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Date: 05/10/2007 5:37:12 PM
Subject: Supplemental RAIs on Sections 3.9.2, 3.9.3, 3.9.5, 3.9.6, and 3.10

John,

We have identified several additional supplemental request for information that we need to resolve. These are from five different sub-sections in Chapter 3. We will appreciate your quick response to resolve many of these open items.

Thanks
Chandu

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Thomas Scarbrough

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Supplemental RAI for ESBWR Sections 3.9.2, 3.9.3, 3.9.5, 3.9.6, and 3.10

1. Comment on response to RAI 3.9-42 (MFN 06-489):

By letter dated November 30, 2006, the applicant stated that the codes and standards that are applicable to equipment identified in Subsection 3.9.2.2.2 are specified in Table 3.2-1, and the applicable ASME Code edition and addenda are shown in Table 1.9-22. The applicant also stated that the testing and/or analysis records for all ASME mechanical equipment that is required to meet Seismic Category I equipment qualification requirements will be available for staff review when the equipment is ready for delivery. The staff found the applicant's commitment to make available the testing and/or analysis records of equipment qualification for staff audit acceptable. However, the applicant should include this commitment in its revised DCD as a COL action item. The staff found the applicant's response on the codes and standards to be inadequate. It should be noted that although some mechanical equipment items are qualified solely by design/analysis, in accordance with industry standards such as ASME Code Section III, there are others which are qualified by tests or a combination of testing and analysis. The applicant is requested to identify all relevant mechanical equipment items for which testing is involved in their qualification. And, for such equipment items, the applicant is requested to identify the qualification standards (such as IEEE 344), with the editions, which are acceptable to the NRC for the equipment seismic and dynamic qualification. In addition, the applicant is also requested to provide a summary description of how the qualification will be performed for each of these equipment items.

2. Comment on response to RAI 3.9-114 (MFN 07-086):

In RAI 3.9-114, the staff requested the applicant to discuss how snubber end fitting clearance and lost motion are accounted for, and how they would affect the calculations of snubber reaction loads and stresses using a linear analysis methodology. In multiple snubber applications where mismatch of end fitting clearance and lost motion exist, the staff also requested the applicant to discuss their potential impact on the synchronism of activation level or release rate, and, consequently, on the assumption of the load sharing of multiple snubber supports. By letter dated February 16, 2007, the applicant stated that in multiple snubber applications where mismatch of end fitting clearance and lost motion could possibly exist, the synchronism of activation level or release rate will be evaluated, if deemed necessary, in the piping analysis model when this application could be considered critical to the functionality of the system, such as a multiple snubber application located near rotating equipment. Equal load sharing of multiple snubber supports will not be assumed if a mismatch in end fitting clearances exists and will be evaluated as a part of this assessment. The staff found the applicant's response to be insufficient in explaining how the effects of snubber end fitting clearance and lost motion would be calculated and, as a result, how non-equal load sharing of multiple snubber supports will be accounted for in the piping analysis model. _

3. Comment on response to RAI 3.9-171 (MFN 07 -208):

GE's response is acceptable. GE references GEFR-000879, "Depressurization Valve Development Test Program Final Report," in the DCD and its RAI response. Please provide the above report to NRC for information and revise the DCD to incorporate your response to this RAI.

4. Comment on response to RAI 3.9-132 (MFN 06-464):

In its response to RAI 3.9-132, dated November 22, 2006, the applicant stated it will submit additional analysis work for most of the components identified in the RAI in the revision of Licensing Topical Report NEDE-33259P, scheduled for the release to the NRC in March 2007. The applicant has decided that no analyses of the Control Rod Guide Tubes and Housings, and the In-Core Monitor Guide Tubes and Housings are necessary. The Staff considers that the NRC RAI 3.9-132 is unresolved because the applicant has not yet submitted the additional analyses. The applicant should also explain why it would not perform any analyses of the Control Rod Guide Tubes and Housings, and the In-Core Monitor Guide Tubes and Housings.

5. Comment on response to RAI 3.9-133 (MFN 07-194):

In its response to RAI 3.9-133, the applicant committed to instrumenting the prototype ESBWR steam dryer per DCD Tier 2, Subsection 3.9.2.4 and Subsection 3L.4.6 of DCD, Tier 2, Appendix 3L, and the prototype ESBWR chimney partitions, per Section 3L.5 of DCD, Tier 2, Appendix 3L. The applicant clarifies Item 5 in DCD, Tier 2, Section 3L.2.1 (page 3L-4), stating that the statement, "FIV will not be an issue," does not apply to the steam dryer or chimney partition assembly. The applicant has also clarified that vibration data for all equipment listed in DCD Tier 2, Table 3L.4 will be acquired during initial startup and power ascension testing. Pressure data, however, while recorded during startup testing, will not be evaluated in detail unless the primary vibration measurements indicate the need for further assessment. The staff finds the applicant's response acceptable, however, the applicant is requested to revise the DCD, Tier 2, Section 3.9.5 to include the above clarifications.

6. Comment on response to RAI 3.9-135 (MFN 07-194):

In its response to RAI 3.9-135, the applicant refers to the following three additional documents that are yet to be submitted:

Reference 3L-5: General Electric Company, "Steam Dryer - Acoustic Load Definition," NEDC-33312P, Class III (Proprietary)

Reference 3L-6: General Electric Company, "Steam Dryer - Structural Evaluation," NEDC-33313P, Class III (Proprietary)

Reference 3L-7: General Electric Company, "Steam Dryer - Instrumentation and Power Ascension Monitoring," NEDC-33314P, Class III (Proprietary).

The applicant is requested to submit these documents so that its response to RAI 3.9-135 can be evaluated.

7. Comment on response to RAI 3.9-136 (MFN 07-194):

In its response to RAI 3.9-136, the applicant refers to a future report - Reference 3L-5: General Electric Company, "Steam Dryer - Acoustic Load Definition," NEDC-33312P, Class III (Proprietary) - to address parts (a) and (b) of this RAI. The applicant is requested to submit Reference 3L-5 (NEDC-33312P) so that the staff can evaluate its

response to RAI 3.9-136.

8. Comment on response to RAI 3.9-138 (MFN-07-194):

In its response to parts (a), (b) and (c) of the RAI 3.9-138 in a letter (MFN 07-194) from J. C. Kinsey of GE to USNRC, dated April 2, 2007, the applicant refers to a report - Reference 3L-7: General Electric Company, "Steam Dryer - Instrumentation and Power Ascension Monitoring," NEDC-33314P, Class III (Proprietary), which is not yet available for review. Even though the applicant provides some insight on planned dryer instrumentation [parts (a)-(c)], which will be placed near regions where the highest fluctuating stresses are expected, the information provided to date is not sufficient to address fully the RAI. Please provide the remaining information requested in original_RAI 3.9-138.

9. Comment on response to RAI 3.9-139 (MFN 07-194):

In its response to RAI 3.9-139(a), the applicant states that the methodology for developing the strain gage and acceleration response acceptance criteria are described in Subsection 3L.5.2.2 of DCD, Tier 2, Appendix 3L. However, this response cannot be evaluated because the applicant has not provided Subsection 3L.5.2.2 as part of Appendix 3L. The applicant is requested to provide Subsection 3L.5.2.2 of DCD, Tier 2, Appendix 3L, so that the response to RAI 3.9-139(a) can be evaluated.

10. Comment on response to RAI 3.9-142 (MFN 06-464):

In its response to NRC RAI 3.9-142, dated November 22, 2006, the applicant stated that the operation of isolation condenser system and gravity driven cooling system would not result in any vibration issues because these two systems are passive systems that do not operate during normal plant conditions and rely on hydraulic principles to create flow. Also the plant operation with these systems in operation would be very limited.

However, the staff has a concern about the pump-driven reactor water cleanup/shutdown cooling system that might produce flow-induced vibrations. Generally the amplitudes of the pressure fluctuations due to vane passing frequencies from the pump are quite small. However, when the pulsation frequency coincides with the natural frequency of a component, the pressure pulsation can cause stresses of high magnitude even though the amplitude of the pressure fluctuations due to steam lines of BWR plants, and have caused pressure waves and vibrations that have damaged plant equipment including steam dryers and safety relief valves. The applicant is requested to identify any vessel internal components that have natural frequencies which correspond to the pump vane passing frequencies. If so, the applicant should submit analyses which show clearly that the stresses within those components are below the ASME fatigue code limits.

11. Comment on response to RAI 3.9-147 (MFN 06-464):

Since the natural circulation of the working fluid in the ESBWR is a new feature and only occurs when the fuel assemblies generate heat, the staff requested the applicant in NRC RAI 3.9-147 to justify that the flow velocities and their distribution over the reactor internals are verified for FIV analysis and testing, per SRP Section 3.9.2.

In its response to NRC RAI 3.9-147, dated November 22, 2006, the applicant explains how the working fluid flows in an ESBWR, and highlights positive aspects of the ESBWR design. The applicant states that the flow paths are cleaner in an ESBWR, with fewer flow disturbances. Also, the flow rates within the core region is slower than in forced circulation plant, leading to lower hydrodynamic excitation and resulting vibration.

The applicant's explanation of the benefits of ESBWR design regarding flow rates and patterns does not provide the information requested in the RAI, "justify that the flow velocities and their distribution over the reactor internals are verified for FIV analysis and testing, per SRP 3.9.2." The applicant's response did not address the NRC RAI 3.9-147. Please respond to RAI 3.9-147 precisely.

12. Comment on response to RAI 3.9-150 (MFN 06-464):

In its response to NRC RAI 3.9-150, dated November 22, 2006, the applicant explains that prior to startup testing, finite element models of the reactor internal components will be constructed and analyzed for their natural frequencies and mode shapes. Dynamic acceptance criteria for all accelerometers and strain gages to be placed on the components will be developed based on the FE model results. Also prior to startup, impact tests will be conducted on all instrumented components with an open reactor vessel at ambient conditions. The test results will be used to guide FE model revisions if they are deemed necessary.

The applicant's response states that impact tests will be performed for the first ESBWR. As a supplemental RAI, the applicant is requested to address impact tests for the first and subsequent ESBWR plants in the DCD.

13. Comment on response to RAI 3.9-151 (MFN 06-464):

In its response to the NRC RAI 3.9-151, dated November 22, 2006, the applicant states:

"The program that GE intends to complete pertaining to FIV of reactor internal components is explained in Licensing Topical Report NEDE-33259P. This plan includes the completion of analysis for the remaining reactor internal components, and the details of the measurement and inspection program to be implemented at the startup of the first ESBWR plant. GE's plan is to complete this work in 2007 prior to submittal of the first COL submittal. Regarding the steam dryer FIV program, GE is planning to implement design features that will reduce the FIV susceptibility of the steam dryer, and commitments related to testing at subsequent ESBWR plants is not appropriate until all the evaluation work is complete."

The applicant's response to the first part of the RAI 3.9-151[RAI 3.9-151(a)] regarding the program pertaining to FIV of reactor internal components is addressed in LTR NEDE-33259P and the applicant plans to complete the program before the submittal of the first COL application. This information should be included in the DCD, Tier 2, Section 3.9.5, so that the COL applicant would be aware of it. The applicant is requested to revise the DCD to incorporate this information.

The applicant's response to the second part of RAI 3.9-151[RAI 3.9-151(b)] regarding steam dryer instrumentation is incomplete. The applicant does commit to instrument the steam dryer bank hoods, end plates, skirt, drain channels, and support ring in its

response to RAI 3.9-73. The applicant is requested to incorporate this information in DCD, Tier 2, Section 3.9.5. In addition, the applicant is requested to include commitments related to testing of steam dryer at second and subsequent ESBWR plants in DCD.

14. Comment on response to RAI 3.10-2 S01:

GE response to NRC RAI 3.10-2 S01 is incomplete. RG 1.100 Revision 2, places some restrictions on the use of criteria and procedures provided in IEEE 344-1987, in particular, on the application of the qualification by experience. Therefore, it is incorrect in stating that IEEE 344-1987 (R1993) meets the RG 1.100, Revision 2. However, in GE responses to RAIs 3.10-3 and 3.10-4, GE stated that GE does not utilize operating experience database for equipment seismic qualification and GE does not maintain a database for operating experience. GE is requested to delete all the statements related to "experience data" in DCD, Tier 2, Revision 3 (For examples, first and last paragraph of Section 3.10.1.1 and the second sentence of Section 3.10.2). Also in DCD, GE is requested to confirm that Section 9, "Experience," of IEEE 344-1987 is not applicable to ESBWR.

15. Comment on response to RAI 3.10-5 S01:

In response to RAI 3.10-5, GE stated that the DCD Subsection 3.10.4 will be revised to include subsection 3.10.2.3 for "Equipment Qualification Records." However, it is not implemented in DCD, Tier 2, Revision 3. GE is requested to revise the DCD Subsection 3.10.4.

Furthermore, in DCD Subsection 3.10.4 of ESBWR DCD, Tier 2, Revision 2 and Revision 3, GE stated that COL holders shall prepare a Dynamic Qualification Report and shall maintain the equipment records including the reports in a permanent file readily available for audit. The "COL holders" should be revised to the "COL applicant," and the COL information should be available for staff review/audit before the issuance of the COL license.

16. Comment on response to RAI 3.10-6:

GE response to RAI 3.10-6, dated September 1, 2006, did not adequately address the information requested. The number of SRV actuation events assumed and the total SRV test duration calculated are inconsistent with those stated in item (d) of NEDE-24326-1-P (dated January 1983), which is used in DCD, Tier 2. GE is requested to respond to the exact questions asked in RAI 3.10-6 (1) and (2). Please provide a clear statement about the differences in SRV actuations assumed and if the proper justification for the difference between two numbers.