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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 65 – Electric Power – RAI Numbers 8.1-1 through 8.1-14**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Reference:

1. MFN 06-353, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 65 Related to ESBWR Design Certification Application*, September 26, 2006

Enclosure:

1. MFN 06-451 – Response to Portion of NRC Request for Additional Information Letter No. 65 – Related to ESBWR Design Certification Application – Electric Power – RAI Numbers 8.1-1 through 8.1-14

cc: AE Cubbage USNRC (with enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRF 0000-0060-7979

Enclosure 1

MFN 06-451

Response to Portion of NRC Request for

Additional Information Letter No. 65

Related to ESBWR Design Certification Application

Electric Power

RAI Numbers 8.1-1 through 8.1-14

NRC RAI 8.1-1

In DCD Tier 2, Rev. 1, Section 8.1 please describe the capability of the ESBWR design to withstand and recover from a station blackout lasting a specified minimum duration.

GE Response

The ESBWR capability to recover from an SBO event and the duration was described in DCD Tier 2 Rev. 1 Section 8.3.2.1.1, which referenced Appendix 8B and Section 15.5.5. These referenced sections supplied the requested details. Please note that Appendix 8B was basically a duplication of Section 15.5.5; therefore, Appendix 8B has been deleted in DCD Tier 2 Rev. 2 transmitted to the NRC by GE letter MFN 06-360, dated 9/29/06.

DCD Impact

No additional DCD changes will be made in response to this RAI.

NRC RAI 8.1-2

DCD Tier 2, Rev. 1, Figure 8.1-3, Direct Current Power Supply – Class 1E, indicates that four batteries are designed for a 24 hour discharge and two batteries are designed for 72-hour discharge. Confirm that no direct current (dc) power is required following discharge of the batteries or identify the safety-related power supply that will be used to recharge the batteries while at the same time supplying the dc load through the battery chargers and/or directly to the 120 volts alternating current (Vac) instrument buses.

GE Response

The batteries will be recharged (after 72 hours) through the battery chargers shown on Figure 8.1-3. The chargers will also supply the required direct current load demand of the dc system, as well as the load demand of the Class 1E UPS 120 VAC system. The Isolation Power Centers, Figure 8.1-3, will supply the 480 VAC power to the battery chargers. The Isolation Power Centers are powered by the nonsafety-related PIP buses, which are supplied power from the nonsafety-related Standby Diesel Generators during a loss of offsite power (see Figure 8.1-1, sheets 2 & 3). If offsite power is available, the PIP buses will be powered through the UATs or RATs (see Figure 8.1-1, sheet 1).

This RAI requests to identify the safety-related power supply that will be the source for the recharge. The source is not required to be a safety-related power supply, since, the battery will not require recharging until after the first 72 hours of an event. In accordance with SECY-95-132, the active systems required after the first 72 hours of an event can be nonsafety-related.

Note: Revision 2 of Tier 2 was issued to the NRC by GE letter MFN 06-360, dated 9/29/06. This revision changed the Class 1E battery configuration to two 72 hour batteries per division for a total of eight Class 1E batteries. There are no longer any 24 hour Class 1E batteries.

DCD Impact

No additional DCD changes will be made in response to this RAI.

NRC RAI 8.1-3

DCD Tier 2, Rev. 1, Section 8.1.5.2.1 describes the standby on-site ac power supply system which can provide power to achieve cold shutdown in the event of a loss of preferred power. This statement appears to contrast with Section 8.3.1.1.8 which states that the standby on-site ac power supply system is not relied upon to perform any safety-related function. Is the standby on-site ac power supply system considered a mitigating system that is important to safety?

GE Response

The Safe Shutdown Condition for the ESBWR is achieved at 420°F or below. The ESBWR is able to achieve this condition utilizing passive safety-related systems and does not require an AC source of power. To achieve cold shutdown nonsafety-related active systems would be required that require AC power. Since these systems are not required until after 72 hours, they are not required to be safety related (see SECY-94-084 & SECY-95-132, Item – C, Safe Shutdown Requirements).

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.1-4

On page 8.1-5, DCD Tier 2, Rev. 1, states that the Class 1E UPS support the safety-related logic and control functions during normal, upset, and accident conditions. Describe what is meant by 'upset.'

GE Response

The definition of upset, as utilized for the ESBWR, is listed below. It is located in Chapter 3 of the DCD, Section 3.9.3.1.1, Plant Conditions.

> Upset Condition:
>
> An upset condition is any deviation from normal conditions anticipated to occur often enough that design should include a capability to withstand the conditions without operational impairment. The upset conditions include system operational transients (SOT), which result from any single operator error or control malfunction, from a fault in a system component requiring its isolation from the system, or from a loss of load or power. Hot standby with the main condenser isolated is an upset condition.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.1-5

In Section 8.1.5.2.4, the DCD states that the standby diesel generators are not safety-related, and by inference, that RG 1.9 (and therefore Institute of Electrical and Electronics Engineers Standard 387 (IEEE 387)) does not apply to the ESBWR. If the ESBWR design will not commit to the requirements of IEEE 387 and the guidance in RG 1.9 to demonstrate the capacity and capability of the standby diesel generators, identify what industry consensus standard will be used to demonstrate the availability and reliability of the standby diesel-generator units. (Note that Regulatory Guide (RG) 1.108 was withdrawn in 1993 and the original content of RG 1.108 was assumed into RG 1.9, Selection, Design, Qualification and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Emergency Power Systems At Nuclear Power Plants, Rev. 3.)

GE Response

The standby diesel generators will be manufactured, tested, installed and operated in accordance with recognized standards such as: Diesel Engine Manufacturers Association (DEMA), Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines and National Electrical Manufacturers Association (NEMA), NEMA MG 1 Motors and Generators.

Additionally, the COL licensee will review all plant SSCs (structures, systems and components) for Maintenance Rule (10 CFR 50.65) applicability (see Subsection 8.3.4.15 of DCD Tier 2, Rev. 2). The diesel generators will be classified per this review. The appropriate monitoring, testing, predictive/preventative maintenance and post-maintenance testing will be determined and the results trended. These results will be monitored against licensee-established goals, in a manner sufficient to provide reasonable assurance that such structures, systems, and components, are capable of fulfilling their intended functions. Such goals shall be established commensurate with safety and, where practical, take into account industry-wide operating experience.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.1-6

In Section 8.1.5.2.4, identify what limits will be placed on the standby diesel-generators for use other than powering the plant investment protection (PIP) buses. Describe what effects the use of the standby diesel units for peaking service will have on their availability and reliability. The response to branch technical position (BTP) ICSB-8, Use of Diesel-Generator Units for Peaking, implies that the standby diesel-generator units will be used for peaking.

GE Response

The standby diesel generators may be utilized to supply power to house load (PIP) buses during times the grid is under heavy loads and requires maximum generation. This would allow the main generator to supply the grid with this additional power to help maintain grid stability. ICSB-8 states, "In particular, emergency power diesel-generator sets should not be used for peaking service." ISCB references IEEE 308 and Regulatory Guide 1.32 in support of this conclusion. These standards address Class 1E safety-related diesel generators, which supplied the required AC power required by active safety-related system plants during an event with a loss of offsite power. Additionally, these power sources were required to be available (up to speed and ready to be loaded) in a very short duration (less than 10 seconds) from the start of the event. This was required by the accident analysis to enable the active safety-related systems to fulfill their mission and meet the requirements of the design and licensing basis.

The ESBWR passive safety-related systems design relies on stored energy and requires no AC power to perform the required mission for the first 72 hours. It is for this reason that the standby diesel can be used for peaking. Specifically, if during peaking, a design basis event occurs and a standby diesel protective trip and lockout were to occur, the operators would have ample time to review and reset the lockout during the 72 hour period before the diesels would be needed to be placed in service. Therefore, the active safety-related system plants would not be able to meet their design basis for the 10 second time required for the safety-related diesel involved, whereas, the ESBWR can.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.1-7

Identify the reliability goals for the standby diesel-generators and describe how these goals will be monitored and maintained. (Reference: NUREG/CR 0660, Enhancement of Onsite Diesel Generator Reliability)

GE Response

The COL licensee will review all plant SSCs (structures, systems and components) for Maintenance Rule (10 CFR 50.65) applicability (see Subsection 8.3.4.15 of DCD Tier 2, Rev. 2). The standby diesel-generators will appropriately be classified per this review. The appropriate monitoring, testing, predictive/preventative maintenance and post-maintenance testing will be determined and the results trended. These results will be monitored against licensee-established goals, in a manner sufficient to provide reasonable assurance that such structures, systems, and components, are capable of fulfilling their intended functions. Such goals shall be established commensurate with safety and, where practical, take into account industry-wide operating experience.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.1-8

Equipment to Achieve Safe-Shutdown (DCD Tier 2, Rev. 1, Section 8.1.6.3). The COL should not only identify equipment required to achieve safe-shutdown but also the equipment required to maintain safe-shutdown.

GE Response

Section 8.1.6.3 was not intended as a COL item. This paragraph has been relocated out of the COL subsection in DCD Tier 2, Rev. 2. It is now Subsection 8.1.6 and has been slightly edited for grammatical purposes. The COL subsection has also been relocated in DCD Tier 2 Rev. 2 and is now Subsection 8.1.7.

The equipment and systems required to achieve and maintain safe shutdown are described in other sections of the DCD Tier 2 such as Subsections 5.4.6, 5.4.7, and 5.4.8.

Note: Revision 2 of Tier 2 was issued to the NRC by GE letter MFN 06-360, dated 9/29/06.

DCD Impact

No additional DCD changes will be made in response to this RAI.

NRC RAI 8.1-9

DCD Tier 2, Rev. 1, References (8.1.7). The only IEEE standard referenced in this section, IEEE-944, has been withdrawn by IEEE. Identify all other American National Standards Institute, IEEE, National Electrical Manufacturers Association, National Fire Protection Association and any other industry consensus standard used to demonstrate the capability, capacity and reliability of the electric power systems.

GE Response

IEEE-944 will be deleted in the next revision of DCD Tier 2 and the additional industry standards that apply will be added to Subsections 8.2 and 8.3, and Appendix 8A.

DCD Impact

DCD Tier 2, Section 8.1.7, 8.2, and 8.3, and Appendix 8A will be revised as noted in the response in the next revision of the DCD.

NRC RAI 8.1-10

DCD Tier 2, Rev. 1, References (8.1.7). Clarify why Title 10 of the Code of Federal Regulations, Part 50 (10 CFR 50) Appendices A and B have not been included in this reference section.

GE Response

10 CFR 50 Appendix A will be added as a reference to this section because the applicable GDC's (General Design Criteria) are addressed in this section. 10 CFR 50 Appendix B will not be added, this regulation is addressed in DCD Tier 2, Chapter 17, Quality Assurance.

DCD Impact

DCD Tier 2, Subsection 8.1.8, References, will be revised to add 10 CFR 50 Appendix A as a reference in Revision 3.

NRC RAI 8.1-11

DCD Tier 2, Rev. 1, Figure 8.1-1, One-Line Diagram (High Voltage Circuit Breaker). Clarify why there is no circuit breaker required between the unit auxiliary transformer and the line between the switchyard and the main generator. It appears that a unit auxiliary transformer fault would unnecessarily challenge the switchyard.

GE Response

The UAT feed configuration has been changed and the UATs are no longer fed directly from the switchyard. They are now feed from an isolated phase bus that taps off the isolated phase bus that links the main generator with the main transformers. Additionally, a circuit breaker has been placed on the input to each UAT from its tap from the isolated phase bus. These changes have already been incorporated in DCD Tier 2, Rev. 2, issued to the NRC by GE letter MFN 06-360, dated 9/29/06.

DCD Impact

No additional DCD changes will be made in response to this RAI.

NRC RAI 8.1-12

DCD Tier 2, Rev. 1, Figure 8.1-1, One-Line Diagram (Auxiliary Transformer Ratings). All auxiliary transformers are shown with a 100 MVA forced oil, forced air rating. Identify the expected margin between the connected load and the transformer rating.

GE Response

The power reserve for the Unit Auxiliary Transformers based on the preliminary calculations are 14% for the 13.2 kV loads and 10% for the 6.9 kV loads.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 8.1-13

DCD Tier 2, Rev. 1, Figure 8.1-1, One-Line Diagram (Standby Diesel-Generator). Confirm the indicated rating of the standby diesel-generator rating of 15 MVA. Identify the total PIP bus loads connected to the standby diesel-generators. Describe the experience history of stationary diesel-generators used in standby service at this rating.

GE Response

Refer to response to RAI 8.3-13 for PIP loads and standby diesel generator rating. The diesel-generators will be 514 RPM, 16V46, 975 kW/cylinder units which are currently used as both marine and power plant base load engines and also used in Europe for standby backup units. The engine is virtually identical to the smaller units presently in use over the past 30 years at United States nuclear power plants except it has more cylinders. The units are also designed for low emissions that will meet the EPA regulations being invoked in the United States.

DCD Impact

No DCD changes will be made in response to this RAI

NRC RAI 8.1-14

Compliance of Regulatory Requirements and Guidelines (DCD Tier 2, Rev. 1). Section 8.1.6.3 states in part that ... "Several criteria pertaining to safety-related diesel generators and of Ac power systems are not applicable for the ESBWR because the ESBWR does not require Ac power to achieve safe shutdown, and its two diesel generators are not safety related. However, defense-in-depth principles such as redundancy and diversity are incorporated in the design and integration of ESBWR systems."

To obtain defense-in-depth, the reliability of the Ac power system and the standby diesel generators should be demonstrated through surveillance testing. Since surveillance requirements for these systems are not included in Section 3.8 of the technical specifications, nor licensing conditions specified to monitor the performance or condition of these systems against established goals in accordance with 10 CFR 50.65(a)(1), please explain how the defense-in-depth philosophy is validated?

GE Response

Refer to the responses in RAI 8.3-16 and RAI 8.1-5.

DCD Impact

No DCD changes will be made in response to this RAI.