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MFN 07-641

Docket No. 52-010

December 5, 2007

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter Nos. 25 and 69 Related to ESBWR Design Certification Application – Safety Analyses – RAI Numbers 15.2-2S01 and 15.3-11S01**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letters dated May 9 and October 11, 2006. GEH responses to RAI Numbers 15.2-2S01 and 15.3-11S01 are addressed in Enclosure 1.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 06-142, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, GEH, *Request For Additional Information Letter No. 25 Related To ESBWR Design Certification Application*, dated May 9, 2006.
2. MFN 06-381, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, GEH, *Request For Additional Information Letter No. 69 Related To ESBWR Design Certification Application*, dated October 11, 2006.
3. MFN 06-173, Letter from David H. Hinds to U.S. Nuclear Regulatory Commission, *Partial Response to NRC Request for Additional Information Letter No. 25 Related to ESBWR Design Certification Application - Accident Analyses - RAI Numbers 15.0-3 through 15.0-15; 15.2-1, 15.2-2, and 15.2-4*, dated June 16, 2006.
4. MFN 07-038, Letter from David H. Hinds to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 69 - Safety Analysis - RAI Numbers 15.3-6 through 15.3-7, 15.3-9 through 15.3-12, 15.3-15, 15.3-17 and 15.3-18,* dated January 30, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter Nos. 25 and 69 Related to ESBWR Design Certification Application - Safety Analyses – RAI Numbers 15.2-2S01 and 15.3-11S01

cc: AE Cubbage USNRC (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
eDRF 0000-0076-6972

Enclosure 1

MFN 07-641

Response to Portion of NRC Request for Additional Information Letter Nos. 25 and 69 Related to ESBWR Design Certification Application

Safety Analyses

RAI Numbers 15.2-2 S01 and 15.3-11 S01

NRC RAI 15.2-2 S01:

NRC Staff Supplemental Request for Information on GE's Partial Response to ESBWR RAI 15.2-2 (MFN 06-173 dated June 16, 2006)

1. DCD Figures 15.2-4(a) and 15.2-7(a) show high narrow power peak of less than a second duration. Energy deposition has not been calculated to assure of acceptable fuel cladding interaction. Please explain why you did not consider fuel energy deposition.

2. GE's response to this RAI stated that this event scenario will be studied in more detail and revisions will be made to the DCD as appropriate. Please provide a supplemental response to document the completion of this study and inform the staff if any changes result.

GEH Response:

Part 1:

The high narrow power response observed in DCD Tier 2, Revision 4, Figures 15.2-4a and 15.2-7a is similar to the response observed in other transients in DCD Tier 2, Revision 4, Sections 15.2 and 15.3. RAI 15.3-11 S01 asks a similar question about DCD Tier 2 Figures 15.3-4a and 15.3-5a. A review of DCD Tier 2, Revision 4, Tables 15.2-5 and 15.3-1, and observation of the related event figures concludes that the flux peak in Figure 15.3-5a (Generator Load Rejection with Total Turbine Bypass Failure) represents the most severe response. The Normalized Nodal Power Density Response curve provided in response to RAI 15.3-11 S01 demonstrates that the ESBWR fast limiting transient response is well within that analyzed to be acceptable for GE14 and GE14E fuel with respect to Anticipated Operational Occurrence acceptance criteria for fuel cladding strain and fuel melting listed in DCD Tier 2, Revision 4, Table 15.0-3.

Part 2:

The possibility that all MSIVs could close after a closure of one MSIV is stated and analyzed in the following DCD Tier 2, Revision 4 Subsections:

DCD Subsection 15.2.2.6.1 states:

> *"An inadvertent closure of one MSIV may cause an immediate closure of all other MSIVs, depending on reactor conditions. Closure of all MSIVs is discussed in Subsection 15.2.2.7."*

DCD Subsection 15.2.2.7.1 states:

> *"A closure of one MSIV may cause an immediate closure of all other MSIVs, depending on reactor conditions. If this occurs, it is also included in this category. During the MSIV closure, position switches on the valves provide a reactor scram*

if the valves in two or more main steamlines are less than that shown in Table 15.2-1..."

DCD Impact:

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

NRC RAI 15.3-11 S01:

NRC Staff Supplemental Request for Information on GE's Partial Response to ESBWR RAI 15.3-11 Letter 69 (MFN 07-038 dated January 30, 2007)

1. DCD Figure 15.3-4a indicates a sharp rise in total power (although the corresponding simulated power peak is not as pronounced) very much like control rod drop event. Please calculate the total power deposition and the corresponding cladding strain along with the pellet clad mechanical interaction for cladding strain.

2. Generator load Rejection with Total Turbine Bypass Failure event results in a very short burst of energy. Please calculate the fuel energy deposition and the pellet cladding mechanical interaction for this transient.

GEH Response:

The Generator Load Rejection with Total Turbine Bypass Failure, also known as the Load Rejection No Bypass (LRNBP) event clearly has the most severe response of the two transients discussed in the RAI. In fact (as shown in DCD Tier 2, Revision 4, Tables 15.2-5 and 15.3-1), this event bounds all ESBWR fast core-wide Anticipated Operational Occurrences and Infrequent Events. As noted in Reference 15.3-11-1, the heat flux remains very low with respect to the acceptance criteria for GE14 fuel. For fast transients, like LRNBP (Infrequent Event category for ESBWR), the heat flux is not as effective in determining the margin to centerline melt and cladding circumferential strain (because of the thermal inertia of the rod). Current methodology accepts that if the nodal power evolution of any node in the core during a transient is bounded by the generic Normalized Nodal Power Density (NNPD) used to define the fast transient limits, then the thermal-mechanical Limits are not threatened.

The NNPD for the LRNBP has been extracted and penalized with a 1.5 factor, as documented in Reference 15.3-11-2, and compared with the generic GE14 NNPD curve (see Figure 15.3-11-1). This factor is a significant conservatism and is considered applicable and bounding for the ESBWR. As discussed in Reference 15.3-11-1 the GE14 and GE14E fuels are very similar, and the generic GE14 NNPD curve for fast transients can be applied to GE14E fuel.

Significant margin exists to the generic NNPD, therefore, the ESBWR is expected to have significant margins for cladding strain and fuel melt criteria as listed in DCD Tier 2, Revision 4, Table 15.0-3. To clarify the DCD with respect to the thermal-mechanical evaluation, DCD Tier 2 changes are listed below.

The acceptance criteria for Infrequent Events are based on radiological consequences, not fuel thermal-mechanical performance (see DCD Tier 2, Revision 4, Table 15.0-5). By demonstrating conformance to the cladding strain and fuel melt thermal-mechanical criteria for AOOs, no fuel failures due to thermal-mechanical concerns need be

considered. These results also demonstrate that no Maximum Linear Heat Generation Rate (MLHGR) limits need to be adjusted for the AOO fast transients, which have NNPD responses significantly more mild than the LRNBP Infrequent Event.

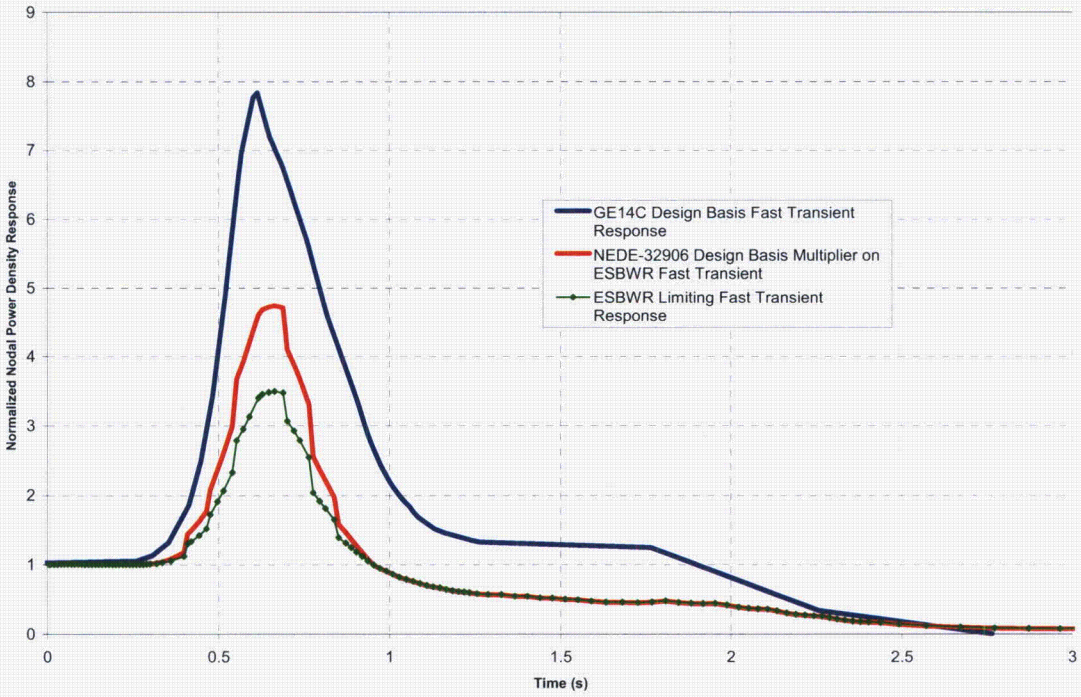

Figure 15.3-11-1. Normalized Nodal Power Density Response

DCD Impact:

DCD Tier 2 will be updated in Revision 5 with the following paragraph added to the end of Subsection 15.2.6:

"For the core loading in Reference 15.2-2, no adjustment to the Maximum Linear Heat Generation Rate (MLHGR) limits is needed to ensure compliance with the fuel thermal-mechanical acceptance criteria (cladding strain and fuel melt). The slow events, (fuel temperature follows fuel power in a quasi steady state condition) from the set of potentially limiting events, are evaluated for each fuel cycle using methodology consistent with Subsection 4.2.3.8 and Reference 15.2-1. Any required adjustment to the MLHGR limits is documented in the COLR in accordance with Technical Specification. For fast events, sufficient margin to fuel thermal-mechanical acceptance criteria exist. No fuel cycle specific evaluation is required."

Reference 15.2-1 is to be updated as follows in DCD Revision 5:

15.2-1 GE Nuclear Energy, "TRACG Application for Anticipated Operational Occurrences Transient Analysis" NEDE-32906P-A, Revision 3, September 2006.

The following sentence is to be added to the end of DCD Tier 2, Revision 5, Subsections 15.3.4.4, 15.3.5.4 and 15.3.6.4:

The fuel thermal-mechanical response shows margin to the AOO cladding strain and fuel melt criteria; therefore, no thermal-mechanical related fuel failures are expected.

References:

15.3-11-1. ESBWR Design Control Document Tier 2 Chapter 15, 26A6642BP Revision 4, "Safety Analysis," Tables 15.2-5 and 15.3-1, September 2007.

15.3-11-2. ESBWR Design Control Document Tier 2 Chapter 15, 26A6642BP Revision 4, "Safety Analysis," Table 15.3-13, September 2007.