Enclosure 1

MFN 09-044

Response to Portion of NRC Request for Additional Information Letter No. 271 Related to ESBWR Design Certification Application

Containment Systems

RAI Number 6.2-201

NRC RAI 6.2-201:

The staff reviewed GEH's response to RAI 6.2-23 S02 in GEH letter MFN 08-270 and conducted an independent ESBWR shield wall annulus pressurization analysis. The staff developed the shield wall annulus model for the TRACE computer code. The staff performed analyses for double ended pipe breaks in the FW and RWCU lines. The staff used TRACE to calculate transient break mass and energy releases and the shield wall annulus pressurization. Based on its review of GEH's response to RAI 6.2-23 S02 and TRACE analyses, the staff makes the following requests which need to be addressed for the staff to complete its review:

A. *Confirm that the TRACG analysis assumed that the reactor vessel insulation is undeformed and remains in place. If not, provide specific analyses considering and justifying the transient movement of the insulation, and showing that the impact on the final figures of merit, such as shield wall annular pressure, is negligible.*

B. *Provide results of long-term pressure and moments on the shield wall and reactor pressure vessel. If not, justify that the impact on the final figures of merit is negligible.*

C. *Provide the results of the differential pressure on the shield wall (i.e., the pressure in the break shield wall volume minus the pressure in the vent volume outside the shield wall).*

D. *Revise the TRACG model to include volumes modeling the drywell and the vent wall annular volume surrounding the shield wall. If not, justify that the impact on the final figures of merit is negligible.*

E. *The three-dimensional VESSEL model for codes like TRACG and TRACE solve conservation equations which assume that control volumes are bounded by solid surfaces or flow restrictions.*

   Describe how the TRACG shield wall annulus model addresses these limitations and justify the assumed shield wall annulus nodalization. Reference and discuss any experimental validation which substantiates the use and noding of the VESSEL model for the shield wall pressurization analyses. Provide any other experimental or sensitivity analyses which were used in developing the assumed nodalization.

GEH Response:

A. The reactor vessel insulation is not modeled in the current annulus pressurization analysis. Results of a sensitivity study and discussions concerning impacts are included in the response to RAI 6.2-23 S01, Item 4, under Part D (MFN 06-159 Supplement 1, dated September 12, 2007). The impact on the final figures of merit is negligible.

B. Results of the pressure history show that the calculated pressure is approaching steady-state at the end of the transient, and can be considered as long-term pressure. The impact on the final figures of merit is negligible. Moments are not within the scope of the annulus pressurization analysis.

C. The results of the differential pressure on the shield wall will not be provided, but can be determined from the results provided. In the computer analysis, the vent volume outside the shield wall is assumed at atmospheric pressure during the transient. The differential pressure on the shield wall is the difference between the calculated annulus pressure and atmospheric pressure. The calculated pressure in tabular and graphical forms are included in the response to RAI 6.2-23 S03, Part B (MFN 08-681, dated September 10, 2008).

D. The upper drywell is considered in the current annulus pressurization analysis. However, the vent wall annular volume surrounding the shield wall is not credited in the annulus pressurization analysis. This assumption is conservative with respect to the calculated pressure by not crediting the vent wall annular volume in the pressurization analysis. The upper drywell volume is approximate 84% of the total volume of the upper drywell volume and the vent wall annular volume. The calculated pressure at the upper drywell is expected to be lower if the vent wall annular volume is considered. However, the impact on the peak pressure is negligible because the vent wall annular region is located further downstream from the peak pressure location and the peak pressure occurs very early in the transient. There is no sensitivity study on the impact due to no credit of the vent wall annular volume because the analysis and results are in the conservative direction.

E. In TRACG, the VESSEL control volume may be limited by a solid surface, a flow restriction, or connection via an open face to neighboring control volume(s). The model nodalization information is included in the response to RAI 6.2-23 (MFN 06-159, dated June 5, 2006). There is no specific experimental validation that substantiates the use and nodalization of the VESSEL model for the shield wall pressurization analyses. However, TRACG has been extensively qualified against break flow tests with different scale and conditions. The validation information on the TRACG model for containment analysis is included in the response to the RAI 6.2-29 S01 (MFN 06-159 Supplement 2, dated October 24, 2007). The comparison of the TRACG subcompartment pressurization analysis with approved code calculation result is included in the response to the RAI 6.2-29 S03 (MFN 08-719, dated October 17, 2008).

DCD Impact:

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