "ready standby." In order to ensure the 72 hours of passive operation of the PCCS, the pool cross-connect valves, which are part of the ICS, must open to allow water to flow from the equipment pool to the IC/PCCS inner expansion pools. These valves are controlled by the Q-DCIS~~SIs~~.

The PCCS is designed to Quality Group B Requirements per Regulatory Guide (RG) 1.26. The system is designed as Seismic Category I per RG 1.29. The common pool that the PCCS condensers share with the ICs of the ICS is an ESF. This pool is designed such that no locally generated force (such as an IC tube rupture) can destroy its function. Protection requirements against mechanical damage, fire and flood apply to the common IC/PCCS pool.

The safety-related IC/PCCS pool subcompartments provide protection for the PCCS condensers to comply with 10 CFR 50, Appendix A, Criteria 2 and 4.

The PCCS condensers do not fail in a manner that damages the safety-related IC/PCCS pool because it is designed to withstand the induced dynamic loads, which are caused by combined seismic, DPV/SRV or LOCA conditions in addition to PCCS operating loads.

The PCCS provides the containment heat removal function required in Criterion 38. For further discussion, see the following subsections:

Chapter/ Section	Title
6.2.2	Passive Containment Cooling System
Table 7.1-1	I&C Regulatory Requirements Applicability Matrix

3.1.4.10 Criterion 39 — Inspection of Containment Heat Removal System

Criterion 39 Statement

The containment heat removal system shall be designed to permit appropriate periodic inspection of important components, such as the torus, sumps, spray nozzles, and piping to assure the integrity and capability of the system.

Evaluation Against Criterion 39

The PCCS condenser is an integral part of the containment (drywell) pressure boundary and is used to mitigate the consequences of an accident. Because of this function it is classified as an ESF. The PCCS is designed to ASME Code Section III, Class MC and Section XI, IWE requirements for design and accessibility of welds for in-service inspection to meet 10 CFR 50 Appendix A, Criterion 16. Ultrasonic testing of tube-to-header welds and eddy current testing of tubes can be done with the PCCS condenser in place.

The containment heat removal system is designed to permit periodic inspection of major components to meet the requirements of Criterion 39. For further discussion, see the following subsections:

The design of the CIS meets the requirements of Criterion 43. For further discussion, see the following sections:

Chapter/ Section	Title
	(Deleted)
3.9	Mechanical Systems and Components
6.2.3	Reactor Building Functional Design
6.2.5	Combustible Gas Control in Containment
6.5.4	Suppression Pool as a Fission Product Cleanup System
6.6	Preservice and Inservice Inspection and Testing of Class 2 and 3 Components and Piping
Table 7.1-1	I&C Regulatory Requirements Applicability Matrix

3.1.4.15 Criterion 44 — Cooling Water

Criterion 44 Statement

A system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions.

Suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available), the system safety function can be accomplished, assuming a single failure.

Evaluation Against Criterion 44

The ESBWR ultimate heat sink is the IC/PCCS pool. In the event of a DBA, heat is transferred to the IC/PCCS pool(s) through the ICS and the PCCS. The water in the IC/PCCS pool(s) is allowed to boil and the resulting steam is vented to the environment. The PCCS has no active components and requires no electrical motive power or control and instrumentation functions to perform its safety-related function of transferring heat to the ultimate heat sink. The initial IC/PCCS pool volume, combined with the Equipment Storage Pool and Reactor Well, provides sufficient water volume for at least 72 hours after a LOCA without external make-up to the IC/PCCS pools. The pool cross-connect valves, which are part of the ICS, must open to allow water to flow from the equipment pool to the IC/PCCS inner expansion pools. These valves are controlled by the Q-DCIS. Because only one of the two valves on either side of the equipment pool needs to open~~Therefore~~, no credible single failure can prevent the IC/PCCS pools from performing their safety-related function.

The requirements of Criterion 44 for heat transfer to the ultimate heat sink are met. For further discussion, see the following sections:

Table 1.9-8

Summary of Differences from SRP Section 8

SRP Section	Specific SRP Acceptance Criteria	Summary Description of Difference	Subsection Where Discussed
8.1, 8.3.1, 8.3.2	GDC 2	None	
8.1, 8.3.1, 8.3.2	GDC 4	None	
8.1, 8.2, 8.3.1, 8.3.2	GDC 5	The ESBWR is a single-unit plant. Therefore, this GDC is not applicable	8.1.5.2.4, Table 8.1-1, 8.2.2.2
8.1, 8.2, ~~8.3.1,~~ 8.3.2	GDC 17	None	
8.3.1	GDC 17	The ESBWR does not need or have safety-related standby AC power sources.	8.1.5.2.4, Table 8.1-1, 8.2.2.2, 8.3.1.2.1
8.1, 8.2, 8.3.1, 8.3.2	GDC 18	None	
8.2, ~~8.3.1,~~ 8.3.2	GDCs 33, 34, 35, 38, 41 and 44	None. Met by providing a design that complies with GDC 17.	
8.3.1	GDCs 33, 34, 35, 38, 41 and 44	The ESBWR does not need or have safety-related standby AC power sources.	8.1.5.2.4, Table 8.1-1, 8.2.2.2, 8.3.1.2.1
8.1, 8.3.1, 8.3.2	GDC 50	None	
8.1, 8.3.1, 8.3.2	RG 1.6	The ESBWR does not need or have safety-related standby AC power sources.	8.1.5.2.4, 8.3.2
8.1, 8.3.1	RG 1.9	The ESBWR diesel-generator units are not safety related, nor is AC power needed to achieve safe shutdown. Therefore, this RG is not applicable.	8.1.5.2.4, Table 8.1-1