Summary of Follow-up Audit on documentation of ESBWR Section 3.9.1 Computer Codes PISYS08 & ANSI714 related to RAI-3.9-254 and RAI 3.9-255

On March 19, 2010, the NRC staff performed an on-site review at the GEH office in Washington, DC, of ESBWR Verification and Validation (V&V) package of Computer Codes PISYS & ANSI7 with the intent to resolve RAI-3.9-254 & 255. During this review, the staff identified additional items to be addressed in order to close the RAIs.

The staff reviewed applicant's software design documents, as listed in the Attachment A, to confirm the applicant's design is consistent with the method described in ESBWR design control document (DCD) Appendix 3D for environmental fatigue evaluation and piping stress computer codes.

During review of ANSI714 V&V package, the staff noted that the temperature used in the calculation for Fen is not consistent with NUREG/CR-6909. NUREG/CR-6909 states that an average temperature for the transient may be used to estimate Fen during a load cycle. GEH used the greater temperature of (1) average temperature of the down temperature transient; (2) the beginning temperature of the up temperature transient. The staff asked GEH to justify the difference. GEH staff responded that fatigue consideration is for tension side, the up temperature transient (heatup) caused compression stress. On this basis, GEH does not consider the average temperature of the up temperature transient. The staff noted that the fatigue usage accounts for cyclic loadings of compression and tension. As a result of discussion, GEH is requested to provide either technical justification or revise the computer code to be consistent with NUREG/CR-6909.

During the review of PISYS08 User's Manual (Reference 5 of Appendix A), the staff noted that the user manual was not updated to incorporate the material properties revision. For instance, page 2-23 of the manual shows that the1979 Edition was noted while the test report page 3-1 indicated that the 2004 Edition was used. In addition, GEH stated in the PISYS08 revision notes that PISYS08 has the built-in material properties for thermal expansion and modulus of elasticity based on the 2001 Edition through the 2003 Addenda in lieu of the 1989 Edition for PISYS07. GEH is requested to clarify the differences on the Code Edition and Addenda for PISYS08.

During the review, the staff pointed out that the document such as the PISYS08 user's manual shows the preparer and the approver to be the same person. The staff asked GEH to discuss the quality assurance (QA) status of this program. GEH explained that the PISYS08 and ANSI714 computer codes were reviewed and approved by the design review team and are considered being the Level 2R programs. The documentation of these two programs are completed pending completion of review and approval by the GEH Software Control Component for a level 2 status. GEH is requested to discuss the condition subject to the level 2R program regarding its application to the design of ASME Class 1 piping and components for ESBWR. GEH is also requested to commit to NRC the date to bring PISYS08 and ANSI714 up to the level 2 status.

During the review, the staff also noted that in Section 2.1.2.3 of the PISYS08 Test Report (Reference 4 of Appendix A), the results for pipe support should be the results for the pipe support loads. GEH is requested to revise the test report to address the pipe support loads. Regarding the verification of multiple support time history analysis performed by PISYS08, GEH

is requested to include the validation results for this method in Section 2, Summary and Conclusion of the test report.

Further more in a discussion outside the review of PISYS and ANSI7 documentation, the staff asked GEH regarding the last paragraph in DCD Section 3K.2 for intersystem LOCA resolution. It stated that "The periodic surveillance and leak rate testing requirements for high-pressure to low-pressure isolation valves are not applicable to the ESBWR, because, as shown in this appendix, the ESBWR design does not contain a pressure isolation valve between the RCPB and a low-pressure piping system." The staff reviewed DCD section 3K which identified that the criteria of URS design pressure (0.4 times the normal operating RCPB pressure) and minimum wall thickness of the low-pressure piping should be no less than that of standard weight pipe has been used for ESBWR low-pressure piping side. On this basis, the last paragraph may not be valid. GEH requested to clarify and address this issue.

Summary of Follow-up Audit of design specifications for valves and equipment qualification

On March 19, 2010, the NRC staff conducted a follow-up audit of design specifications for valves and equipment qualification being prepared in support of the ESBWR design certification application at the GEH office in Washington, DC. The purpose of the audit was to review the implementation of the follow-up actions specified by GEH in its letter (MFN 09-604) dated September 21, 2009, in response to the NRC staff audit of design specifications conducted at the GEH office in Wilmington, NC, in July 2009.

During the March 2010 audit, the NRC staff reviewed Revision 2 (dated October 7, 2009) to General Valve Requirements Specification SR3-1-A11-TRD-5302 to confirm that specific changes resulting from the July 2009 audit had been incorporated. For example, the staff determined that SR3-1-A11-TRD-5302 had been revised (1) to ensure that valve suppliers justify the gate and globe valve seat coefficients of friction and butterfly valve bearing coefficients of friction (rather than assuming a generic value); (2) to specify that valve suppliers address the allowable vibration level as related to potential flow-induced vibration; and (3) to clarify the application of degraded voltage criteria for ac and dc motor-operated valves, the measurement of running load for power-operated valves, and the use of sealed gear operators for manual valves. The ESBWR Design Control Document is being revised to reference Revision 3 to Regulatory Guide (RG) 1.100, "Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," for the acceptance of the use of ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." The ESBWR design specifications will be updated to reference this latest revision to RG 1.100 consistent with the DCD provision.

The NRC staff confirmed that Equipment Qualification Specification SR3-1-A11-TRD-4040 (Revision 0, dated November 20, 2009) had been finalized and issued since the July 2009 audit. The specification addresses the environmental qualification of electrical and mechanical equipment to be used in the ESBWR by applying the provisions of the IEEE standards. In its audit review, the staff noted that SR3-1-A11-TRD-4040 indicates that the provisions of IEEE 323-1974, "Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," will be applied for the environmental qualification of mechanical equipment.

The NRC staff reviewed Revision 1 (dated October 20, 2009) to Condition Monitoring Specification SR3-1-A11-TRD-1003 that had been modified in response to staff findings during

the July 2009 audit. The staff found that Revision 1 to SR3-1-A11-TRD-1003 clarified that the condition monitoring program is a non-regulatory program. The specification indicates that the licensee will be responsible for ensuring that the applicable regulatory and quality assurance requirements are met if the condition monitoring program is applied to support regulatory programs.

The NRC staff found that Revision 0 (dated November 6, 2009) to RTNSS Requirements Document A11-5310 for the design of equipment within the Regulatory Treatment of Non-Safety Systems (RTNSS) program had been completed since the July 2009 audit. Further, the NRC staff confirmed that other follow-up items related to valve design specifications listed in the GEH letter dated September 21, 2009, had been completed.

ATTACHMENT A

The following documents were reviewed during an on-site review of PISYS08 and ANSI714 on March 19, 2010.

For PISYS08:

1. Hardware/Software System Specification - PISYS08P, H/SSS # 0000-0113-0450, Rev. 2
2. Software Management Plan - PISYS08P, SMP # 0000-0045-8042, Rev. 2
3. Software Test Plan - PISYS08P, STP # 0000-0115-3755, Rev. 0 .
4. Software Test Report - PISYS08P, STR # 0000-0115-3756, Rev. 0.
5. User Manual - PISYS08P, UM # 0000-0115-3769, Rev. 0

For ANSI714:

6. Hardware/Software System Specification -ANSI714P, H/SSS # 0000-0049-2141, Rev. 0
7. Software Management Plan -ANSI714P, SMP # 0000-0049-2143, Rev. 0
8. Software Test Plan -ANSI714P, STP # 0000-0115-3707, Rev. 0
9. Software Test Report -ANSI714P, STR # 0000-0115-3710, Rev. 0
10. User Manual -ANSI714P, UM # 0000-0115-3711, Rev. 0