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MFN 06-488

Docket No. 52-010

December 22, 2006

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. 68 – Emergency Core Cooling Systems - RAI Numbers 6.3-39, 6.3-40, and 6.3-61**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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Reference:

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

Enclosure:

1. MFN 06-488 – Response to Portion of NRC Request for Additional Information Letter No. 68 – Related to ESBWR Design Certification Application – Emergency Core Cooling Systems – RAI Numbers 6.3-39, 6.3-40, and 6.3-61

cc:	AE Cubbage	USNRC (with enclosures)
	GB Stramback	GE/San Jose (with enclosures)
	eDRF	0060-9120 – RAI 6.3-39
		0060-6810 – RAI 6.3-40
		0061-8792 – RAI 6.3-61

Enclosure 1

MFN 06-488

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

Emergency Core Cooling Systems

RAI Numbers 6.3-39, 6.3-40, and 6.3-61

NRC RAI 6.3-39:

Please address the following questions related to the debris source term:

a) *DCD Tier 2, Section 6.1 (Page 6.1-1), states that the thermal insulation materials are primarily metallic and metal-encapsulated. Some antisweat and nonmetallic thermal insulation material will be used on the cooling water lines. Please identify the fiber and particulate contents of these insulation materials, the amount of the material and the location of these cooling water lines. In addition, for the metal-encapsulated insulation, please identify the type of material underneath the metal-encapsulation. If they contain fiber and particulate, please discuss the mass amount.*

b) *If the antisweat insulation, nonmetallic insulation and metal encapsulated materials contain either fiber or particulate material, please describe the possible destruction mechanisms if they are exposed to a high energy jet from a postulated pipe break. Please discuss the destruction pressures of these materials.*

GE Response:

Design Control Document (DCD) Tier 2, Section 6.1, will be revised by stating that only metallic insulation is used inside containment.

DCD Impact:

Revision 3 to DCD Tier 2, Section 6.1, will be revised as noted in the attached markup.

6.1 ENGINEERED SAFETY FEATURE MATERIALS

Materials used in the engineered safety features (ESF) components have been evaluated to ensure that material interactions do not occur that can potentially impair operation of the ESF. Materials have been selected to withstand the environmental conditions encountered during normal operation and postulated accidents. Their compatibility with core and containment spray water has been considered, and the effects of radiolytic decomposition products have also been evaluated.

Coatings used on exterior surfaces within the primary containment are suitable for the environmental conditions expected. ~~Primarily~~**Only** metallic ~~and metal-encapsulated~~ insulation ~~are~~**is** used inside **the** containment~~, except antisweat insulation used on cooling water lines~~. All nonmetallic thermal insulation employed **outside the containment** is required to have the proper ratio of leachable sodium plus silicate ions to leachable chloride plus fluoride (Regulatory Guide 1.36), in order to minimize the possible contribution to stress corrosion cracking of austenitic stainless steel.

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.

GE 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 (GDCS) 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
GDCS 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 6.3-61:

Provide additional information on power coastdown (i.e. power from delayed neutrons contributing to fission power after the reactor scram) is accounted for with your decay heat curve in your TRACG input deck.

GE Response:

GE technical design procedure (GE procedure) has been followed in the ESBWR decay heat evaluations. Decay heat parameters in ANSI/ANS 5.1-1979 and ANSI/ANS 5.1-1994 are both available for the GE procedure. For ESBWR licensing, the ANSI/ANS 5.1-1994 standard was selected for the decay heat analysis.

The GE procedure provides more complete decay heat assessment than the ANSI/ANS 5.1 standards in the sense that it considers the decay heat sources from fission products, actinides, and activation products, as well as fission power from delayed neutrons and decay heat associated with neutron capture effects. Fission power from delayed neutron is an important source of heat for the first minute or so after shutdown, therefore it is sensitive to the manner at which the reactor is shutdown. The fraction of delayed neutron induced fission power assumed in the GE procedure was generated with a calculation model which coupled neutron physics and thermal hydraulic analysis consistent with a large break loss-of-coolant accident (LOCA) in BWR/6.

The ESBWR decay heat curve was generated based on the PANACEA file of an ESBWR equilibrium core, computed off-line following the GE procedure. The contribution from delayed neutrons has been included.

DCD Impact:

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