



HITACHI

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MFN 12-045

Docket number: 05200010

June 26, 2012

Attn: David Misenhimer
US Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: NRC Requests for Additional Information Related to the Audit of the Economic Simplified Boiling Water Reactor (ESBWR) Steam Dryer Design Methodology Supporting Chapter 3 of the ESBWR Design Control Document – Draft Response RAI 3.9-271

Reference:

1. MFN 12-037 Letter from USNRC to Jerald G. Head, GEH, Subject: Request for Additional Information Letter No. 414 related to ESBWR Design Certification Application (DCD) Revision 9" received May 1, 2012

In regard to the Requests for Additional Information transmitted in your May 1, 2012 Letter, Reference 1, to support the NRC ESBWR Steam Dryer Methodology Audit conducted March 21 – 23, 2012 Docket 5200010, please find attached the draft response for RAI 3.9-271.

Enclosure 1 contains the draft response and is acceptable for public release.

If you have any questions concerning this letter, please contact Peter Yandow at 910-819-6378.

Sincerely,

A handwritten signature in black ink, appearing to read "Jerald Head". The signature is fluid and cursive, with the first name "Jerald" and last name "Head" clearly distinguishable.

Jerald G. Head
Senior Vice President, Regulatory Affairs

Commitments: No commitments are made.

Enclosure:

1. Draft Response to RAI 3.9-271

cc: Glen Watford, GEH
Peter Yandow, GEH
Patricia Campbell, GEH
Mark Colby, GEH
Scott Bowman, GEH
Draft eDRF 0000-0146-9752

Enclosure 1

MFN 12-045

Draft Response for RAI 3.9-271

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DRAFT RESPONSE FOR REVIEW

NRC RAI 3.9-271

GEH is requested to confirm that the PBLE method 1 and 2 benchmarks are performed using the same version of PBLE that will be used for the ESBWR certified design. In the event an updated version of PBLE will be used for future ESBWR calculations, GEH is requested to provide a procedure for computing the updated version bias and uncertainties. Additionally, GEH is requested to describe the process for quality control of the PBLE program. In consideration of the significance of the PBLE program in providing confidence in the structural integrity of the ESBWR steam dryer, GEH is requested to address the need to describe the PBLE program in ESBWR DCD, Tier 2, Appendix 3D, "Computer Programs Used in the Design of Components, Equipment, and Structures."

GEH Response

Responses to each element of the NRC request are provided below.

Item 1 – PBLE Versions

GEH is requested to confirm that the PBLE method 1 and 2 benchmarks are performed using the same version of PBLE that will be used for the ESBWR certified design.

Response:

The Plant Based Load Evaluation (PBLE) method is described in References 1 and 3, which will be used for the ESBWR certified design, as well as applied to the method 1 and 2 benchmarks.

DRAFT RESPONSE – FOR REVIEW ONLY

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Item 2 – Potential Updates

In the event an updated version of PBLE will be used for future ESBWR calculations, GEH is requested to provide a procedure for computing the updated version bias and uncertainties.

Response:

There are two types of changes that could occur with any computational method: (1) a change to the algorithm that has no impact on results¹, e.g., adding new variables to an output file to enable plotting, or (2) a change to the algorithm that changes the results, such as the addition of a new encoded mathematical model or a new correlation used to represent a physical phenomenon. New or changed models (i.e., a “type 2” change as defined here, which would not be described in References 1 or 3) could impact previously reviewed bias and uncertainty values, and place the modified PBLE outside of the NRC reviewed ESBWR standard design, which would have to be addressed through the appropriate regulatory change process (e.g., license amendment, Section VIII of design certification rule, or addressed in a COL application). “Type 1” changes, by definition, would not impact calculated bias and uncertainty values, and would be accomplished in compliance with standard quality procedures (see item #3).

In the event that a method change results in a need to update biases and uncertainties, the values would be produced consistent with the results presented in Reference 3, which would include narrow band values. Changes to regulatory documents would be made (as necessary) according to appropriate change control processes.

¹ Other changes in this category include platform (e.g., a new MatLab version) or computer operating system upgrades. These changes typically produce slight changes in results (e.g., “round off” in trailing digits). However, this is a very small impact and any variation in calculated results is insignificant.

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Item 3 – Quality Control

Additionally, GEH is requested to describe the process for quality control of the PBLE program.

Response:

The GEH design control procedures reflect ASME NQA-1 requirements [1]. In general, the results of computer programs used for design analysis are verified with each use or pre-verified to show the following:

- The computer program produces correct solutions for the encoded mathematical model within defined limits for each parameter employed.
- The encoded mathematical model produces a valid solution to the physical problem associated with the particular application.

Pre-verified computer programs are controlled to ensure that changes are documented and approved by authorized personnel. When pre-verified computer programs are used, the encoded mathematical model does not need to be verified.

Pre-verified computer programs that comply with GEH procedures are well documented, extensively tested, and maintained under a configuration management system. Currently, PBLE is stored as a permanent design record. While this is an effective means of maintaining a version for archival/retrieval, it does not meet the standards for control applied to pre-verified programs. Therefore, each application of PBLE must be extensively verified to ensure compliance with design control requirements. From a practical standpoint, prior work may be leveraged, so that verification activities will typically include checks for changes and a demonstration that prior results can be reproduced.

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Item #4 – ESBWR Computer Program List

In consideration of the significance of the PBLE program in providing confidence in the structural integrity of the ESBWR steam dryer, GEH is requested to address the need to describe the PBLE program in ES BWR DCD, Tier 2, Appendix 3D, "Computer Programs Used in the Design of Components, Equipment, and Structures."

Response:

NRC RAI 3.9-100 previously requested essentially the same information: *Provide a listing and description of the computer programs and calculational procedures used for the analysis of the reactor pressure vessel and the reactor pressure vessel internals, including the core support structures.* GEH responded to RAI 3.9-100 in MFN 07-225, dated April 18, 2007 (ML071160076).

The computer programs included in Appendix 3D of the DCD are those related to Seismic Category I structures, systems, and components. The content of Appendix 3D is specifically discussed in the NRC FS ER for Chapter 3 in Sections 3.9.1.2.2 and 3.9.1.3.3, and the GEH response to RAI 3.9-100 is specifically addressed in Section 3.9.3.3.2, which explains that the NRC found the response to be acceptable. Additional information below provides the rationale for why the PBLE computer program was not included in Appendix 3D and how that is consistent with NRC regulatory guidance. On this basis, GEH does not consider a change to the DCD is necessary to add PBLE to Appendix 3D.

- According to DCD Section 3.2.1: *Structures, systems and components that perform no safety-related function, but whose structural failure or interaction could degrade the functioning of a Seismic Category I item to an unacceptable level of safety or could result in incapacitating injury to occupants of the main control room, are designated Seismic Category II. These items are designed to structurally withstand the effects of an SSE.*
- As listed in DCD Table 3.2-1 (under item B11 for the reactor pressure vessel system, item 8 – reactor internals non-safety-related components), the steam dryer is Seismic Category II component and, thus, is not within the scope of the guidance for Section 3.9.1 of the DCD. Instead, the steam dryer is subject to NRC regulatory guidance in Sections 3.9.2 and 3.9.5 for reactor internals subject to operational flow transients. NRC regulatory guidance in SRP 3.9.2 refers to RG 1.20 for the review acceptance criteria of the computer programs and modeling approaches for the steam dryer. Thus, the level of detail in the DCD and LTRs is deemed appropriate in this regard.

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While it is recognized that PBLE is important for the Flow Induced Vibration (FIV) analysis of the ESBWR steam dryer, Appendix 3D is limited to descriptions of the computer programs used in the analysis of seismic Category I (safety-related) components, equipment, and structures. The PBLE program is stored as a permanent design record; the methodology description is included in References 2 and 3.

This approach is consistent with NRC regulatory guidance. Specifically, Tier 2 Appendix 3D of the ESBWR DCD is referenced in Section 3.9.1, which is consistent with NRC regulatory guidance in RG 1.206 (see, e.g., C.I.3.9.1) and the Standard Review Plan (SRP) Section 3.9.1, both of which state that this section of the DCD should provide information concerning the design transients and resulting loads and load combinations with appropriate specified design and service limits for seismic Category I components and supports.

References

1. NEDC-33408P-A, NEDO-11209-A, *GE Hitachi Nuclear Energy Quality Assurance Program Description*, Rev. 9, August 2011, Class I.
2. *ESBWR Steam Dryer Plant Based Load Evaluation Methodology*, Revision 1, October 2010, Class III.
3. NEDC-33408 Supplement 1P-A, *ESBWR Steam Dryer Plant Based Load Evaluation Methodology Supplement 1*, Revision 2, October 2010, Class III

DCD/LTR Changes

No change is proposed for the DCD or referenced License Topical Reports.

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