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MFN 07-306  
Supplement 1

Docket No. 52-010

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U.S. Nuclear Regulatory Commission  
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Subject: **Response to Portion of NRC Request for Additional Information  
Letter No. 97 Related to ESBWR Design Certification Application -  
Technical Specifications - RAI Number 16.2-124 S01**

Enclosure 1 contains the subject supplemental RAI response resulting from a June 15, 2007 e-mail from the NRC. GE's original response was provided in the Reference 1 letter.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Handwritten signature of Kathy Sedney in cursive script.

James C. Kinsey  
Project Manager, ESBWR Licensing

DO68  
NRO

References:

1. MFN 07-306, Letter from Jim Kinsey to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.2-124*, June 4, 2007

Enclosures:

1. MFN 07-306, Supplement 1 - Response to Portion of NRC Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application - Technical Specifications - RAI Number 16.2-124 S01

cc: AE Cabbage USNRC (with enclosures)  
DH Hinds GEH (with enclosures)  
RE Brown GEH (w/o enclosures)  
eDRF 0067-6418/2

**Enclosure 1**

**MFN 07-306, Supplement 1**

**Response to Portion of NRC Request for**

**Additional Information Letter No. 97**

**Related to ESBWR Design Certification Application**

**- Technical Specifications -**

**RAI Number 16.2-124 S01**

**NRC RAI 16.2-124**

*SR 3.8.3.6 requires battery capacity verification every 60 months and 12 months when battery shows degradation or has reached 85% of expected life. IEEE Std. 1188- 2005, recommends that the performance test interval should not be greater than 25% of the expected service life or two years, whichever is less. Provide basis for not following IEEE Std 1188- 2005.*

**GE Response**

GE will revise the frequency for Surveillance Requirement (SR) 3.8.3.6 to require verification of battery capacity every “24 months AND 12 months when the battery shows degradation or has reached 85% of the expected life.” This frequency is consistent with the recommendations for performance testing in Section 6.3 of IEEE Standard 1188-2005, “Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications,” for a battery with an expected service life of 20 years, as specified for the ESBWR in DCD 3.8.2.1.1.

**DCD Impact**

DCD Tier 2, Chapters 16 and 16B, Revision 4, will include the following changes:

**Chapter 16, Specification 3.8.3 Changes:**

SURVEILLANCE		FREQUENCY
SR 3.8.3.6	Verify each required battery capacity is $\geq 80\%$ of the manufacturer's rating when subjected to a performance discharge test {or a modified performance discharge test}.	2460 months
		AND
		12 months when battery shows degradation or has reached 85% of the expected life

**Chapter 16B, Specification 3.8.3 Bases Changes:**

**SR 3.8.3.6**

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.3.6{; however, only the modified performance

discharge test may be used to satisfy the battery service test requirements of SR 3.8.1.3}.

{A modified discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will ~~often~~ confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

It may consist of just two rates; for instance, the one minute rate for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test must remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.}

{The acceptance criteria for this Surveillance are consistent with IEEE-1188 (Ref. 1) {and IEEE-485 (Ref. 5)}. Acceptance criteria involve demonstrating the capacity of each cell exceeds 90%, and the capacity of all cells are within 10% of the average cell performance.

The Surveillance Frequency for this test is normally 2460 months. If the battery shows degradation, or if the battery has reached 85% of its expected life Surveillance Frequency is reduced to 12 months. Degradation is indicated, according to IEEE-1188 (Ref. 1), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 90% of the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-1188 (Ref. 1).

**NRC RAI 16.2-124, Supplement 1**

*Comment on response to RAI 16.2-124 (MFN 07-306, June 4, 2007):*

*The proposed minimum battery capacity of 80% is applicable to vented lead acid batteries. GE's proposed changes to SR 3.8.3.6 should be revised to state:*

*Verify each required battery capacity is greater than or equal to 90% of the manufacturer's rating when subjected to a performance discharge test {or a modified performance discharge test}.*

*These changes are consistent with the proposed Bases and Section 6.3 of IEEE Standard 1188-2005; "Recommended Practices for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications."*

**GEH Response**

Surveillance Requirement (SR) 3.8.3.6 verifies that battery degradation due to age and usage has not caused battery capacity to fall below the capacity needed to meet the design duty cycle. Therefore, the acceptance criterion for SR 3.8.3.6 is the percentage of the manufacturer's capacity rating that is needed to meet the design duty cycle. The percentage of the manufacturer's capacity rating that is needed to meet the design duty cycle is determined by the battery sizing calculation. As stated in DCD 8.3.2.1.1, battery sizing is performed in accordance with IEEE 485-1997(R2003), "IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations," for an expected 20-year service life. The design objective of a 20-year service life requires that the batteries be sized to include an allowance (i.e., aging factor) for degradation due to age and usage, as explained in IEEE 485, section 6.3.3, "Aging Factor." The battery manufacturer's recommendation for the aging factor needed for a 20-year service life for a valve regulated lead acid battery has not been finalized. Therefore, GEH will revise SR 3.8.3.6 to specify the acceptance criterion as " $\geq \{80\}$ % of the manufacturer's rating," using brackets to identify that the acceptance criterion is preliminary as explained in DCD 16.0.

The frequency for performing SR 3.8.3.6 is based on section 6.3 of IEEE 1188-2005, "Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications." Section 6.3 of IEEE 1188 includes a recommendation that a performance test be performed within one year if an initial acceptance test indicates any battery cell is  $< 90\%$  of the manufacturer's rating or any cell is not within 10% of the average cell. These criteria were incorrectly used as a description of the acceptance criteria for a performance test in the Bases for SR 3.8.3.6. GEH will revise the Bases for SR 3.8.3.6 to include the correct acceptance criteria. Additionally, GEH will continue to use brackets to enclose allowances that would allow a modified performance test to be performed in lieu of both the performance test required by SR 3.8.3.6 and the service test required by SR 3.8.1.3.

**DCD Impact**

DCD Tier 2, Chapters 16 and 16B, will be revised as shown below:

Chapter 16, Specification 3.8.3 Changes:

SURVEILLANCE		FREQUENCY
SR 3.8.3.6	Verify each required battery capacity is $\geq \{80\}$ % of the manufacturer's rating when subjected to a performance discharge test{ or a modified performance discharge test}.	2460 months  AND  12 months when battery shows degradation or has reached 85% of the expected life

Chapter 16B, Specification 3.8.3 Bases Changes:

SR 3.8.3.6

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

{Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.3.6; however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.1.3}.

{A modified discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

It may consist of just two rates; for instance, the one minute rate for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelope the duty cycle of the service test. Since the ampere-hours removed by a one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test must remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.}

{The acceptance criteria for this Surveillance are consistent with IEEE-1188 (Ref. 1) and IEEE-485 (Ref. 5)}. ~~Acceptance criteria involve demonstrating the capacity of each cell exceeds 90%, and the capacity of all cells are within 10% of the average cell performance.~~ These references recommend that the battery be replaced if its capacity is

below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. The battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this {80}% limit.

The Surveillance Frequency for this test is normally 2460 months. If the battery shows degradation, or if the battery has reached 85% of its expected life Surveillance Frequency is reduced to 12 months. Degradation is indicated, according to IEEE-1188 (Ref. 1), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is 90% of the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-1188 (Ref. 1).