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MFN 09-321

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U.S. Nuclear Regulatory Commission
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Subject: **Partial Response to NRC RAI Letter No. 328 Related to ESBWR Design Certification Application – DCD Tier 2 Section 3.9 – Mechanical Systems and Components; RAI Numbers 3.9-254 and 3.9-255**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) partial response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) letter number 328 sent by NRC letter dated April 16, 2009 (Reference 1). RAI Numbers 3.9-254 and 3.9-255 are addressed in Enclosure 1.

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

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-273 Letter from U.S. Nuclear Regulatory Commission to J. G. Head, GEH, *Request For Additional Information Letter No. 328 Related to ESBWR Design Certification* dated April 16, 2009

Enclosure:

1. Partial Response to NRC RAI Letter No. 328 Related to ESBWR Design Certification Application - DCD Tier 2 Section 3.9 – Mechanical Systems and Components; RAI Numbers 3.9-254 and 3.9-255

cc:	AE Cubbage	USNRC (with enclosures)
	JG Head	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF Section	0000-0101-5568 (RAIs 3.9-254 and 3.9-255)

Enclosure 1

MFN 09-321

Response to Portion of NRC Request for

Additional Information Letter No. 328

Related to ESBWR Design Certification Application

DCD Tier 2 Section 3.9 –

Mechanical Systems and Components

RAI Numbers 3.9-254, 3.9-255

NRC RAI 3.9-254

Additional information about PISYS computer code.

In ESBWR DCD Appendix 3D Section 3D.4.1, PISYS was listed as a computer code for the static and dynamic analyses of the piping systems. The PISYS program was validated against benchmark problems in NUREG/CR-1677 and Documented in Reference 3D-1 (NEDE-24210, "PISYS analysis of NRC Benchmark problems," dated August, 1979). However, Section 3D.4.1.2 noted that the PISYS07 was used for ESBWR piping analysis. PISYS07 was validated against benchmark problems in NUREG/CR-6049. GEH is requested to:

(1) Explain why PISYS is described and listed in Appendix D in lieu of PISYS07 which is actually used for ESBWR piping analysis,

(2) Discuss the differences between PISYS and PISYS07,

(3) Clarify whether PISYS07 program is documented as part of the documentation for PISYS in Reference 3D-1 or elsewhere,

(4) Confirm that PISYS and PISYS07 were both updated to incorporate methods and guides for response spectrum analysis and time history analysis in accordance with Regulatory Guide 1.92, Revision 2, published on July 2006 for ESBWR piping analysis (Ref. Section 3.7.3),

(5) Confirm that results of PISYS07 (similar to PISYS) can be passed on to the ANSI7 runs via EZPYP computer program for performing the fatigue

analysis of piping,

(6) Clarify whether PISYS described in Section 3D.4.1 is the computer program in Reference 3D-1 where a 1979 version of PISYS was documented, and

(7) Confirm whether the validation package for PISYS07 is available for the staff review. The information should include the author, source code, dated version, and facility; the program users manual and theoretical description, the extent and limitation of the program application; and the benchmarking

problems, the QA control and maintenance of the program in accordance with 10CFR50 Appendix B and ASME NQA-1.

GEH Response

(1) Explain why PISYS is described and listed in Appendix D in lieu of PISYS07 which is actually used for ESBWR piping analysis,

PISYS is the GEH pipe stress analysis programs name. The number 07 is the version of the program. Any change or improvement to the program will advance the number to a new version. PISYS07 has been benchmarked by Brookhaven National Library (BNL) for the ABWR certification. The results are documented in NUREG-1503, section 3.12.4.1. This section is excerpted as follows.

> *" To review GE's computer program for ABWR piping modeling, the staff performed an independent confirmatory piping analysis of representative piping system in the ABWR standard plant. The purpose of this analysis was to verify the adequacy of the computer program used by GE to generate the sampling piping analyses that was audited by the staff on March 23 through 26, 1992 at GE 's office in San Jose, California. These were DFSER open items 3.9.1-2, 14.1.3.4.1-1 and 14.1.3.3.4.3-1. The results of confirmatory analysis verify that this computer program is adequate with acceptable accuracy. The staff concludes that the computer program verification process for ABWR is acceptable. Therefore, DFSER Open Items 3.9.1-2, 14.1.3.4.1-1 and 14.1.3.3.4.3-1 are resolved. "*

BNL has also performed a benchmark analysis of PISYS07 using a model of the ESBWR main steam lines 2-3. The benchmark results were presented by BNL in the January 2007 audit meeting in GE, San Jose, California. All the benchmark results issues were resolved during this meeting.

(2) Discuss the differences between PISYS and PISYS07,

GEH Response:

See the response to item (1).

(3) Clarify whether PISYS07 program is documented as part of the documentation for PISYS in Reference 3D-1 or elsewhere,

GEH Response:

PISYS07 has been benchmarked with NUREG/CR-6049 and has met the requirements of RG 1.92 Rev. 2 for double sum of modal results and high frequency missing mass analysis requirements. The benchmarking results are shown in document GE-NE-0000-0070-1785 R0 that has been included in the response to RAI 3.12-11 S01.

(4) Confirm that PISYS and PISYS07 were both updated to incorporate methods and guides for response spectrum analysis and time history analysis in accordance with Regulatory Guide 1.92, Revision 2, published on July 2006 for ESBWR piping analysis (Ref. Section 3.7.3),

GEH Response:

See response to item (3)

(5) Confirm that results of PISYS07 (similar to PISYS) can be passed on to the ANSI7 runs via EZPYP computer program for performing the fatigue analysis of piping,

GEH Response:

Yes, all versions of the PISYS program have the same features.

(6) Clarify whether PISYS described in Section 3D.4.1 is the computer program in Reference 3D-1 where a 1979 version of PISYS was documented, and

GEH Response:

NEDO-24210 August 1979 in 3D.4.1 is the documentation for the first version of the PISYS program. Each version of PISYS program has additional design record file to document the changes, improvements, verification, design review and all documentations according to GENE internal engineering procedures.

(7) Confirm whether the validation package for PISYS07 is available for the staff review. The information should include the author, source code, dated version, and facility; the program users manual and theoretical description, the extent and limitation of the program application; and the benchmarking problems, the QA control and maintenance of the program in accordance with 10CFR50 Appendix B and ASME NQA-1.

GEH Responses:

The PISYS validation package is available.

The NRC staff and the BNL representatives have already reviewed the PISYS07 validation package during the audit meeting in San Jose, California in January 2007. Refer to response (1), The program meets 10CFR50 Appendix B and ASME NQA-1 requirements.

DCD Impact

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

NRC RAI 3.9-255

Fatigue analysis including the environmental effects for piping and components in accordance with NRC Regulatory Guide 1.207 and NUREG/CR-6909.

ESBWR Tier 2 Rev. 5 Appendix 3D, Section 3D.4.2 states that ANSI7 computer program performs the fatigue analysis including the environmental effects for piping and components in accordance with NRC Regulatory Guide 1.207 and NUREG/CR-6909. GEH is requested to provide a summary of description of calculation on how the maximum stress intensity differences between two load sets were determined for the fatigue evaluation and on how the maximum strain rate was calculated for determining the environmental correction factor, Fen, in accordance with RG 1.207.

GEH Response

In determining the environmental correction factor, Fen, in accordance with RG 1.207 for the strain rate effect, the maximum strain rate effect outlined in NUREG/CR-6909 Appendix A is included in the analysis.

The stress intensity differences between two load sets determined for the fatigue evaluation are performed in accordance with NB-3650 Equations 10, 11 and 14. The environmental correction factor, Fen, is calculated for each load set pair.

DCD Impact

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