NRR-PMDAPEm Resource

From: Jackson, Diane
Sent: Tuesday, September 08, 2015 11:27 AM
To: Shams, Mohamed
Cc: DiFrancesco, Nicholas; Wyman, Stephen; Spence, Jane; Devlin-Gill, Stephanie; Roche, Kevin; Yee, On; Andrukat, Dennis; Wang, George; Tseng, Ian; Schleicher, Lisa; Rivera-Lugo, Richard; 50.54f_Seismic Resource; RidsNroDsea Resource
Subject: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - TECHNICAL REVIEW CHECKLIST RELATED TO INTERIM ESEP SUPPORTING IMPLEMENTATION OF NTTF R2.1, SEISMIC (TAC NO. MF5267 AND MF5268)
Attachments: Sequoyah R2 1 ESEP NRC Review.docx

September 8, 2015

MEMORANDUM TO: Mohamed K. Shams, Chief
Hazards Management Branch (JHMB)
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

FROM: Diane T. Jackson, Chief
Geosciences and Geotechnical Engineering Branch 2 (RGS2)
Division of Site Safety and Environmental Analysis
Office of New Reactors

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - TECHNICAL REVIEW CHECKLIST RELATED TO INTERIM EXPEDITED SEISMIC EVALUATION PROCESS SUPPORTING IMPLEMENTATION OF NTTF RECOMMENDATION 2.1, SEISMIC, RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NO. MF5267 AND MF5268)

The NRC technical staff working through the Geosciences and Geotechnical Engineering Branches 1 and 2 (RGS1 and RGS2) completed the Technical Review Checklist of the SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2response to Enclosure 1, Item (6) of the March 12, 2012, request for information letter issued per Title 10 of the Code of Federal Regulations, Subpart 50.54(f), to power reactor licensees and holders of construction permits requesting addressees to provide further information to support the NRC staff's evaluation of regulatory actions to be taken in response to Fukushima Near-Term Task Force (NTTF) Recommendation 2.1: Seismic which implements lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake and subsequent tsunami. This addresses the staff review of the interim Expedited Seismic Evaluation Process (ESEP) report in response to Requested Item (6) of Enclosure 1, "Recommendation 2.1: Seismic," of the 50.54(f) letter. Attached is a file containing the technical review checklist to prepare a response letter to the licensee.

The NRC staff reviewed the information provided and, as documented in the enclosed staff checklist, determined that sufficient information was provided to be responsive to this portion of the Enclosure 1 of the 50.54(f) letter. The application of this staff review is limited to the interim ESEP as part of NTTF R2.1: Seismic activities.

This electronic memo constitutes the DSEA concurrence provided that only editorial changes are made to the staff assessment that would not affect the technical conclusions or technical context of the assessment.

This concludes the NRC's efforts associated with TAC NO. MF5267 and MF5268 for the review of the interim ESEP report for the SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2.

Docket Nos: 50-327 and 50-328

CONTACT: Stephanie Devlin-Gill
Office of New Reactors
301-415-5301

Copy: Nicholas DiFrancesco, Steve Wyman, Jane Spence, Stephanie Devlin-Gill, Kevin Roche, On Yee, Richie Rivera-Lugo, Dennis Andrukat, George Wang, Ian Tseng, Lisa Schleicher, 50.54(f) Seismic Resource, RidsNroDsea Resource

Hearing Identifier: NRR_PMDA
Email Number: 2418

Mail Envelope Properties (cf4f5c12055f43d59ab8de5cd4b2f605)

Subject: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - TECHNICAL REVIEW CHECKLIST RELATED TO INTERIM ESEP SUPPORTING IMPLEMENTATION OF NTTF R2.1, SEISMIC (TAC NO. MF5267 AND MF5268)
Sent Date: 9/8/2015 11:27:08 AM
Received Date: 9/8/2015 11:27:18 AM
From: Jackson, Diane

Created By: Diane.Jackson@nrc.gov

Recipients:
"DiFrancesco, Nicholas" <Nicholas.DiFrancesco@nrc.gov>
Tracking Status: None
"Wyman, Stephen" <Stephen.Wyman@nrc.gov>
Tracking Status: None
"Spence, Jane" <Jane.Spence@nrc.gov>
Tracking Status: None
"Devlin-Gill, Stephanie" <Stephanie.Devlin-Gill@nrc.gov>
Tracking Status: None
"Roche, Kevin" <Kevin.Roche@nrc.gov>
Tracking Status: None
"Yee, On" <On.Yee@nrc.gov>
Tracking Status: None
"Andrukat, Dennis" <Dennis.Andrukat@nrc.gov>
Tracking Status: None
"Wang, George" <George.Wang@nrc.gov>
Tracking Status: None
"Tseng, Ian" <Ian.Tseng@nrc.gov>
Tracking Status: None
"Schleicher, Lisa" <Lisa.Schleicher@nrc.gov>
Tracking Status: None
"Rivera-Lugo, Richard" <Richard.Rivera-Lugo@nrc.gov>
Tracking Status: None
"50.54f_Seismic Resource" <50.54f_Seismic.Resource@nrc.gov>
Tracking Status: None
"RidsNroDsea Resource" <RidsNroDsea.Resource@nrc.gov>
Tracking Status: None
"Shams, Mohamed" <Mohamed.Shams@nrc.gov>
Tracking Status: None

Post Office: R4PWMSMRS03.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	3082	9/8/2015 11:27:18 AM
Sequoyah R2 1 ESEP NRC Review.docx	44974	

Options
Priority: Standard
Return Notification: No
Reply Requested: No

Sensitivity: Normal
Expiration Date:
Recipients Received:

TECHNICAL REVIEW CHECKLIST

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO EXPEDITED SEISMIC EVALUATION PROCESS INTERIM EVALUATION

IMPLEMENTING NTTF RECOMMENDATION 2.1 SEISMIC

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

By letter dated March 12, 2012 (USNRC, 2012a), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) "Conditions of License" (hereafter referred to as the "50.54(f) letter"). Enclosure 1 of the 50.54(f) letter requests addressees to reevaluate the seismic hazard at their site using present-day methods and guidance for licensing new nuclear power plants, and identify actions to address or modify, as necessary, plant components affected with the reevaluated seismic hazards. Requested Information Item (6) in Enclosure 1 to the 50.54(f) letter requests addressees to provide an interim evaluation and actions taken or planned to address a higher seismic hazard relative to the design basis, as appropriate, prior to completion and submission of the seismic risk evaluation.

Additionally, by letter dated April 12, 2013[1], the Electric Power Research Institute (EPRI) staff submitted EPRI TR 3002000704 "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force (NTTF) Recommendation 2.1: Seismic" (hereafter referred to as the guidance). The Augmented Approach proposed that licensees would use an Expedited Seismic Evaluation Process (ESEP) to address the interim actions as requested by Information Item (6) in the 50.54(f) letter. The ESEP is a simplified seismic capacity evaluation with a focused scope of certain key installed Mitigating Strategies equipment that is used for core cooling and containment functions to cope with scenarios that involve a loss of all AC power and loss of access to the ultimate heat sink to withstand the Review Level Ground Motion, which is up to two times the safe shutdown earthquake (SSE). Due to the expedited and interim nature of the ESEP, the assessment does not include many considerations that are part of a normal risk evaluation. These deferred items, include but are not limited to, structures, piping, non-seismic failures, and operator actions, as well scenarios such as addressing loss of coolant accidents. By letter dated May 7, 2013[2], the NRC staff endorsed the guidance. Central and eastern United States licensees with a reevaluated seismic hazard exceeding the SSE submitted an ESEP interim evaluation in December 2014.

Consistent with the interim nature of this activity, the staff performed the review of the licensee's submittal to assess whether the intent of the guidance was implemented. A multi-disciplined team checked whether the identified methods were consistent with the guidance. A senior expert panel reviewed the team's questions, if any, and checklist for consistency and scope. New or updated parameters (e.g., In-Structure Response Spectra, High Confidence of Low Probability of Failure calculations) presented by the licensees were assessed only based on licensee statements for acceptability for the Item (6) response. The application of this staff review is limited to the ESEP interim evaluation as part of NTTF R2.1: Seismic activities.

---

1 ADAMS Accession No. ML13102A142

2 ADAMS Accession No. ML13106A331

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Sequoyah Nuclear Plant, Units 1 and 2

By letter dated December 22, 2014[3], Tennessee Valley Authority (TVA) provided an Expedited Seismic Evaluation Process (ESEP) report in a response to Enclosure 1, Requested Information Item (6) of the 50.54(f) letter, for the Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah).

I. Review Level Ground Motion

The licensee: • described the determination of the review level ground motion (RLGM) using one of the means acceptable by the guidance • identified location of the control point and is consistent with March 2014 Seismic Hazard and Screening Report[4](SHSR) submittal • compared the site ground motion response spectra used to select the ESEP RLGM to the SSE.	Yes Yes Yes
Sequoyah used a scaled SSE at a ratio of 2.0.	
Notes from the Reviewer: 1. The licensee used the maximum ratio of two times the SSE because the GMRS from the March 2014 SHSRwas greater than two times the SSE for the site. 2. Staff notes that the SSE given by the licensee in Table 4-2 of the ESEP report does not match the SSE given by the licensee in Table 3.1-1 of the SHSR. The SSE in the ESEP is lower than the SSE in the SHSR. However, since the ESEP SSE matches the SSE defined in the licensee's UFSAR, the SSE used by the licensee for the ESEP is appropriate. **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	
The NRC staff concludes: • the licensee's RLGM meets the intent of the guidance • the RLGM is reasonable for use in the interim evaluation	Yes Yes

II. Selection of the Success Path

The licensee: • described the success path • described normal and desired state of the equipment for the success path • ensured that the success path is consistent with the plant's overall mitigating strategies approach or provided a justification for an alternate path • stated that the selection process was in accordance with the guidance or meets the intent of the guidance • used installed FLEX Phase 1 equipment as part of the success path • included FLEX Phase 2 and/or 3 connections • considered installed FLEX Phase 2 and/or 3 equipment	Yes Yes Yes Yes Yes Yes Yes
Notes from the Reviewer: None **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	

3 ADAMS Accession No. ML14365A055

4 ADAMS Accession No. ML14098A478

The NRC staff concludes that: • the selected success path is reasonable for use in the interim evaluation • the licensee considered installed Phase 2 and 3 connections or equipment in the interim evaluation.	Yes Yes

III. Selection of the Expedited Seismic Equipment List (ESEL)

The licensee: • developed and provided the ESEL by applying the ESEP • identified equipment considering the following functions: o Core cooling (with focus on Mode 1) function o Available, sustainable water source o Containment function and integrity	Yes Yes Yes Yes
Notes from the Reviewer: None **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	
For PWR Plants ONLY The licensee included indicators / instrumentation for the following functions: level, pressure, temperature, that would be indicative of (but not explicitly identified to specific instruments): water level of the steam generator (SG), pressure of SG, containment, and reactor coolant system (RCS); and temperature of the RCS.	Yes
For BWR Plants ONLY The licenseeconsidered indicators for the following functions: level, pressure, temperature that would be indicative of (but not explicitly identified to specific instruments): Temperature of suppression pool, RCS, containment); Pressure of suppression pool, RCS, and drywell; water level of the suppression pool.	N/A
Notes from the Reviewer: None **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	
Through a sampling of the ESEP key components, the NRC staff concludes that: • the licensee's process to develop the ESEL meets the intent of the guidance for the interim evaluation • the desired equipment state for the success path were identified • the licensee considered the support equipment for the ESEL • both front-line and support systems appeared to be included in the ESEL as evidenced by inclusion of SSCs on the success path and of support systems (e.g., batteries, motor control centers, inverters).	Yes Yes Yes Yes

IV. Walkdown Approach

The licensee: • described the walkdown screening approach, including walkbys and walkdowns performed exclusively for the ESEP, in accordance	Yes

with the guidance • credited previous walkdown results, including a description of current action(s) to verify the present equipment condition and/or configuration (e.g., walk-bys), in accordance with the guidance • stated that the walkdown was performed by seismically trained personnel	Yes Yes
Notes from the Reviewer: None **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	
The licensee: • described, as needed, adverse material condition of the equipment (e.g., material degradation) • credited previous walkdown results, included a description of current action(s) to verify the present equipment condition (e.g., walk-bys), meeting the intent of the guidance	Yes Yes
The licensee: • described the conditions of structural items considered for the interim evaluation, including: o spatial interactions (i.e., interaction between block walls and other items/components) o anchorage o piping connected to tanks (i.e., differential movement between pipes and tanks at connections)	 Yes Yes Yes
Notes from the Reviewer: None **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	
The licensee reported deviations for Sequoyah. If deviations were identified, there is a discussion of how the deficiencies were or will be addressed in the ESEP submittal report.	No N/A
The NRC staff concludes that: • the licensee described the performed walkdown approach, including any credited previous efforts (e.g., Individual Plant Examination of External Events(IPEEE)) consistent with the guidance • the licensee addressed identified deviations consistent with the guidance, if any	Yes N/A

V. Capacity Screening Approach and High Confidence/Low Probability of Failure (HCLPF) Calculation Results

The licensee: • described the capacity screening process for the ESEL items, consistent with the guidance (e.g., use of EPRI NP-6041 screening table). • presented the results of the screened-out ESEL items in the ESEP report • described the development of in-structure response spectrum (ISRS) based on scaling[(4)] • described the development of ISRS based on new analysis consistent with the guidance • described the method for estimating HCLPF capacity of screened-in ESEL items, including both structural and functional failure modes consistent with the guidance: o use of Conservative Deterministic Failure Margin (CDFM) o use of fragility analysis (FA) o use of experience data or generic information • credited IPEEE spectral shape for HCLPF capacity estimates is similar to or envelopes the RLGM, and anchored at the same control point • presented the results of HCLPF capacities including associated failure modes for screened-in ESEL items • reviewed the ESEL items with the lowest HCLPF values to ensure that their capacities are equal or greater than the RLGM	Yes Yes Yes N/A Yes Yes N/A N/A Yes Yes Yes

Notes from the Reviewer:

1. The licensee listed four (4) cold leg accumulator isolation valves as inaccessible for walkdowns in the Section 7.1, however, these valves were screened with HCLPF values in the Attachment B, page B-3, and Table 8-1. In response to the staff question about the screening of these valves, the licensee performed a walkdown during their April 2015 Unit 1 outage and determined that the same conclusions related to the equivalent components in Unit 2 applied to components in Unit 1. The staff finds that the licensee response (ML15239A287) adequately addressed the concerns for the purposes of the interim evaluation.
2. In response to staff questions, the licensee provided a list of ESEL items located at an elevation above 40 ft. from grade level. The licensee also provided a reference to the method used to analyze these components, which cover the entire height range. The staff finds the approach followed by the licensee, as described in its response (ML15239A287), to be acceptable for the purposes of this interim evaluation.
3. The staff requested clarification whether the IPEEE review level earthquake (RLE) used for screening is defined in the free-field at the top of the soil surface, or whether it is defined on rock at the base of containment at the same point as the ESEP GMRS. In response (ML15239A287), the licensee provided confirmation that the IPEEE RLE and the ESEP GMRS are both defined on rock at the base of the containment structure. The staff finds this response acceptable because the licensee provided the requested clarification, which shows that the IPEEE RLE and ESEP GMRS are defined consistently, for the purposes of the interim evaluation.
4. The licensee did not use either ISRS method identified in the ESEP guidance. However, the licensee used a review level earthquake (RLE) defined in the IPEEE and scaled it to

1.5. Since the maximum required RLGM may be defined as 2xSSE, and the scaled RLE that was used fully bounds 2xSSE between 1 to 10 Hz (as shown in Figure 5.2 of the submittal), this scaled RLE is a conservative substitute for the RLGM. Using this substituted RLGM, the licensee's method to develop the ISRS is consistent with the first option in the guidance; by scaling the ISRS associated with the IPEEE by the same scale factor of 1.5 as applied to the RLE defined in the IPEEE. The staff finds that the method used to develop the ISRS is consistent with the intent of the guidance and acceptable for use in the ESEP.

5. The staff requested further clarification from the licensee to determine whether the appropriate IPEEE-based HCLPF capacity to credit for the ESEP screening should be 0.20g as accepted by TVA, or 0.30g as specified in the ESEP submittal. In response (ML15239A287), the licensee clarified and provided basis to support that TVA made plant upgrades, accompanied by more rigorous HCLPF estimation analyses, to increase the HCLPF capacity to more than 0.30g (defined on rock), and that the minimum upgrade IPEEE HCLPF capacity is now 0.35g. Given that the RLGM (NUREG/CR0098 curve) anchored at 0.30g fully bounds 2xSSE between 1 to 10 Hz, the staff finds that the upgraded HCLPF capacity is sufficient and that the licensee's response (ML15239A287) adequately addressed the concerns and is acceptable for the purpose of this interim evaluation.

Deviation(s) or Deficiency(ies), and Resolution:

No deviations or deficiencies were identified.

The NRC staff concludes that:	
• the licensee described the implementation of the capacity screening process consistent with the intent of the guidance	Yes
• the licensee presented capacity screening and calculation results, as appropriate, in the ESEP report	Yes
• the method used to develop the ISRS is consistent with guidance for use in the ESEP	No – See Note #4 above
• for HCLPF calculations, the licensee used HCLPF calculation methods as endorsed in the guidance	Yes
• no anomalies were noted in the reported HCLPF	Yes

VI. Inaccessible Items

The licensee:	
• provided a list of inaccessible items	Yes
• provided a schedule of the planned walkdown and evaluation for all inaccessible items	Yes
• provided Regulatory Commitment to complete walkdowns.	Yes
Sequoyah will provide results: <u>within 60 days following completion of ESEP activities.</u>	

Notes from the Reviewer:

- The licensee will complete the walkdowns of Unit 1 inaccessible items listed in Section 7 of the ESEP report during the upcoming refueling outage.

Deviation(s) or Deficiency(ies), and Resolution:

No deviation or deficiencies were found in the review of this particular section.

The NRC staff concludes that the licensee: • listed inaccessible items • committed to provide the results (e.g., walkdowns, walk-bys, etc.) of the remaining inaccessible items consistent with the guidance • substitutions, if needed, were appropriately justified	 Yes Yes N/A

VII. Modifications

The licensee: • identified modifications for ESEL items necessary to achieve HCLPF values that bound the RLGM (excluding mitigative strategies equipment (FLEX)), as specified in the guidance • provided a schedule to implement such modifications (if any), consistent with the intent of the guidance • provided Regulatory Commitment to complete modifications • provided Regulatory Commitment to report completion of modifications.	 Yes Yes Yes Yes
Sequoyah will: • For Unit 1: complete plant modifications (if any are identified from inaccessible items' walkdowns) not requiring a planned refueling outage will be completed by December 2016, and modifications requiring a refueling outage will be completed within two planned refueling outages after December 31, 2014. For Unit 2: complete the identified modification will be completed no later than the end of U2R20 Refueling Outage (planned December 31, 2015). • report completion of modifications: within 60 days following completion of ESEP activities.	
Notes from the Reviewer: None **Deviation(s) or Deficiency(ies), and Resolution:** No deviation or deficiencies were found in the review of this particular section.	
The NRC staff concludes that the licensee: • identified plant modifications necessary to achieve the target seismic capacity • provided a schedule to implement the modifications (if any) consistent with the guidance	 Yes Yes

VIII. Conclusions:

The NRC staff assessed the licensee's implementation of the ESEP guidance. Due to the interim applicability of the ESEP evaluations, use of the information for another application would require a separate NRC review and approval. Based on its review, the NRC staff concludes that the licensee's implementation of the interim evaluation meets the intent of the guidance. The staff concludes that, through the implementation of the ESEP guidance, the licensee identified and evaluated the seismic capacity of certain key installed Mitigating Strategies equipment that is used for core cooling and containment functions to cope with scenarios that involve a loss of all AC power and loss of access to the ultimate heat sink to withstand a seismic event up to the Review Level Ground Motion (RLGM) and thus, provides additional assurance while the plant seismic risk evaluation is being conducted. In the case of Sequoyah, the RLGM was set at the maximum ratio of two times the SSE in accordance with

the guidance because the GMRS is above two times the SSE. The ISRS was developed using a review level earthquake defined in the IPEEE study, which was scaled to exceed aGMRS-to-SSE ratio of 2.0. As described above, this method was judged to be acceptable for the purpose of this interim evaluation. The application of this staff review is limited to the ESEP interim evaluation as part of the NTTF R2.1: Seismic activities. The licensee will complete all walkdown and HCLPF evaluations and modifications (if needed)for the inaccessible items for Unit 1 by December 2016 for modifications not requiring a planned refueling outage, and/orwithin two planned refueling outages after December 31, 2014for modifications requiring a refueling outage. For Unit 2,the identified modification will be completed no later than the end of U2R20 Refueling Outage (planned December 31, 2015). Further, the licensee committed to submit a letter summarizing the results within 60 days following completion of ESEP activities.

In summary, by implementing the ESEP interim evaluation, the licensee demonstrated that additional assurance exists which supports continued plant safety and confirms that sufficient time exists to allow the completion of longer-term seismic evaluations to support regulatory decision making. The NRC staff concludes that the licensee responded appropriately to Enclosure 1, Item (6) of the 50.54(f) letter, dated March 12, 2012, for Sequoyah Nuclear Plant, Units 1 and 2.

Principal Contributors: Dennis Andrukat, George Wang, Ian Tseng, Lisa Schleicher, On Yee, Richard Rivera-Lugo, Nikolaos Simos (NRC Consultant)