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MFN 06-488 Supplement 1

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Subject: Response to Portion of NRC Request for Additional Information Letter No. 68 Related to ESBWR Design Certification Application - Emergency Core Cooling Systems - RAI Number 6.3-40 S01

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI originally transmitted via the Reference 1 letter and supplemented by an NRC request for clarification in Reference 2.

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

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 06-379, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 68 Related to ESBWR Design Certification Application*, October 10, 2006
2. E-Mail from Shawn Williams, U.S. Nuclear Regulatory Commission, to George Wadkins, GE Hitachi Nuclear Energy, dated July 27, 2007 (ADAMS Accession Number ML072080241)

Enclosure:

1. MFN 06-488 Supplement 1 - Response to Portion of NRC Request for Additional Information Letter No. 68 Related to ESBWR Design Certification Application - Emergency Core Cooling Systems - RAI Number 6.3-40 S01

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Enclosure 1

MFN 06-488 Supplement 1

**Response to Portion of NRC Request for
Additional Information Letter No. 68
Related to ESBWR Design Certification Application**

Emergency Core Cooling Systems

RAI Number 6.3-40 S01

NRC RAI 6.3-40:

In DCD Tier 2, Section 6.3, it was indicated that the suppression pool equalization lines are considered part of emergency core cooling system (ECCS) and that they are credited for the bottom drain line of coolant accident (LOCA) case. However, GE representatives have stated in meeting that for all design basis LOCA scenarios, the equalization line check valves are not opened due to high vessel downcomer water level. Please provide TRACG analysis results (differential pressure (DP) across equalization line check valves) for all design basis LOCA cases to demonstrate that the valves would not be opened during design basis LOCA cases within 72 hours of a LOCA and beyond. In addition, please provide the calculation uncertainties of the calculated DP across the check valves.

GEH Response:

The equalization line initiation logic is described as follows:

- (1) Reactor pressure vessel (RPV) level drops to Level 1 + 30 minutes delay time to create a permissive signal, and
- (2) RPV level drops to Level 0.5 (1.0m above top of active fuel (TAF), or 8.453m from RPV bottom), to initiate opening of squib valves in the equalization lines.

For ESBWR TRACG calculations, the calculated RPV level after the permissive signal initiated is always greater than 8.453m from RPV bottom for 72 hours. Therefore, the squib valves in the equalization lines are still closed in 72 hours.

The RPV minimum downcomer levels after the level permissive is reached for Bottom Drain Line, Gravity-Driven Cooling System (GDCCS) Injection Line, Feedwater Line, and Main Steam Line break cases presented in Design Control Document (DCD) Tier 2, Revision 2, are listed in the following table:

Break Type	Permissive Signal Time (hr)	Min. RPV Level (m)	Time at Min. (hr)
Bottom Drain Line	0.58	12.20	9.03
GDCCS Injection Line	0.54	10.73	16.33
Feedwater Line	0.61	15.61	20.09
Main Steam Line	0.62	21.67	70.83

The results show the RPV levels stay above Level 0.5 setpoint for 72 hours and beyond for all design basis loss-of-coolant accident (LOCA) scenarios.

Since the squib valves are not opened in these ESBWR TRACG calculations, calculations of the differential pressure (DP) across the check valves, and the uncertainties of DP across the check valves, are not necessary. The pressure differences between the RPV and drywell are available in the DCD.

DCD Impact:

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

NRC RAI 6.3-40 S01:

Staff is uncertain on why the minimum reactor pressure vessel (RPV) water level values stated in the response to RAI 6.3-40 do not correspond with the values provided in Table 6.3-5, "Summary of ECCS-LOCA Performance Analyses" of the DCD. Please explain.

Also, please revise the DCD to include the response to RAI 6.3-40.

GEH Response:

The permissive signal for the actuation of the equalization line valves occurs after the reactor pressure vessel (RPV) water level reaches Level 1 with a delay time of 30 minutes. The table in the GEH response to RAI 6.3-40 represents the minimum RPV water level reached after this permissive signal. After the permissive signal, the RPV water level stays above Level 0.5 for over 72 hours. DCD Tier 2, Revision 4, Table 6.3-5 lists the minimum RPV water level reached during each loss-of-coolant accident (LOCA) event analyzed, which is within the 30 minute time delay for the permissive signal. The results from the GEH response to RAI 6.3-40 are addressed with a statement in DCD Tier 2, Revision 4, Table 6.2-7a through Table 6.2-7e. The equalization lines are discussed further in DCD Tier 2, Revision 4, Subsection 6.3.2.7.1 and Subsection 6.3.2.7.2.

DCD Tier 2, Table 6.3-1, will be revised to include the information provided in the response to RAI 6.3-40 by renaming line item "B.2 Gravity-Driven Core Cooling System" as "B.2 Gravity-Driven Cooling System (Short-Term)," and adding new line item "B.6 Gravity-Driven Cooling System (Long-Term)" with new entries as requested.

DCD Impact:

DCD Tier 2, Table 6.3-1, will be revised as shown in the attached markup.

ESBWR

26A6642AT Rev. 05

Design Control Document/Tier 2

Table 6.3-1

Significant Input Variables to the ECCS-LOCA Performance Analysis

B.2 Gravity-Driven Core-Cooling System (Short-Term)		
Variable	Units	Value
Initiating Signal	—	ECCS-LOCA confirmed initiating signal (See B.1)
GDCS Injection valve timer delay	sec	150
Minimum drainable inventory per GDCS pool		See Table 6.3-2
Minimum elevation of GDCS pool surfaces above the RPV nozzles		See Table 6.3-2
GDCS drain line loss coefficient (k/A ²)	1/m ⁴ [1/ft ⁴]	12.587*10 ³ [1.458*10 ⁶]

B.6 Gravity-Driven Cooling System (Long-Term)		
Variable	Units	Value
Permissive Signal Delay Time after Level 1	min	30
Initiation Signal Level 0.5 after Permissive Signal	meters (above TAF) [ft] (above TAF)	1 [3.28]