HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

MFN 07-165
Supplement 2

Docket No. 52-010

December 11, 2007

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 109 Related To ESBWR Design Certification Application – DCD Chapter 8 – Electrical Power - RAI 8.3-52 Supplement 3**

The purpose of this letter is to submit a portion the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC Letter 109, dated October 12, 2007, Reference 1. GEH's response to the RAI 8.3-52 Supplement 3 is addressed in Enclosure 1. The previous supplemented response dated June 18, 2007 was submitted via Reference 2 in response to Reference 3. The Supplement 1 response dated May 15, 2007 (Reference 4) was requested by NRC in Reference 5. The original RAI response was submitted on March 12, 2007 to the NRC via Reference 6 in response to NRC Letter No. 92 (Reference 7).

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

D068

NRO

References:

1. MFN 07-555, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 109 Related To ESBWR Design Certification Application*, dated October 12, 2007
2. MFN 07-165 Supplement 1, Letter from James C. Kinsey to U.S. Nuclear Regulatory Commission, *Response to RAI 8.3-52 Supplement 2 Related to ESBWR Design Certification Application – DCD Section 8 – Electrical Power*, dated June 18, 2007
3. Email from AE Cubbage (NRC to JC Kinsey (GEH), Supplement 2 to RAI 8.3-52, dated June 5, 2007
4. MFN 07-165, Letter from David Hinds to U.S. Nuclear Regulatory Commission, *Response to RAI 8.3-52 Supplement 1, and Submittal of Editorial Clarifications Related to ESBWR Design Certification Application – DCD Section 8 – Electrical Power*, dated May 15, 2007
5. Email from I. Berrios (NRC) to D. Lewis, *Sup RAO Ch 8*, dated May 4, 2007
6. MFN 07-143, Letter from David Hinds to U.S. Nuclear Regulatory Commission, *Summary Report - RAI Resolutions Incorporated in ESBWR Design Control Document, Revision 3, and RAI Response Schedule*, dated March 12, 2007
7. MFN 07-105, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 92 Related to ESBWR Design Certification Application*, dated January 31, 2007

Enclosure:

1. MFN 07-165, Supplement 2, Response to Portion of NRC Request for Additional Information Letter No. 109 Related to ESBWR Design Certification Application - RAI Number 8.3-52 S03

cc: AE Cubbage USNRC (with enclosures)
RE Brown GEH/Wilmington (with enclosures)
GB Stramback GEH/San Jose (with enclosures)
eDRF 0000-0078-2249

MFN 07-165, Supplement 2

Enclosure 1

Response to Portion of NRC Request for

Additional Information Letter No. 109

Related to ESBWR Design Certification Application

RAI Number 8.3-52 S03

For historical purposes, the original text of RAI 8.3-52 and any previous supplemental text and GE responses are included preceding each supplemental response. Any original attachments or DCD mark-ups are not included to prevent confusion.

RAI 8.3-52: (Reference MFN 07-143, Enclosure 1)

Address battery load profile. DCD Tier 2, Table 8.3-6 should identify an ESBWR common design load profile rather than defer the information as a COL item.

Original GE Response:

Deleted T8.3-6, "Class 1E Battery Loading Profile." This information is covered in ITAAC 2.13.3-1, 3a.

Also, deleted T8.3-7, "Amp. Hour Load Table for 72 Hour Battery Rate." This information is covered in ITAAC 2.13.3-1, 3a.

RAI 8.3-52, Supplement 1

Provide loading profile for safety-related DC power systems based on each of safety-related UPS buses, Bus Nos. 11, 12, 21, 22, 31, 32, 41, and 42.

GE Response:

As clarification, RAI 8.3-52 was responded to in the change list that was provided with DCD Chapter 8 Revision 3 and later summarized in MFN 07-143.

In response to the above RAI 8.3-52 S01 received Friday, May 4, 2007, GE provides the following: The loading profile will not be provided until the DCIS loads are established. The DRAFT safety-related DCIS loads are currently scheduled for approximately Sept. 2008 with confirmed loads not being known until 12/2011 to 6/2012, based on having actual procured vendor loads for the load profile. The Subsection **8.3.2.1.1 Safety-Related Batteries**, states that "the two batteries in each division are rated to exceed 72 hours and are **sized for the DC load in accordance with IEEE Standard 485 (Reference 8.3-2) with an expected 20-year service life**." The same subsection, under **Inspection, Maintenance, and Testing** states that "battery capacity tests are conducted in accordance with IEEE 1188 (Reference 8.3-8). These tests ensure that the battery has the capacity to meet safety-related load demands." The final load profile will have an analyses performed and tested in accordance with ITAAC Table 2.13.3-1, 3a. & 3b. Acceptance Criteria.

3a). Analyses reports of the as-built batteries exist and conclude that two sets of safety-related batteries in each division have the capacity, as determined by the vendor performance specification, to supply its rated constant current, for a minimum of 72 hours without recharging.

3b). Test report(s) conclude that the capacity of each as-built safety-related battery equals or exceeds the analyzed battery design duty cycle capacity.

The selected batteries are capable of being sized to meet the above stated criteria without expansion of the current rooms designated for each division's batteries. A preliminary battery size has been selected to meet the estimated maximum design load profile with the ability to increase the battery size by 50% of the estimated size if necessary.

DCD Impact:

No additional DCD Tier 2 changes will be made in response to this RAI.

NRC RAI 8.3-52 Supplement 2

In MFN-07-165, dated May 15, 2007, GE provided supplement 1 of the response to RAI 8.3-52. The associated DCD markup provided stated:
"8.3.2.1.1 Safety-Related Station Batteries and Battery Chargers 250V Safety-Related DC Systems Configuration Figure 8.1-3 shows the overall 250 VDC system provided for safety-related Divisions 1, 2, 3 and 4. Divisions 1, 2, 3 and 4 consist of two separate battery sets for each division. Each set supplies power to the safety-related inverters for at least 72 hours following a design basis event. The DC systems are operated ungrounded for increased reliability."

The response also stated:
"The final load profile will have an analyses performed and tested in accordance with ITAAC Table 2.13.3-1, 3a. & 3b. Acceptance Criteria.

3a). Analyses reports of the as-built batteries exist and conclude that two sets of safety-related batteries in each division have the capacity, as determined by the vendor performance specification, to supply its rated constant current, for a minimum of 72 hours without recharging.

3b). Test report(s) conclude that the capacity of each as-built safety-related battery equals or exceeds the analyzed battery design duty cycle capacity."

Both of these sections of the response refer to "two sets of safety-related batteries in each division." It is the staff's understanding that the design consists of just one set (of two) safety related batteries per division with the set of batteries supplying power for 72 hours. Please clarify this RAI response.

GHNEA Response

DCD Tier 2 Chapter 8 states at Subsection 8.3.2.1.1, under Safety Related Batteries, "In division 1,2,3 and 4 the two 250 volt safety-related batteries per division are each rated to exceed 72-hour station blackout conditions."

The same Subsection 8.3.2.1.1, first paragraph, second sentence, states, "Divisions 1, 2, 3 and 4 consist of two separate battery sets for each division." GE will revise this second sentence and the following third sentence to: "Divisions 1,2, 3 and 4 consist of two separate batteries in each division." "Each battery supplies power to its safety-related inverter for at least 72 hours following a design bases event." The word "sets" or "set" have been removed from both sentences as an editorial correction. They caused confusion and misunderstanding.

The Tier 1 ITAAC Table 2.13.3-1, 3a) states "Analyses reports of the as-built batteries exist and conclude that two sets of safety-related batteries in each division have the capacity, as determined by the vendor performance specification, to supply its rated constant current, for a minimum of 72 hours without recharging." This will be revised to

delete the words "sets of" and will replace "its" with "their". This editorial correction will ensure that the Tier 1 reflects the design described within Tier 2.

Table 8.3-2, Battery Duty Cycles, show two batteries per each safety related division. Each safety-related battery is 250 volts and has a 72-hour duty cycle. Each safety-related division has 72-hours of DC power available when two 72-hour batteries are operable per division.

In support of our June 4, 2007 teleconference, also refer to DCD Revision 3, Chapter 16B, Bases discussion supporting the Technical Specification requirement for operability of the DC Source Divisions. The Bases discussion for the LCO subsection states: "Each required division is required to have two DC Sources, with each DC source consisting of the 250 V battery, the associated battery charger (either the normal or the standby charger), and all the associated control equipment and interconnecting cabling." Technical Specification 3.8.1 Actions apply equally for inoperability of one or both DC sources.

DCD Impact

Tier 1 and Tier 2 DCD Sections will be revised as shown above and reflect the marked-up attachments to this DCD.

NRC RAI 8.3-52 S03

In Supplements 1 and 2 of the responses to RAI 8.3-52, GE stated that a battery size has been selected to meet the estimated maximum design load profile with the ability to increase the battery size by 50% of the estimated size. The load profile for safety-related dc power systems based on each of safety-related UPS buses will have an analyses performed and tested in accordance with ITAAC. Update the DCD to include the load profile for each UPS bus and the associated battery size.

GEH Response

As discussed in the teleconference with the Staff held October 15, 2007, GEH has completed a calculation for the safety-related battery nominal load profile and will revise DCD Tier 2, Revision 5 to include a table of nominal load requirements for each safety-related division.

The loads assumed for each divisional battery are estimated nominal values. These nominal loads are based on assumed equipment vendor information, using equipment vendor data with the highest load information, and loading of Remote Multiplexing Unit (RMU) cabinets based on best engineering load estimates. In addition, the loads for the RMUs powering solenoid valves were determined based on the conservative assumption that the solenoid valves would remain energized for 72 hours and all of the squib valves were considered to fire at the same time. This would conservatively encompass all design basis scenarios.

In addition, the responses to RAIs 8.3-52, 8.3-52 S01, and 8.3-52 S02 referenced Tier 1 ITAAC Table 2.13.3-1, #3a and #3b. Revision 4 of DCD Tier 1 re-ordered the ITAAC tables and the referenced ITAAC was changed to Table 2.13.3-3, ITAAC #6 and re-worded. To maintain continuity with the previous RAI responses and the Staff's drafted SER, Revision 5 of DCD Tier 1 will change the referenced ITAAC back to the original wording and will be re-numbered as #3a and #3b. However, the ITAAC will remain in Table 2.13.3-3. The ITAAC tables were re-numbered in Revision 4 as an administrative change because additional content was added to the table. The numbering of the ITAAC table does not affect this ITAAC or its content.

DCD Impact

DCD Tier 2, Table 8.3-3 will be added as noted in the attached markup.
DCD Tier 1, Text and Table 2.13.3-3 will be changed as noted in the attached markup.

Table 8.3-3

250VDC Safety-Related Battery Nominal Load Requirements

	DC Power (Watts)					
	Normal	**1 min DBA**	**1-5 min DBA**	**5-15 min**	**15-60 min**	**1-72 hours**
Division 1	23506	24756	19444	21444	20244	20244
Division 2	19756	21006	15694	17694	16494	16494
Division 3	17756	19006	19319	21069	19869	19869
Division 4	17756	19006	19319	20769	19569	19569

Notes:

(1) The loads assumed for each divisional battery are estimated nominal values. These nominal loads are based on assumed equipment vendor information and best engineering load estimates.

(2) The loads for RMUs powering solenoid valves and squib valves are based on the assumption that the solenoid valves would be operable (energized) for 72 hours and all of the squib vales are considered to fire at the same time. This will conservatively encompass all design basis scenarios.

2.13.3 Direct Current Power Supply

Design Description

Completely independent safety-related and nonsafety-related DC power systems are provided.

Nonsafety-related DC power systems are not part of the plant safety design basis, and are independent and separated from the safety-related DC power supplies.

The 250 V Safety-Related DC systems provide four divisions of power to operate safety–related loads for at least 72 hours following a design basis accident. The 250V Safety-Related DC systems are also adequately sized for the station blackout loads.

(1) The functional arrangement of the 250V Safety-Related DC systems is as shown on Figure 2.13.3-1 and the component locations are shown in Table 2.13.3-1.

(2) The functional arrangement of the 125 V and 250 V Nonsafety-Related DC systems is as shown on Figure 2.13.3-2.

(3) Two 72-hour batteries in each division are sized to supply their design loads, at the end of installed life, for a minimum of 72 hours without recharging.

~~(3)~~(4)The 250V Safety-Related DC systems identified in Table 2.13.3-1 conform to Seismic Category I requirements and are housed in Seismic Category I structures.

~~(4)~~(5)The 250 V Safety-Related DC systems provide four independent and redundant safety-related divisions.

~~(5)~~(6)Separation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.

~~(6)The two 250 VDC safety-related batteries in each division are each capable of supplying power to their safety-related loads for at least 72 hours following a design basis accident.~~

(7) Each battery charger associated with each 250 VDC safety-related battery has sufficient capacity to meet the largest combined demands of the various continuous steady-state loads plus the charging capacity to restore the battery from the design minimum charge state to the fully charged state within the time stated in the design basis, consistent with the requirement given in IEEE 308.

(8) The 250 V Safety-Related DC battery and battery charger circuit breakers, and DC distribution panels and their circuit breakers and fuses, are sized to supply their load requirements.

(9) The battery chargers are designed to prevent their AC source from becoming a load on the 250 VDC safety-related batteries because of power feedback from loss of AC power.

(10) The minimum set of displays, alarms and controls, based on the applicable codes and standards, including HFE evaluations and emergency procedure guidelines, is available in the main control room..

(11) Equipment qualification of the 250 V Safety-Related DC systems is addressed in DCD Tier 1 Section 3.8.

Table 2.13.3-3

ITAAC For The Direct Current Power Supply

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. Two 72-hour batteries in each division are sized to supply their design loads, at the end of installed life, for a minimum of 72 hours without recharging.	a. Analyses for the as-built safety-related batteries to determine battery capacities will be performed based on the design duty cycle for each battery.	a. Analysis reports of the as-built batteries exist and conclude that two safety-related batteries in each division have the capacity, as determined by the vendor performance specification, to supply their rated constant current for a minimum of 72 hours without recharging.
	b. Tests of each as-built safety-related battery will be conducted by simulating loads which envelope the analyzed battery design duty cycle.	b. Test report(s) conclude that the capacity of each as-built safety-related battery equals or exceeds the analyzed battery design duty cycle capacity.
~~3~~4. The 250V Safety-Related DC systems equipment identified in Table 2.13.3-1 - Conform to Seismic Category I requirements, and - Are housed in Seismic Category I structures.	i) Type tests and/or analyses of the 250V Safety-Related DC system equipment will be performed.	i) A report exists and concludes that the as-built 250V Safety-Related DC system equipment conforms to Seismic Category I requirements.
	ii) Inspections of the as-built 250V Safety-Related DC systems will be performed to verify that the equipment is installed in accordance with the configurations specified in the type tests and/or analyses.	ii) Inspection report(s) document that the as-built 250V Safety-Related DC system equipment is installed in accordance with the configurations specified by the type tests and/or analyses.

Table 2.13.3-3

ITAAC For The Direct Current Power Supply

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	iii) Inspections of the as-built 250V Safety-Related DC systems will be performed to verify that the equipment is housed in Seismic Category I structures.	iii) Inspection report(s) document that the as-built 250V Safety-Related DC system equipment is housed in Seismic Category I structures.
45. The 250 V Safety-Related DC systems provide four independent and redundant safety-related divisions.	Tests will be performed on the as-built 250 V Safety-Related DC systems by providing a test signal in only one safety-related division at a time.	i) Test report (s) demonstrate that a test signal exists only in the as-built safety-related division under test in the 250 V Safety-Related DC systems. ii) Test report(s) demonstrate that a test signal originating from the as-built divisional safety-related 250 VDC distribution panel exists at the terminals of its divisional safety-related loads.
~~5~~6. Separation is provided between safety-related divisions, and between safety-related divisions and nonsafety-related equipment.	Inspection of the as-built 250 V Safety-Related DC systems will be performed.	Inspection report(s) document that, in the as-built 250 V Safety-Related DC systems, physical separation or electrical isolation exists between safety–related divisions. Physical separation or electrical isolation exists between safety-related divisions and nonsafety-related equipment.

Table 2.13.3-3

ITAAC For The Direct Current Power Supply

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
~~6. The two 250 VDC safety-related batteries in each division are each capable of supplying power to their safety-related loads for at least 72 hours following a design basis accident.~~	~~A service test will be performed on each divisional Safety-Related 250 VDC battery in accordance with the applicable IEEE standard 1188.~~	~~Test report(s) document that the results of the service test meet the design basis requirement capacity as defined in the applicable IEEE standard 1188.~~
7. Each battery charger associated with each 250 VDC safety-related battery has sufficient capacity to meet the largest combined demands of the various continuous steady-state loads plus the charging capacity to restore the battery from the design minimum charge state to the fully charged state within the time stated in the design basis, consistent with the requirement given in IEEE 308.	Testing of each 250 VDC safety-related battery charger will be performed.	Test report(s) document that following a battery discharge to the bounding design basis accident discharge state, the battery charger is capable of recharging its associated battery to the fully charged state while supplying the largest combined demands of the various continuous steady state simulated and /or real loads consistent with the requirement given in IEEE 308.
8. The safety-related DC battery and battery charger circuit breakers, and DC distribution panels and their circuit breakers and fuses, are sized to supply their load requirements.	Analyses of the as-built 250V Safety-Related DC electrical distribution system will be performed to determine the capacities of the battery and battery charger circuit breakers, and DC distribution panels and their circuit breakers and fuses.	Analyses for the as-built 250V Safety-Related DC electrical distribution system exist, and analysis report(s) conclude that the capacities of safety-related battery and battery charger circuit breakers, and DC distribution panels and their circuit breakers and fuses, as determined by their nameplate ratings, exceed their analyzed load and DC interrupting current requirements.