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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 90 - Emergency Core Cooling Systems - RAI Numbers 6.3-76 and 6.3-77**

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

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. MFN 07-084, Letter from U.S. Nuclear Regulatory Commission to David Hines, *Request for Additional Information Letter No. 90 Related to ESBWR Design Certification Application*, January 29, 2007

Enclosure:

1. MFN 07-346 - Response to Portion of NRC Request for Additional Information Letter No. 90 - Related to ESBWR Design Certification Application - Emergency Core Cooling Systems - RAI Numbers 6.3-76 and 6.3-77

cc:	AE Cubbage	USNRC (with enclosures)
	BE Brown	GHNEA/Wilmington (with enclosures)
	GB Stramback	GHNEA/San Jose (with enclosures)
	eDRF	0000-0065-5480

Enclosure 1

MFN 07-346

Response to Portion of NRC Request for

Additional Information Letter No. 90

Related to ESBWR Design Certification Application

Emergency Core Cooling Systems

RAI Numbers 6.3-76 and 6.3-77

NRC RAI 6.3-76:

In the DCD Revision 2, Table 6.3-5 the minimum chimney static head for the steam line break inside containment for the cases run with bounding values are higher than those run using the nominal values. Please explain.

GHNEA Response:

During the loss-of-coolant accident (LOCA) transient, the chimney partitions and the downcomer interact with each other through the lower plenum. The minimum chimney static head for a chimney partition depends on the downcomer collapsed level as well as the interaction with the other chimney partitions. For the purpose of discussions, the following comparisons and discussions are based on the main steam line break (MSLB) with failure of one Gravity Driven Cooling System (GDCS) injection valve, for cases with nominal and bounding values.

The static head in the downcomer (as indicated by the downcomer collapsed level) supports the two-phase fluid (as indicated by the chimney static head levels) inside the core shroud. The TRACG analyses use five separate components to simulate the level responses in the chimney regions. For each LOCA case, the minimum chimney static head level during the transient among these five components is reported in DCD Tier 2, Revision 3, Table 6.3-5. During the GDCS injection period, the subcooled GDCS water replenishes the downcomer. The downcomer (the driving channel) interacts with five chimney components inside the shroud (the five receiving channels in parallel) and refills these components with the incoming subcooled water.

Figure 6.3-76-1 compares the downcomer collapsed levels for the nominal and bounding cases. Throughout the transient, the downcomer collapsed level for the bounding case is lower than that for the nominal case. The level rebounds shortly after the initiation of GDCS flow. The downcomer collapsed level rises back to 10 m elevation at about 900 seconds for the nominal case, and at about 1050 seconds for the bounding case. After this time, the downcomer as well as the lower plenum regions are filled with subcooled water from the GDCS pools. The downcomer collapsed levels continue to rise for the remainder of the transient.

Figure 6.3-76-2 compares the downcomer collapsed level with the chimney static head level (from TRACG component TEE0722) for the nominal case. The downcomer collapsed level reaches the minimum at 650 seconds. The downcomer level rebounds after the initiation of GDCS flow and reaches 10 m elevation at 900 seconds. After this time, the downcomer collapsed level and the chimney static head level are in equilibrium state (more or less), and both levels rise as the result of GDCS flow. During the process of refilling the chimneys, the chimney static head level fluctuates around the downcomer collapsed level. These fluctuations are the result of: (a) interaction between the core void and the incoming subcooled water from the lower plenum, and (b) parallel channel flows among the five chimney components. The fluctuations subside when the core void is dissipated after 1600 seconds. For this case, the minimum chimney static head level is 9.15 m and occurs at 1050 seconds, during the period of level fluctuations.

Figure 6.3-76-3 compares the downcomer collapsed level with the chimney static head level (from TRACG component TEE0712) for the bounding case. The level interaction between the downcomer and the chimney starts at 1050 seconds. Compared to the nominal case the starting time is 150 seconds later. Therefore both the decay heat and core void are lower for the bounding case at the start time of the level fluctuations. For the bounding case, the minimum chimney static head level occurs at 818 seconds, around the same timing as the minimum downcomer collapsed level. The minimum chimney static head level is 9.37 m and occurs prior to the period of level fluctuations.

In summary, different analysis conditions (nominal versus bounding) generate similar response for the downcomer collapsed level, but with timing and scale shifted. This causes some differences in the timing and magnitude for the interaction between the downcomer and the chimney levels (parallel channel flows interactions). For the cases discussed above, the minimum chimney static head occurs at different times, before the period of level fluctuations for the bounding case and during the level fluctuations for the nominal case.

It should be noted that: (a) at the start of the level fluctuations, the global reactor pressure vessel (RPV) water level is more than 2 m above the top of active fuel; and (b) the global RPV water level rises after that time for the remainder of the transient.

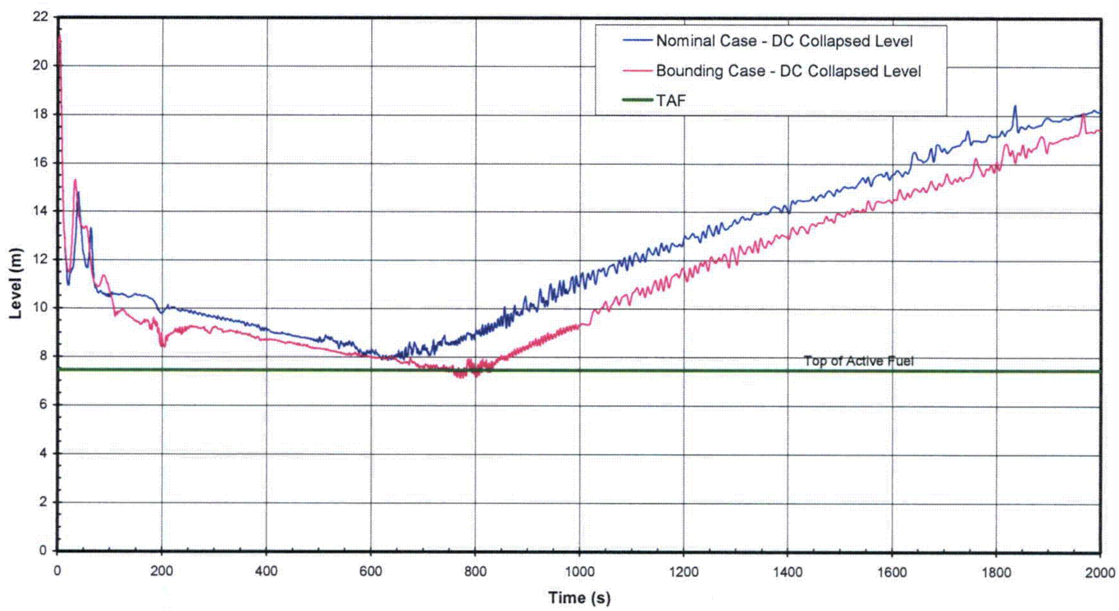

Figure 6.3-76-1. Comparison of Downcomer (DC) Collapsed Level Nominal vs. Bounding Cases (Main Steam Line Break, 1 GDCS Valve Failure)

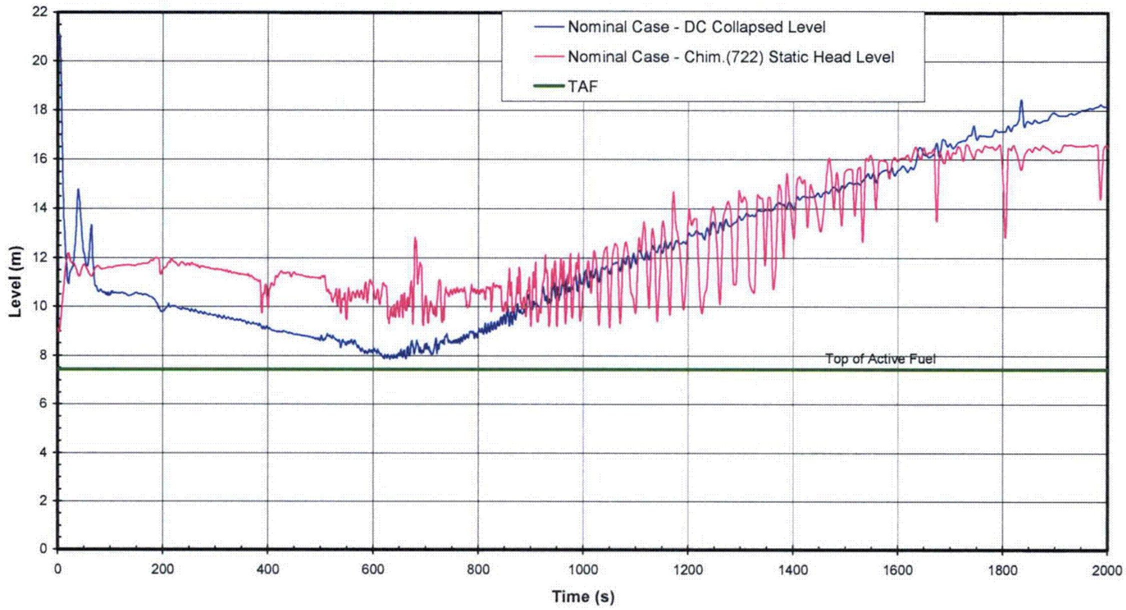

Figure 6.3-76-2. Comparison of DC Collapsed Level versus Chimney Static Head Level Nominal Case (Main Steam Line Break, 1 GDCS Valve Failure)

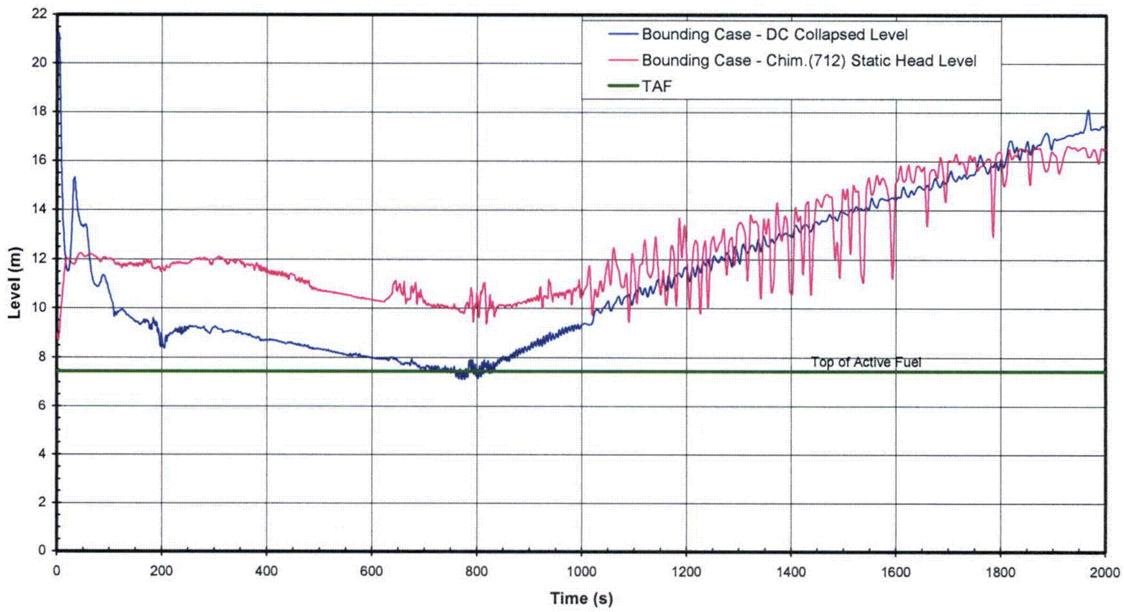

Figure 6.3-76-3. Comparison of DC Collapsed Level versus Chimney Static Head Level Bounding Case (Main Steam Line Break, 1 GDCS Valve Failure)

DCD Impact:

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

NRC RAI 6.3-77:

In the DCD Revision 2 Table 6.3-5, the label of "Minimum Chimney Static Head Level Above Vessel Zero Per Active Single Failure m (ft)" is misleading since you are only adding the static head in the chimney to the elevation of the bottom of the chimney. Demonstrate that the static head from vessel zero is not different from the values in this table, or revise this label in the next revision of the DCD to more accurately represent what you are calculating.

GHNEA Response:

The label in DCD Tier 2, Revision 3, Table 6.3-5 will be revised to state: "Minimum Chimney Static Head Level* with Reference to Vessel Zero Per Active Single Failure."

The footnote * will be revised as follow:

"* Chimney static head level with reference to vessel zero is calculated by adding the equivalent height of water corresponding to the static head of the two-phase mixture inside the chimney to the elevation (7.896 m) of bottom of chimney."

DCD Impact:

DCD Tier 2, Revision 3, Table 6.3-5, will be revised as stated in the above discussion.