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U.S. Nuclear Regulatory Commission
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Subject: **Revised Transmittal of ESBWR Tier 2, Chapter 8 Design Control Document Markups Related to GEH Internal Corrective Actions**

The purpose of this letter is to re-submit markups to ESBWR DCD, Tier 2, Chapter 8 which are a result of GEH internal review and correction process but are not related to NRC Requests for Additional Information.

Enclosure 1 contains the change list and markups to changes to DCD Tier 2 as a result of GEH's internal review of Chapter 8. The changes were previously submitted in Reference 1 but contained errors.

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

Sincerely,

FOR

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 10-057, Richard E. Kingston to U.S. Nuclear Regulatory Commission, "*Transmittal of ESBWR Tier 2, Chapter 8 Design Control Documents Markups Related to GEH Internal Corrective Actions,"* dated February 10, 2010

Enclosure:

1. DCD Tier 2, Chapter 8 Change List and Markups

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 Section	0000-0113-1721, Rev 2

Enclosure 1

MFN 10-057, REVISION 1

DCD Tier 2, Chapter 8

Change List and Markups

A detailed description of the onsite AC power system is provided in Subsection 8.3.1.

8.1.3.2 Onsite DC Power System

The onsite DC power system includes the plant batteries and battery chargers and their DC loads, including the DC/AC inverters and the inverter loads.

The nonsafety-related 125 VDC power system, Figure 8.1-2, provides power for nonsafety-related DC loads. The nonsafety-related 250V batteries are provided to supply DC power to the inverters that supply 120 VAC to the Nonsafety-Related Distributed Control and Information System (N-DCIS) and DC power to the nonsafety-related DC loads. The 125 VDC power and 250 VDC power are normally supplied through nonsafety-related battery chargers from the nonsafety-related PIP buses. In the event that this power supply is lost, power is supplied from the nonsafety-related batteries for two hours.

The safety-related 250 VDC power distribution system, Figure 8.1-3, provides four independent and redundant onsite sources of power for operation of the safety-related UPS inverters that supply all safety-related AC loads including the Safety-Related Distributed Control and Information System (Q-DCIS). The safety-related 250 VDC bus is normally supplied through the safety-related battery chargers from the isolation power centers, which are powered from the PIP buses. In the event that this power supply is lost, DC power is supplied from the safety-related batteries for 72 hours. The system is physically and electrically separated into four divisions.

A detailed description of the onsite DC power system is provided in Subsection 8.3.2.

8.1.4 Safety-Related Loads

The safety-related loads utilize the four divisions of DC power sources for instrumentation or control power, for systems required for safe shutdown. Multiple divisions of DC power are involved in performing a single safety-related function and ensure that only two divisions of DC power are required for safe shutdown during a design basis accident (DBA). The control and instrumentation systems required for safe shutdown are identified in Section 7.4, which indicate the four separate divisions of power to each system required for safe shutdown, as shown in Figure 8.1-4.

8.1.5 Design Basis

8.1.5.1 Offsite Power

The offsite power system is described in Subsection 8.2.1.

Electric power from the utility grid to the offsite power system is provided by transmission lines designed and located to minimize the likelihood of failure while ensuring grid reliability. The transmission system serves the main offsite power circuit (Normal Preferred Power), and the reserve offsite power circuit (Alternate Preferred Power) through the site switchyard(s).

The switchyard is designed to minimize the likelihood of simultaneous failure of both the normal and alternate preferred power sources.

A single tie line connects the plant main generator circuit breaker MOD and UAT MODs to the switchyard and constitutes the plant's normal preferred offsite power circuit.

The ESBWR diesel generator units are nonsafety-related. Therefore this criterion does not apply.

Other Safety Review Plan (SRP) Criteria:

- NUREG/CR 0660, "Enhancement of Onsite Diesel Generator Reliability" – The ESBWR diesel-generator units are not safety-related, nor is AC power needed to achieve safe shutdown; therefore, the NUREG is not directly applicable. However, defense-in-depth principles such as redundancy and diversity are incorporated in the design and integration of ESBWR systems.
- NUREG 0737, "Clarification of TMI Action Plan Requirements."
- NUREG-0718, Revision 1, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing License," relating to TMI Item I.D.3, "Safety System Status Monitoring," regarding the application of Regulatory Guide 1.47.
- TMI Action Item II.E.3.1, "Emergency Power Supply for Pressurizer Heater" – This criterion is applicable only to PWRs and does not apply to the ESBWR.
- TMI Action Item II.G.1, "Emergency Power for Pressurizer Equipment" – This criteria is applicable only to PWRs and does not apply to the ESBWR.

8.1.6 Compliance to Regulatory Requirements and Guidelines

Table 8.1-1 presents a matrix of regulatory requirements and guidelines, in accordance with Table 8-1 of the Standard Review Plan. Note that several criteria pertaining to safety-related diesel generators and AC power systems are not applicable for the ESBWR, because the ESBWR does not require AC power to achieve safe shutdown or to perform any safety-related function. Therefore, the diesel generators are nonsafety-related. However, defense-in-depth principles such as redundancy and diversity are incorporated in the design and integration of ESBWR systems.

8.1.7 COL Information

None.

8.1.8 References

8.1-1 Title 10, Code of Federal Regulations, Part 50 (10 CFR 50) Appendix A, "General Design Criteria for Nuclear Power Plants."

8.3.1.1.3 Uninterruptible AC Power Supply System

Safety-Related Uninterruptible AC Power Supply System

Figure 8.1-4 shows the overall safety-related Uninterruptible AC Power Supply (UPS) system. The safety-related UPS for each of the four divisions is supplied from a 480V isolation power center in the same division. The isolation power centers are connected to PIP nonsafety-related buses, which are backed by standby diesel generators. Divisions 1, 2, 3 and 4 each have three battery chargers, including one standby per division, two batteries and two UPS rectifiers. Each rectifier (battery charger and UPS rectifier) receives 480 VAC normal power from the isolation power center of that division, see Figure 8.3-1, and converts it to 250 VDC. The 480 VAC/250 VDC UPS rectifiers and the safety-related 72-hour batteries of that division, maintained fully charged by the 480 VAC/250 VDC battery chargers, supply 250 VDC power through diodes to two parallel output 120 VAC single phase UPS inverters.

The safety-related UPS inverter high DC input voltage trip setpoint and time delay are greater than the associated battery charger and UPS rectifier high DC output voltage trip setpoint and time delay. This arrangement prevents safety-related UPS inverter trips as a result of fast transients on the AC supply that may occur during the ESBWR islanding transient or as a result of generator voltage regulator failures, for which protective relaying and breaker operations may not otherwise prevent safety-related UPS inverter trips.

Power is distributed to the individual safety-related loads from associated 120 VAC distribution panels, which supply power to the Reactor Building and the Control Building.

The plant design and circuit layout of the UPS provide physical separation of the equipment, cabling, and instrumentation essential to plant safety. Equipment of each division of the safety-related UPS distribution system is located in an area separated physically from the other divisions. No provisions exist for the interconnection of the safety-related UPS buses of one division with those of another division or nonsafety-related power. All components of safety-related UPS AC systems are housed in Seismic Category I structures.

Refer to Subsection 8.3.1.1.5 for a discussion of physical separation and independence.

Four divisions of safety-related UPS provide 120 VAC power for the Q-DCIS loads/logic components (reference Section 7.1 for Q-DCIS description) and other safety-related loads requiring uninterruptible power (see Figure 8.1-4). Two divisions (1 and 2) of safety-related power supply the Reactor Protection System (RPS) scram pilot valve solenoids and the same two divisions supply power to the Main Steam Isolation Valve (MSIV) solenoids (see Figure 7.2-1 and Figure 8.1-4).

The four divisions of safety-related UPS are shown in Figure 8.1-4. The safety-related UPS buses are each supplied independently from their divisional safety-related inverters, which, in turn, are powered from one of the independent and redundant DC buses of the same division and from their isolation power center. The divisional DC bus is powered through a battery charger connected to its divisional isolation power center, and backed by the division's safety-related batteries. The two inverters in each safety-related division will be configured for parallel redundant operation to allow load sharing and the equal discharge of the division’s safety-related batteries.

8.3-24 NEMA AB-1, "Molded Case Circuit Breakers and Molded Case Switches."

8.3-25 IEEE C37.04, "Standard Rating Structure for AC High-Voltage Circuit Breakers."

8.3-26 IEEE C37.06, "AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities."

8.3-27 IEEE C37.09, "Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis."

8.3-28 IEEE C37.010, "Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis."

8.3-29 IEEE C37.11, "Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis."

8.3-30 IEEE 741, "Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations."

8.3-31 IEEE C37.20.2, "Standard for Metal-Clad Switchgear."

8.3-32 IEEE C37.100, "Standard Definitions for Power Switchgear."

8.3-33 IEEE 603, "Standard Criteria for Safety Systems for Nuclear Power Generating Stations."

8.3-34 IEEE C57.12.80, "Standard Terminology for Power and Distribution Transformers."

8.3-35 IEEE C57.12.90, "Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers."

8.3-36 IEEE C57.93, "Guide for Installation of Liquid-Immersed Power Transformers."

8.3-37 IEEE 338, "Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems."

8.3-38 IEEE 308, "Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."

8.3-39 IEEE 100, "The Authoritative Dictionary of IEEE Standards Terms."

8.3-40 IEEE C37.32, "High-Voltage Air Disconnect Switches Interrupter Switches, Fault Initiating Switches, Grounding Switches, Bus Supports and Accessories Control Voltage Ranges-Schedules of Preferred Ratings, Construction Guidelines and Specifications."

8.3-41 IEEE 484, "Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications."

8.3-42 IEEE 450, "Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications."

ESBWR DCD Tier 2 Chapter 8

26A6642AX Revision 6 to Revision 7 Change List

Item	Location	Description of Change
1.	Entire Chapter	Global chapter editorial changes to correct misspelling and grammar, spell out or integrate acronyms where appropriate, and update references as needed and where required.
2.	S8.1.3.2, 3rd paragraph, 1st and 2nd sentences.	Revised to clarify that safety-related DC power only provides power to the safety-related UPS inverters that then provide all safety-related loads with AC power. Corrected the second sentence to replace the word 'power' with "bus". MFN-10-057.
3.	S8.1.5.2.4, Other Safety Review Plan (SRP) Criteria:, 2nd bullet.	Corrected NUREG title to delete the 'CR' and correct the title to: NUREG 0737, "Clarification of TMI Action Plan Requirements." MFN-10-057.
4.	S8.3.1.1.3, 1st paragraph, 4th, 5th and 6th sentences	Corrected forth sentence to clarify that there are three battery chargers including the standby battery charger and two UPS rectifiers per division. Revised fifth sentence to clarify rectifier source of power and indicate Figure 8.3-1. Revised sentence structure and added clarity to the sixth sentence to reflect the forth and fifth sentence intent and made the word 'rectifier' plural to "rectifiers". MFN-10-057.
5.	S8.3.3.2, 2nd paragraph, added sentences 3 and 4.	In response to RAI 8.3-67 R-1, the NRC requested that GEH add requirements to the cable specifications to satisfy procurement of cables that may become exposed to a wetted environment. Change submitted as R-2 to RAI.8.3-67.
6.	S8.3.3.2, added new last paragraph.	In response to RAI 8.3-67 R-1 NRC questions of 01/06/2010 GEH has added an introduction to new COL 8.3.4-2-A for monitoring underground or inaccessible cables with an accident mitigating function. Change submitted as R-2 to RAI.8.3-67.
7.	S8.3.4, added new 8.3.4-2-A.	In response to RAI 8.3-67 R-1 NRC questions of 01/06/2010 GEH has added a new COL Applicant item based on SRP 8.3.1, AC Power Systems, Rev. 3 – March 2007, III Review Procedure 2. C. 2nd Paragraph. Change submitted as R-2 to RAI.8.3-67.

ESBWR DCD Tier 2 Chapter 8

26A6642AX Revision 6 to Revision 7 Change List

Item	Location	Description of Change
8.	S8.3.5, References.	Corrected title to IEEE 484 to be consistent with latest applicable standard for vented lead-acid batteries. Corrected title to IEEE 450 to be consistent with latest applicable standard for vented lead-acid batteries. MFN-10-057.