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 06-309, Supplement 9

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 105 Related to ESBWR Design Certification Application – Auxiliary Systems- RAI Number 9.1-13 S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated August 16, 2007. GEH response to RAI Number 9.1-13 S01 is addressed in Enclosure 1.

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-460, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, Senior Vice President, Regulatory Affairs, *Request For Additional Information Letter No. 105 Related To ESBWR Design Certification Application*, dated August 16, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 105 Related to ESBWR Design Certification Application – Auxiliary Systems– RAI Number 9.1-13 S01

cc: AE Cubbage USNRC (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
eDRF 0000-0076-8153

Enclosure 1

MFN 06-309, Supplement 9

Response to Portion of NRC Request for

Additional Information Letter No. 105

Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.1-13 S01

On the last page of this transmittal are the references. These references corresponds to the GEH proprietary calculation/analysis that are available for NRC audit at the GEH offices in Washington D.C.

For historical purposes, the original text and GE response to RAIs 9.1-13 is included.

NRC RAI 9.1-13

DCD Tier 2, Section 9.1.3 states that pipes equipped with normally closed manual valves are provided for establishing flow paths from off-site emergency water supplies or the FPS to refill the IC/PCCS pools and SFP following a design basis loss of coolant accident. DCD Tier 1, Figure 2.6.2-1 indicates that the emergency makeup connections and the makeup water supply from the fire protection system each pass through a single isolation valve into a common header in the FAPCS for makeup to the SFP or to IC/PCCS pools.

Clarify how the makeup water necessary for residual heat removal is assured, consistent with the requirements of GDC 34, GDC 38, and GDC 61, assuming a single active failure.

Specify the characteristics of any pumps used with the COL applicant-specified water source necessary to satisfy the single failure criterion for the makeup water supply.

GE Response

In order to provide additional protection against a potential single active failure of the FPS makeup water supply, GE proposes to modify the connection the FAPCS design to include two parallel valves in the makeup water supply line from FPS to FAPCS for both the IC/PCC and spent fuel pools. This change ensures that on-site water sources remain available as makeup for the IC/PCC and spent fuel pools for the first seven days even if a single active failure were to occur. See also RAI 9.1-22. The addition of these parallel valves ensures that the ICS and PCCS condensers can provide sufficient heat removal capability at and beyond 72 hours to satisfy GDC 34 and GDC 38 requirements for considering a single failure.

GDC 61 does not strictly require a single failure be postulated for decay heat removal from the spent fuel storage pool. However, the ESBWR design originally addressed a single active failure by having separate makeup connections to the fire protection system and to an alternate water supply connection point in the

yard area. The new parallel valve being added in response to this RAI provides further assurance that the design can withstand a single active failure.

The only way to disable the entire makeup function to the IC/PCC or spent fuel storage pool (after the change discussed above) would be to postulate a passive failure of the common header piping to the pool. This is low pressure and low temperature safety-related piping, designed to Seismic Category I requirements, which operates infrequently. Thus, there is no requirement to postulate a break in this piping.

NRC RAI 2.4-23 (Amended Response) MFN 06-309

The applicant should define the volume and the minimum delivery rate of the cooling water that would be required to be stored and delivered by the external water source.

GE Response

The main water demand for normal conditions is the makeup for Plant Service Water Cooling Towers and Circulating Water cooling towers (during power operation). These are site dependent and outside of the ESBWR Standard Plant scope.

During accident conditions, there are no water supply requirements within 72 hours after an initiating event. After 72 hours, the only function required for maintaining the plant in a safe shutdown condition is to provide makeup water to the Isolation Condenser/Passive Containment Cooling (IC/PCC) pools and Spent Fuel Pool. The required volume from 72 hours through 7 days is approximately 3,900 m^3 (138,000 ft^3), and the maximum required delivery rate is approximately 46 m^3/hr (200 gpm) at 72 hours.

See responses to RAI 2.4-5 and RAI 2.4-22 for further clarification.

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

NRC RAI 9.1-13 S01

Demonstrate how the proposed total makeup flow rate of 200 gpm is bounding for accidents shortly after a refueling outage.

GEH Response

The minimum makeup water flow rate is determined based on the highest possible heat load at three days post-accident. This information can be found in Reference 1, Table 6, and is adjusted for 20 years of spent fuel by Reference 2. According to Table 6 of Reference 1, the heat load associated with "3 days post-shutdown" is 20.53 MW. This includes the decay heat from the core (17.1 MW) as well as the spent fuel pool (3.43 MW). Reference 2 increases the SFP heat load by 0.68 MW, for a total of 21.21 MW.

Using the heat of vaporization of water (2260 kJ/kg), this heat load can be converted directly to a makeup water flow rate as follows:

$$\frac{2.121 \cdot 10^4 \, kJ/s}{2260 \, kJ/kg} = 9.38 \, kg/s$$

which is then converted to a volumetric flow rate using the density of water at 43ºC (990 kg/m^3)

$$9.38 \, kg/s \div 990 \, kg/m^3 = 9.48 \cdot 10^{-3} \, m^3/s = 150 \, gal/\min$$

Therefore a minimum makeup water flow rate of 200 gpm bound the most limiting heat load.

DCD Impact

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

GEH Proprietary Calculation/Analysis

Ref #	Title	eDRF Section
1)	ESBWR Spent Fuel Pool Decay Heat	0000-0036-0326
2)	Supplement for 20-Year Spent Fuel Storage Capacity	0000-0055-4699 R1