GE Energy

David H. Hinds
Manager, ESBWR

PO Box 780 M/C L60
Wilmington, NC 28402-0780
USA

T 910 675 6363
F 910 362 6363
david.hinds@ge.com

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application - Containment Design - RAI Numbers 6.2-14, 6.2-16, 6.2-17, 6.2-31, 6.2-34, and 6.2-40**

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

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

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Enclosure:

1. MFN 06-188 - Response to Portion of NRC Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application - Containment Design - RAI Numbers 6.2-14, 6.2-16, 6.2-17, 6.2-31, 6.2-34, and 6.2-40

Reference:

1. MFN 06-113, Letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application,* April 24, 2006

cc: WD Beckner USNRC (w/o enclosures)
AE Cubbage USNRC (with enclosures)
LA Dudes USNRC (w/o enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRF 0000-0053-8340

ENCLOSURE 1

MFN 06-188

Response to Portion of NRC Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application Containment Design RAI Numbers 6.2-14, 6.2-16, 6.2-17, 6.2-31, 6.2-34, and 6.2-40

NRC RAI 6.2-14

Describe the extent to which pipe restraints are used to limit the break area of the pipe ruptures. Provide this information as part of DCD Tier 2, Section 6.2.1.2.1, "Design Bases." This information is necessary to evaluate ESBWR subcomparment loads per SRP 6.2.1.2 and RG 1.70, Section 6.2.1.2.

GE Response

As per note in page 7 of the enclosure to letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application,* April 24, 2006, this RAI is related to reactor shield annulus subcompartment only. For pipe break cases in this subcompartment, no credit was taken in the analysis to limit the break area due to presence of pipe restraints.

NRC RAI 6.2-16

Provide plan and elevation drawings showing (i) component and equipment locations, (ii) the routing of high energy lines and the (iii) vent (include doors, blowout panels, etc. as appropriate) locations and configurations for each subcompartment analyzed. The subcompartment volumes and vent paths should be tabularized. For example, see Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition) Rev. 3 (ADAMS ML011340072, ML011340108, and ML011340116), Section 6.2.1.2. Provide this information in DCD Tier 2, Section 6.2.1.2.2, "Design Features." This information is necessary to evaluate ESBWR subcompartment loads per SRP 6.2.1.2 and RG 1.70, Section 6.2.1.2.

GE Response

As per note in page 7 of the enclosure to letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application,* April 24, 2006, this RAI is related to reactor shield annulus subcompartment only. There is no equipment within this subcompartment and the pipe runs through this subcompartment are straight horizontal runs. There are no blowout panels. Response to RAI 6.2-23 provides the information on dimensional data for this subcompartment.

NRC RAI 6.2-17

For vent areas which become available only after the occurrence of a pipe break (for example blowout panels, or as a result of insulation collapsing or being blown out), identify the manner in which these are treated, and justify the vent areas used in the analyses. Provide the dynamic analyses of the available vent area as a function of time (pressure) and the supporting test data. Provide this information in DCD Tier 2, Section 6.2.1.2.2, "Design Features." This information is necessary to evaluate ESBWR subcomparment loads per SRP 6.2.1.2 and RG 1.70, Section 6.2.1.2.

GE Response

As per note in page 7 of the enclosure to letter from U. S. Nuclear Regulatory Commission to Mr. David H. Hinds, *Request for Additional Information Letter No. 18 Related to ESBWR Design Certification Application,* April 24, 2006, this RAI is related to reactor shield annulus subcompartment only. The reactor shield annulus subcompartment vent areas in ESBWR containment are always open. There are no insulation collapsing issues or blowout panels in this subcompartment.

NRC RAI 6.2-31

In addition to the "major components" identified in DCD Tier 2, Section 6.2.3.2, are there other subcompartments in the reactor building (RB) that have been considered for high energy line break evaluations? Are breaks in the RWCU system the only high energy lines in the RB? Are the breaks shown in DCD Tier 2, Table 6.2-11 the only breaks which could lead to subcompartment pressurization and dP across structures?

GE Response

The High Energy systems in RB outside containment are:

- Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) System.
- Nuclear Boiler System (Lines in Main Steam Tunnel)
- Control Rod Drive (from CRD pumps to HCU and to FW lines and from HCU to containment penetrations.
- Standby Liquid Control System Lines.
- Isolation Condenser System (ICS)

Only breaks in the RWCU/SDC system have been considered. It is postulated that breaks occur only at terminal points. It is assumed that SRP 3.6.2 stress level requirements shall be met to avoid postulated breaks at intermediate locations.

As indicated in DCD Tier 2 Section 6.2.3.2, break in ICS is excluded from the RB pressurization analysis (outside containment) as well as Main Steam Line break in Steam Tunnel.

Breaks in CRD and Standby Control System are not considered for pressurization purposes since they are cold water systems.

Therefore Table 6.2-11 as modified below provides the breaks that could lead to RB subcompartment pressurization and create a differential pressure across the subcompartment structures.

Table 6.2-11

RWCU/SDC Break Locations

Break Case	Description
1	Break in RWCU/SDC Non-Regenerative Heat Exchanger (NRHX) Room
2	Break in NRHX Valve Room
3	Break in Regenerative Heat Exchanger Room
4	Break in RWCU/SDC Pump Rooms
5	Break in RWCU/SDC Filter/Demineralizer Room

NRC RAI 6.2-34

Provide a description of the high energy lines within each subcompartment and a justification for the selection of the design bases accident (break size and location) for each subcompartment. Provide this information in DCD Tier 2, Section 6.2.3.2, "Design Description." This information is necessary to evaluate ESBWR subcompartment loads per SRP 6.2.1.2 and RG 1.70, Section 6.2.1.2.

GE Response

HELB accidents are postulated due to piping failures in the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) System, and for location/size of breaks which result in maximum pressure values. The procedure is as follows: (1) Identification of high energy lines outside the containment: RWCU/SDC system, and (2) location of rooms where breaks could occur (it is postulated that breaks only occur at terminal points). See response to RAI 6.2-31

The list of selected break cases evaluated are listed in Table 6.2-11 as modified in response to RAI 6.2-31.

NRC RAI 6.2-40

Provide the piping system within a subcompartment that is assumed to rupture, the location of the break within the subcompartment, and the break size. Give the inside diameter of the rupture of line and the location and size of any flow restrictions within the line postulated to fail. Provide this information as part of DCD Tier 2, Section 6.2.1.2.3, "Design Evaluation." This information is necessary to evaluate ESBWR subcompartment loads per SRP 6.2.1.2 and RG 1.70, Section 6.2.1.2.

GE Response

Break location, size, and pipe inside diameter for Short-Term Pressurization Response for postulated high energy line break (HELB) accidents outside the containment are as follows:

- Break Case 1: Break in RWCU Non-Regenerative Heat Exchanger Room, nominal diameter 300 mm, inside diameter = 288.9 mm (carbon steel)
- Break Case 2: Break in NRHX Valve Room Break, nominal diameter 150 mm, inside diameter = 146.3 mm (carbon steel)
- Break Case 3: Break in Regenerative Heat Exchanger Room, nominal diameter 150 mm, inside diameter = 146.3 mm (carbon steel)
- Break Case 4: Break in RWCU in Pump Room for smaller pump, nominal diameter 200 mm, Inside diameter = 193.7 mm (stainless steel)
- Break Case 5: Break in RWCU in Filter/Demineralizer room, nominal diameter 300 mm, inside diameter = 298.5 mm (stainless steel)

The flow restrictions in the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) System piping for which a break inside the reactor building during reactor full power operation is analyzed consists of venturi type flow elements at the following locations:

- Inside containment in the 300 mm diameter piping originating from the RWCU/SDC system mid-vessel nozzle
- Inside containment in the 150 mm piping connected to the piping originating from the bottom of the reactor vessel.
- Outside containment in the 300 mm return piping to the feedwater lines that are upstream of the motor-operated isolation valve.