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Subject: **Response to Supplemental NRC Request for Additional Information Related to ESBWR Design Certification Application – Electrical Power - RAI Numbers 8.3-47 Supplement 1 and 8.5-14 Supplement 1 – Closure of Open Item for DCD Chapter 8**

Enclosure 1 contains GE-H's response to the subject NRC RAIs 8.3-47 Supplement 1 and 8.5-14 Supplement 1 transmitted via the Reference 1 letter.

Please note that this is the second and final Open item response for DCD Chapter 8 as defined in Reference 3.

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

Sincerely,

/Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

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
2. MFN 07-342, Letter from James C. Kinsey to US Nuclear Regulatory Commission (NRC) - Response to Portion of NRC Request for Additional Information Letter No. 65 Related to ESBWR Design Certification Application – Electrical Power - RAI Number 8.5-14, dated June 18, 2007
3. Letter from US Nuclear Regulatory Commission (NRC) to Robert E. Brown (GE-H), *ECONOMIC SIMPLIFIED BOILING WATER REACTOR (ESBWR) CHAPTER 8 OPEN ITEMS*, ML071760356, dated June 29, 2007
4. MFN 07-309, Letter from James C. Kinsey to US Nuclear Regulatory Commission (NRC) - *Response to Portion of NRC Request for Additional Information Letter No. 65 Related to ESBWR Design Certification Application – Electrical Power - RAI Number 8.3-47*, dated June 13, 2007

Enclosure:

1. Enclosure 1 - Response to RAIs 8.5-14 Supplement 1 and 8.3-47 Supplement 1

cc: AE Cubbage USNRC (with enclosures)
RE Brown GE-H/Wilmington (with enclosures)
GB Stramback GE-H/San Jose (with enclosures)
eDRF 0000-0070-3846

Enclosure 1

Response to
RAIs 8.5-14 Supplement 1
and
8.3-47 Supplement 1

For historical purposes, the original text of RAIs 8.3-47 and 8.5-14 and the GE responses are included preceding each supplemental response. Any original attachments or DCD mark-ups are not included to prevent confusion.

NRC RAI 8.3-47

"Battery room environment Class 1E Battery Rooms.

Reviewer Summary: Describe the environment of the Class 1E battery rooms during and following a design basis event."

GE Response

The safety-related (Class 1E) battery rooms were evaluated for all applicable design base accident events. The design base accident that is described in this RAI represents the most unfavorable conditions to the battery rooms. The event is a High Energy Line Break (HELB) with simultaneous loss of off-site and on-site AC, with no credit for the non-safety diesel generators.

Only one battery room is presented in this RAI response. Of the four battery rooms, the room with the most unfavorable conditions, due to HELB boundary conditions that are adopted for those rooms bordering rooms affected by HELB, the maximum heat load with a 10% margin during a HELB with loss of AC power is presented in this RAI. Therefore the conditions of the room presented in this RAI ensures that no room temperature of the other rooms exceed the room presented.

The computer code that was used to evaluate the battery room is CONTAIN 2.0, which was sponsored by the USNRC.

The initial temperature for the battery rooms was analyzed at 30°C (86°F), which is 8°C (14°F) higher than the expected normal operating temperature.

For analysis purposes the following assumptions were made for battery heat loads. During the first 2 hours of a DBA event the heat load was conservatively analyzed at 7200W (24567Btu/h) above the expected operating heat load even though there are no nonsafety-related loads on the safety-related batteries. From 2 hours to 72 hours the heat load was conservatively analyzed at 6000W (20473Btu/h) above the expected operating heat loads. The assumptions that were made are conservative and therefore the analysis is conservative.

The analysis shows that the change in temperature over the 72 hour period during and after a DBA event is 13.5°C (24°F). The maximum temperature in the battery rooms during a HELB and loss of AC power during the first 72-hour period, when no HVAC cooling is available, is 43.5°C (110°F). It is assumed that after 72 hours normal HVAC cooling is available and the temperature decreases.

With the conservative assumptions used in the analysis the environmental conditions of the battery rooms do not exceed the maximum allowable equipment qualification temperature presented in DCD Table 3H-9. The radiation environmental qualification conditions are presented in DCD Table 3H-6.

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

NRC RAI 8.5-14

Provide a discussion on the effect of temperature on the operability of equipment required during an SBO event. Discussion should include all the areas including containment, auxiliary building, control room, battery rooms, etc., containing equipment required during an SBO event.

GHNEA Response

The effect of temperature on the operability of safety-related equipment, during an SBO event, is addressed in Chapter 3.11 Environmental Qualification of Mechanical and Electrical Equipment, DCD/Tier 2, 26A6642AN Revision 03. The accident conditions in Appendix 3.H.3.2 identify that the effects of SBO have been assumed coincident with and included in both LOCA and HELB temperature analyses.

> "In general, the most severe conditions result from a postulated reactor coolant line break inside the containment, LOCA (bounding case) plus SBO, see Chapter 6 for detailed information. However, conditions were also considered for ruptures occurring in the steam tunnel and breaks in the RWCU/SDC System outside the containment, HELB plus SBO, see Chapter 6 for detailed information."

Tables 3H-8, 3H-9, and 3H-10 show the temperatures for Containment Vessel, Reactor Building with battery rooms, and Control Room Zone, respectively for accident conditions with SBO.

DCD Changes

There are no changes to the DCD do to this RAI.

NRC RAI 8.5-14 Supplement 1 and NRC RAI 8.3-47 Supplement 1

GE analyzed that the maximum temperature in the battery rooms during a high energy line break (HELB) and loss of AC power during 72 hour period is 60°C (140°F). Provide assurance and confirmation for the performance and operability of the safety-related batteries in high temperature room.

GE-H Response

As noted in GE response to RAI 8.3-47, the safety-related battery rooms were evaluated for all applicable design basis accident events. The design basis accident that is described in RAI 8.3-47 represents the most unfavorable conditions to the battery rooms. The event is a High Energy Line Break (HELB) with simultaneous loss of off-site and on-site AC, with no credit for the non-safety-related diesel generators.

The maximum temperature in the battery rooms during a HELB and loss of AC power during the first 72-hour period, when no HVAC cooling is available, is 43.5°C (110°F). It is assumed that after 72 hours normal HVAC cooling is available and the temperature decreases.

With the conservative assumptions used in the analysis, the environmental conditions of the battery rooms do not exceed the maximum allowable equipment qualification temperature presented in DCD Table 3H-9 of 60°C (140°F).

Safety-related batteries will be qualified to IEEE Std 535 "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations". Performance and operability are ensured because the IEEE 535 qualification requirements include testing at 62.8°C (145°F).

However, since significant conservatism is now apparent, the maximum allowable equipment qualification temperature presented in DCD Table 3H-9 for the battery rooms will be reduced.

DCD Changes

Appendix 3H Table 3H-9 for Battery Rooms 1210, 1220, 1230, and 1240 will be changed from 60°C (140°F) to 50°C (122°F) as shown on the attached markup page.

Table 3H-9

Thermodynamic Environment Conditions Inside Reactor Building for Accident Conditions

Plant Zone/Typical Equipment***			
Hydraulic Control Unit (HCU) Rooms HCU, RPS solenoids and RPV water level instrument racks Rooms No 1110, 1120, 1130, 1140 (Figure 1.2-1)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 50 (122) Max Not controlled Not controlled	96 h - 100 days 40 (104) -0 Not controlled
Battery Rooms Div I, II, III and IV batteries Rooms No 1210, 1220, 1230, 1240 (Figure 1.2-2)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h ~~60~~ 50 (~~140~~122) Max Not controlled Not controlled	96 h - 100 days 40 (104) +0 Not controlled
Div I, II, III and IV commodity chases Electrical cables Rooms No 1211, 1221, 1231, 1241 (Figure 1.2-2)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 110 (230) Max Not controlled Not controlled	96 h - 100 days 50 (122) +0 Not controlled
Electrical Division Rooms Div I, II, III and IV electrical and electronic equipment Rooms No 1311, 1321, 1331, 1341 (Figure 1.2-3)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h To be determined Not controlled Not controlled	96 h - 100 days To be determined +0 Not controlled
Lower drywell non-divisional electrical and mechanical penetration Outboard containment isolation valves Rooms No 1300, 1301, 1302, 1303 (Figure 1.2-3)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 110 (230) Max Not controlled Not controlled	96 h - 100 days 50 (122) +0 Not controlled
Div I, II, III and IV electrical penetration rooms Electrical cables and penetrations Rooms No 1312, 1322, 1332, 1342 (Figure 1.2-3)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 110 (230) Max Not controlled Not controlled	96 h - 100 days 50 (122) +0 Not controlled
Remote shutdown panel Rooms No 1313, 1323 (inside rooms 1311 and 1321) (Figure 1.2-3)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 50 (122) Not controlled Not controlled	96 h - 100 days 40 (104) +0 Not controlled
Non-divisional electrical equipment 1 EDCIS panels Rooms No 1500, 1501, 1502, 1503 (Figure 1.2-5)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 50 (122) Max Not controlled Not controlled	96 h - 100 days 40 (104) +0 Not controlled

Table 3H-9

Thermodynamic Environment Conditions Inside Reactor Building for Accident Conditions

Plant Zone/Typical Equipment***			
Div I, II, III and IV electrical penetrations (EL.13570) Electrical cables and penetration Rooms No 1610, 1620, 1630, 1640 (Figure 1.2-6)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 110 (230) Max Not controlled Not controlled	96 h - 100 days 50 (122) +0 Not controlled
Div I, II, III and IV corridors rooms (access to penetration area), divisional electrical cables and 1E DCIS RMUs Rooms No 1710, 1720, 1730, 1740 (Figure 1.2-7)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 50 (122) Max Not controlled Not controlled	96 h - 100 days 40 (104) -0 Not controlled
Div I, II, III and IV electrical penetration (EL. 17500) and Mechanical penetrations. Electrical cables and penetrations. Outboard isolation valves Rooms No 1711, 1721, 1731, 1741 and 1712, 1722, 1732, 1742 (Figure 1.2-7)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 110 (230) Max Not controlled Not controlled	96 h - 100 days 50 (122) -0 Not controlled
SBLC tank rooms SBLC tank instrumentation Rooms No1713, 1723 (Figure 1.2-7)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 50 (122) Max Not controlled Not controlled	96 h - 100 days 40 (104) -0 Not controlled
Main Steamline (MSL) isolation valves MSL drain isolation valves FW isolation valves Rooms No 1770 (Figure 1.2-7)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 117 (234) Max 76 (11) 100	96 h - 100 days 60 (140) -0 Not controlled
ICS/PCC pools ICS pools instrumentation Rooms No 18P3A/B/C/D, 18P4A/B/C/D/E/F, 18P5A/B/C, 18P6A/B/C (Figure 1.2-8)	Time * Temp. °C (°F) ** Press. kPag (psig) Humidity %	0 h - 72 h 112 (234) Max 49 (7.1) 100	96 h - 100 days 100 (212) +0 100

* Time indicates the time after the occurrence of the accident.

** After 72h, the temperature decreases to the temperature value shown for 96h.

*** Electronic equipment is qualified for 50°C during 72 hours; other equipment could be qualified for higher temperatures according to the above values. In locations where room temperature is higher than the above values, the qualification will be done for the calculated temperature, or the equipment will be protected from high temperatures.