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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 269 Related to ESBWR Design Certification Application – Technical Specifications – RAI Number 16.2-184**

Enclosures 1 and 2 contain the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1 letter.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 08-885, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 269 Related to ESBWR Design Certification Application,* October 31, 2008

Enclosures:

1. MFN 09-056 – Response to Portion of NRC Request for Additional Information Letter No. 269 Related to ESBWR Design Certification Application – Technical Specifications – RAI Number 16.2-184
2. MFN 09-056 – DCD Markups for RAI Number 16.2-184

cc:	AE Cubbage	USNRC (with enclosures)
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	DH Hinds	GEH (with enclosures)
	eDRF	96-1331

Enclosure 1

MFN 09-056

Response to Portion of NRC Request for

Additional Information Letter No. 269

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Number 16.2-184

NRC RAI 16.2-184

The staff requests that the applicant provide the required "Established Design Limits" in generic TS 3.8.3 for battery terminal voltage and battery room temperature.

The table entitled "Chapter 16 Changes From Revision 4 TO Revision 5", Item 295 states "Removed brackets from {room} temperature in Condition D and SR 3.8.3.4 consistent with limits on minimum battery temperature needed to ensure battery capacity." However, the following surveillances do not state the acceptance criteria for battery terminal maximum voltage and battery room minimum temperature; neither do the associated bases for these requirements:

> *SR 3.8.3.3 - Verify each required battery terminal voltage is less than or equal to maximum established design limit.*
>
> *SR 3.8.3.4 - Verify required battery room temperature is greater than or equal to minimum established design limit.*

Condition D and required Action D.1 also refer to battery room temperature minimum established design limit.

The staff requests that the applicant revise either the SRS, the Bases, or the DCD (with a specific DCD reference in the Bases) with the numerical values of the above required "Established Design Limits."

GEH Response

The ESBWR Generic Technical Specifications (GTS) are developed utilizing NUREG-1434, “Standard Technical Specifications General Electric Plants, BWR/6,” Revision 3.1.

GTS Surveillance Requirement (SR) 3.8.3.3 is unique to ESBWR, imposing a maximum battery terminal voltage limit in addition to the minimum battery terminal voltage limit in GTS SR 3.8.1.1. Both SRs are modeled after the NUREG-1434 SR 3.8.4.1 where the battery terminal voltage limit is stated as an "established" voltage, allowing the Bases to detail the established value. To address the specific request, the Bases for GTS SR 3.8.3.3 will be revised to include an additional bracketed COL Information Item to provide the specific numerical values for the maximum established design limit for the battery terminal voltage. This will be labeled as "COL 16.0-2-H 3.8.3-3." The existing Reviewer's Note, which is provided in Table 16.0-2-H for this COL Information Item, is appropriate to accommodate this additional detail; requiring the value be supplied consistent with the manufacturer specifications.

GTS SR 3.8.3.4 requirement for battery temperature limit is presented consistent with NUREG-1434 SR 3.8.6.4 in requiring a temperature greater than or equal to "minimum established design limit," allowing the Bases to detail the design limit value. GTS 3.8.3 Condition D, Required Action D.1, and SR 3.8.3.4 (and corresponding Bases) will be corrected to require battery "average cell" temperature rather than battery "room" temperature. This change is also reflected in changes to the Bases for GTS SR 3.8.1.1 and Bases Background of 3.8.3. GTS Bases for SR 3.8.3.4 are also editorially revised

to state that the temperature is verified to be "greater than or equal to" the limit rather than "above" the limit.

Furthermore, in an effort to further consistency with NUREG-1434 SR 3.8.6.4, and to address the specific request, the Bases for GTS SR 3.8.3.4 will be revised to include an additional bracketed COL Information Item to provide the specific numerical values for the minimum established design limit for battery average cell temperature. This will be labeled as "COL 16.0-2-H 3.8.3-3." The existing Reviewer's Note, which is provided in Table 16.0-2-H for this COL Information Item, is appropriate to accommodate this additional detail; requiring the value be supplied consistent with the manufacturer specifications.

DCD Impact

DCD Chapters 16 and 16B will be revised in Revision 6 as shown in Enclosure 2.

Enclosure 2

MFN 09-056

DCD Markups for

RAI Number 16.2-184

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or two batteries on one required division with battery ~~room~~ average cell temperature less than minimum established design limit.	D.1 Restore battery ~~room~~average cell temperature to greater than or equal to minimum established design limit.	12 hours
E. One or more required batteries in redundant required divisions with battery parameters not within limits.	E.1 Restore battery parameters in all but one required division to within limits.	2 hours
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR Required battery with one or more battery cell float voltage < [2.14] V and SR 3.8.3.1 not met.	F.1 Declare associated battery inoperable.	Immediately

COL 16.0-2-H 3.8.3-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	---------- **- NOTE -** Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.1.1. ---------- Verify each required battery is fully charged as indicated by [stabilized charging current or float current within limits].	31 days

COL 16.0-2-H 3.8.3-1

	SURVEILLANCE	FREQUENCY
SR 3.8.3.2 COL 16.0-2-H 3.8.3-3	Verify each required battery pilot cell float voltage is ≥ [2.14] V.	31 days
SR 3.8.3.3	Verify each required battery terminal voltage is less than or equal to maximum established design limit.	31 days
SR 3.8.3.4	Verify each required battery ~~room~~ average cell temperature is greater than or equal to minimum established design limit.	31 days
SR 3.8.3.5 COL 16.0-2-H 3.8.3-3	Verify each required battery connected cell float voltage is ≥ [2.14] V.	92 days
SR 3.8.3.6 COL 16.0-2-H 3.8.3-4 COL 16.0-2-H 3.8.3-2	Verify each required battery capacity is ≥ [80]% of the manufacturer's rating when subjected to a performance discharge test or [a modified performance discharge test].	24 months AND 12 months when battery shows degradation or has reached 85% of the expected life

BASES

SURVEILLANCE REQUIREMENTS (continued)

COL 16.0-2-H 3.8.1-4

COL 16.0-2-H 3.8.1-5

adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer ([2.23] Vpc or [267.6] V at 25°C (77°F) at the battery terminals). Minimum established float voltages are temperature-compensated as a function of battery ~~[room]~~average cell temperature and are provided in the manufacturer operating manual. This voltage maintains the battery in a condition that supports maintaining battery life, [(expected to be approximately 20 years)]. The 31 day Frequency is consistent with manufacturer recommendations and IEEE-1188 (Ref. 7).

SR 3.8.1.2

This SR verifies the design capacity of the battery chargers. According to Regulatory Guide 1.32 (Ref. 8), the battery charger supply is recommended to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

COL 16.0-2-H 3.8.1-1

This SR provides two options. One option requires that each battery charger be capable of supplying [300 or 350] amps at the minimum established float voltage for [4] hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least [2] hours.

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest combined demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the requirements of SR 3.8.3.1 are met.

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Battery Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current and float voltage, individual cell voltage, battery ~~room~~ average cell temperature, and battery capacity for the DC source batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.1, "DC Sources - Operating" and LCO 3.8.2, "DC Sources - Shutdown." In addition to the limitations of this Specification, the Battery Monitoring and Maintenance Program also implements a program specified in Specification 5.5.10 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 1188, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications" (Ref. 1).

The battery cells have an open circuit battery voltage of approximately [256.8] V for [120] cell battery (i.e., cell voltage of [2.139] volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ [2.139] Vpc, the battery cell will maintain its capacity for [30] days without further charging per manufacturer's instructions. However, optimal long-term performance is obtained by maintaining a float voltage [2.23 to 2.25] Vpc at 25°C (77°F). This provides adequate over-potential, which [limits the formation of lead sulfate and self-discharge]. The nominal float voltage of [2.24] Vpc at 25°C (77°F) corresponds to a total float voltage output of [268.8] V for a [120] cell battery as discussed in Chapter 8 (Ref. 2).

COL 16.0-2-H
3.8.3-3

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in Chapter 6 (Ref. 3) and Chapter 15 (Ref. 4) assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC Sources provide the emergency 250 VDC power to the DC Electrical Power Distribution System, which supplies power through the inverters to the Uninterruptible 120 VAC Power buses. Uninterruptible 120 VAC Power supports Q-DCIS and the control power for safety-related systems.

The OPERABILITY of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the

BASES

ACTIONS (continued)

D.1

With one or two batteries on one required division with battery ~~room~~ average cell temperature less than the minimum established design limit, 12 hours is allowed to restore the temperature to within limits. A low temperature results in reduced battery capacity. Since the battery is sized with margin, sufficient capacity exists to perform the intended function and the temporary degradation in battery capacity does not require the battery to be considered inoperable solely as a result of ~~room~~ average cell temperature not met.

E.1

With one or more required batteries in redundant required divisions with battery parameters not within limits, there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function, given that redundant divisions are involved. With redundant divisions involved, this potential could result in a total loss of function on multiple systems that rely upon the batteries. The longer Completion Times specified for battery parameters on one required division not within limits are therefore not appropriate, and the parameters must be restored to within limits on all but one required division within 2 hours.

F.1

When any battery parameter is outside the allowances of the Required Actions for Condition A, B, C, D, or E, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding battery must be declared inoperable. Additionally, discovering one battery with one or more battery cells float voltage less than [2.14] V and SR 3.8.3.1 not met indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately.

COL 16.0-2-H
3.8.3-3

BASES

SURVEILLANCE REQUIREMENTS (continued)

verification every 31 days for pilot cell and 92 days for each connected cell is consistent with manufacturer recommendations. A pilot cell is selected in the series string to reflect the general condition of cells in the battery. The cell selected is the lowest cell voltage in the series string following each quarterly surveillance.

SR 3.8.3.3

COL 16.0-2-H 3.8.3-3

This Surveillance verifies that the temperature-compensated terminal voltage is less than or equal to maximum established temperature-compensated design limit (i.e., [288 V at the battery terminals, or 2.40 Vpc at 25°C (77°F)]). Prolonged use with terminal voltage greater than the maximum established temperature-compensated design limit will reduce battery life. Based on tracking periods of excessive temperature-compensated terminal voltage, the impact on expected battery life can be monitored. The Frequency is consistent with manufacturer recommendations.

SR 3.8.3.4

COL 16.0-2-H 3.8.3-3

This Surveillance verifies that the required battery average cell temperature is ~~above~~ greater than or equal to the design minimum temperature (i.e., [10°C (50°F)]) to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations reduce battery capacity. The Frequency is consistent with manufacturer recommendations.

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.

COL 16.0-2-H 3.8.3-2

[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.]