

NRR-PMDAPEm Resource

From: Jackson, Diane
Sent: Wednesday, September 02, 2015 5:47 PM
To: Shams, Mohamed
Cc: DiFrancesco, Nicholas; Spence, Jane; Devlin-Gill, Stephanie; Roche, Kevin; Yee, On; Wang, Weijun; Gallucci, Ray; Patel, Pravin; Wyman, Stephen; Graizer, Vladimir; Pettis, Robert; 50.54f_Seismic Resource; RidsNroDsea Resource
Subject: VC SUMMER NUCLEAR STATION, UNIT 1 - TECHNICAL REVIEW CHECKLIST RELATED TO INTERIM ESEP SUPPORTING IMPLEMENTATION OF NTTF R2.1, SEISMIC (TAC NO. MF5269)
Attachments: VC Summer R2.1 Seismic ESEP NRC review.docx

September 2, 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: VC SUMMER NUCLEAR STATION, UNIT 1 - 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. MF5269)

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 VC SUMMER NUCLEAR STATION, UNIT 1 response 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. MF5269 for the review of the interim ESEP report for the VC SUMMER NUCLEAR STATION, UNIT 1.

Docket No: 50-395

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, Weijun Wang, Ray Gallucci, Pravin Patel, Bob Pettis, Vladimir Graizer, 50.54f Seismic Resource, RidsNroDsea Resource

Hearing Identifier: NRR_PMDA
Email Number: 2416

Mail Envelope Properties (c77cfca2e76b40388f9e2f1f6a2ae20d)

Subject: VC SUMMER NUCLEAR STATION, UNIT 1 - TECHNICAL REVIEW
CHECKLIST RELATED TO INTERIM ESEP SUPPORTING IMPLEMENTATION OF NTTF R2.1,
SEISMIC (TAC NO. MF5269)

Sent Date: 9/2/2015 5:46:48 PM

Received Date: 9/2/2015 5:46:50 PM

From: Jackson, Diane

Created By: Diane.Jackson@nrc.gov

Recipients:

"DiFrancesco, Nicholas" <Nicholas.DiFrancesco@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

"Wang, Weijun" <Weijun.Wang@nrc.gov>

Tracking Status: None

"Gallucci, Ray" <Ray.Gallucci@nrc.gov>

Tracking Status: None

"Patel, Pravin" <Pravin.Patel@nrc.gov>

Tracking Status: None

"Wyman, Stephen" <Stephen.Wyman@nrc.gov>

Tracking Status: None

"Graizer, Vladimir" <Vladimir.Graizer@nrc.gov>

Tracking Status: None

"Pettis, Robert" <Robert.Pettis@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: HQPWMSMRS07.nrc.gov

Files	Size	Date & Time
MESSAGE	3035	9/2/2015 5:46:50 PM
VC Summer R2.1 Seismic ESEP NRC review.docx	48910	

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
VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1
DOCKET NO.50-395

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, 2013¹, 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, 2013², 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 VC Summer Nuclear Station, Unit 1

By letter dated December 17, 2014³, South Carolina Electric & Gas (SCE&G), 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 Virgil C. Summer Nuclear Station (VC Summer), Unit 1.

I. Review Level Ground Motion

The licensee: <ul style="list-style-type: none"> • 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 report⁴submittal • compared the site ground motion response spectra used to select the ESEP RLGM to the SSE. 	Yes Yes Yes
VC Summer Unit 1 used a scaled SSE at a ratio of 2.0.	
Notes from the Reviewer: <ol style="list-style-type: none"> 1. The licensee used the maximum scaled ratio of 2.0 of the SSE because the GMRS exceeds the SSE by more than 2 times. The licensee used the scaled ratio for all items except the Condensate Storage Tank (CST). 2. Soil SSE (0.25 g) was developed for the surface. The licensee used GMRS, developed for the hard rock, located 85 ft below the plant grade as the RLGM for the CST founded at the grade by following guidance of EPRI 3002000704 Section 4, Option 2. This is acceptable for this purposes of this interim evaluation. 	
Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were found in the review of this particular section.	
The NRC staff concludes: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <u>connections</u> • considered installed FLEX Phase 2 and/or 3 <u>equipment</u> 	Yes Yes Yes Yes Yes Yes Yes
---	---

³ ADAMS Accession No ML14357A168

⁴ ADAMS Accession No. ML 14092A250

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for VC Summer Nuclear Station, Unit 1

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:	
<ul style="list-style-type: none"> • the selected success path is reasonable for use in the interim evaluation 	Yes
<ul style="list-style-type: none"> • the licensee considered installed Phase 2 and 3 connections or equipment in the interim evaluation. 	Yes

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

The licensee:	
<ul style="list-style-type: none"> • developed and provided the ESEL by applying the ESEP 	Yes
<ul style="list-style-type: none"> • identified equipment considering the following functions: <ul style="list-style-type: none"> ○ Core cooling (with focus on Mode 1) function ○ Available, sustainable water source ○ Containment function and integrity 	Yes Yes Yes
Notes from the Reviewer:	
<ol style="list-style-type: none"> 1. The licensee verified that major components in direct flow path using system notebooks. 2. The licensee credited manual valves requiring operation via "reach rods" in ESEL equipment list. The licensee stated that isometric drawings were used to determine if any manual valves required to operate in support of the FLEX functions can be operated using reach rods. Operator actions were outside of the scope of the interim evaluation, as such this is acceptable for the purposes of this interim evaluation. 	
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 licensee considered 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

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for VC Summer Nuclear Station, Unit 1

Notes from the Reviewer:

- The staff requested completion of the ESEL because of no details of pressure indicators/instruments for the RCS. The licensee's responses (ML15159A805 and ML15229A089) updated the ESEP report and revised Table 7.1 to include all missing or inaccessible items and therefore completed the ESEL. The revision of the ESEP report adequately addressed the staff's concern and met the intent of the guidance for this interim evaluation.

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 walk-bys and walkdowns performed exclusively for the ESEP, in accordance 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

N/A

Yes

Notes from the Reviewer:

- New walkdowns were performed for the interim evaluation. Previous walkdown results were used for background purposes only.

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

N/A

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for VC Summer Nuclear Station, Unit 1

The licensee: <ul style="list-style-type: none"> • described the conditions of structural items considered for the interim evaluation, including: <ul style="list-style-type: none"> ○ spatial interactions (i.e., interaction between block walls and other items/components) ○ anchorage ○ piping connected to tanks (i.e., differential movement between pipes and tanks at connections) 	Yes Yes Yes
Notes from the Reviewer: <ol style="list-style-type: none"> 1. Screened-in items (anchors) are not found in Section 6.5 of licensee's ESEP report as referenced, however anchor failure modes for the equipment was listed in Table 6-4. This is a typographical error and does not affect the conclusion of the evaluations. 	
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 VC Summer Unit 1.	No
If deviations were identified, there is a discussion of how the deficiencies were or will be addressed in the ESEP submittal report.	N/A
The NRC staff concludes that: <ul style="list-style-type: none"> • 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 Yes

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

The licensee: <ul style="list-style-type: none"> • 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 spectra (ISRS) based on scaling • 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: <ul style="list-style-type: none"> ○ use of Conservative Deterministic Failure Margin (CDFM) ○ use of fragility analysis (FA) ○ 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 	Yes Yes Yes (see note 1) Yes Yes Yes N/A Yes N/A Yes
---	---

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for VC Summer Nuclear Station, Unit 1

failure modes for screened-in ESEL items <ul style="list-style-type: none"> • reviewed the ESEL items with the lowest HCLPF values to ensure that their capacities are equal or greater than the RLGM 	Yes
<p>Notes from the Reviewer:</p> <ol style="list-style-type: none"> 1. All ISRS, with exception of the Condensate Storage Tank (CST), are developed based on proper scaling. The CST is supported on a surface mounted slab at grade. SSI is performed with the RLGM applied at rock elevation (85 ft below grade) to develop seismic demand for the CST. The GMRS is less than SSE in frequency range up to 5 Hz. This approach utilizes both allowed approaches in the guidance and therefore, is acceptable for the purpose of this interim evaluation. 2. Four items were identified as having HCLPF below the RLGM. As requested by the staff, the licensee described planned modifications to enhance seismic capacity of the plant, including actions to mitigate the four items, are summarized in Section 8.2 of the revised ESEP report in its responses (ML15159A805 and ML15229A089). The licensee also provided commitments to complete modifications. The revision of the ESEP report adequately addressed the staff's concerns and met the intent of the guidance for this interim evaluation. <p>Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were found in the review of this particular section.</p>	
The NRC staff concludes that:	
<ul style="list-style-type: none"> • the licensee described the implementation of the capacity screening process consistent with the intent of the guidance 	Yes
<ul style="list-style-type: none"> • the licensee presented capacity screening and calculation results, as appropriate, in the ESEP report 	Yes
<ul style="list-style-type: none"> • the method used to develop the ISRS is consistent with guidance for use in the ESEP 	Yes
<ul style="list-style-type: none"> • for HCLPF calculations, the licensee used HCLPF calculation methods as endorsed in the guidance 	Yes
<ul style="list-style-type: none"> • no anomalies were noted in the reported HCLPF 	Yes

VI. Inaccessible Items

The licensee: <ul style="list-style-type: none"> • provided a list of inaccessible items 	Yes
<ul style="list-style-type: none"> • provided a schedule of the planned walkdown and evaluation for all inaccessible items 	Yes
<ul style="list-style-type: none"> • provided Regulatory Commitment to complete walkdowns. 	Yes
VC Summer Unit 1 will complete walkdown during: <u>the Fall 2015 refueling outage.</u>	
<p>Notes from the Reviewer:</p> <ol style="list-style-type: none"> 1. The original report (Rev 0, dated 12/15/2014) did not identify any inaccessible items. The licensee provided an updated ESEP report (also labeled "Rev 0," dated 6/4/2015, ML15159A805), which included a list of inaccessible items and committed to complete the walkdowns. In its August 13, 2015, response (ML15229A089), the licensee committed to provide the results of the walkdown and HCLPF results by February 1, 2016. <p>Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were found in the review of this particular section.</p>	

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for VC Summer Nuclear Station, Unit 1

The NRC staff concludes that the licensee: <ul style="list-style-type: none"> • 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 Yes
--	-------------------

VII. Modifications

The licensee: <ul style="list-style-type: none"> • identified modifications for ESEL items necessary to achieve HCLPF values that bound the RLGGM (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
VC Summer will: <ul style="list-style-type: none"> • complete modifications no later than or during the planned <u>Spring 2017 refueling outage</u>. • report completion of modifications <u>60 days after completion of the Spring 2017 refueling outage</u>. 	
<p>Notes from the Reviewer:</p> <p>1. In the ESEP report the licensee indicated which modifications would be performed by December 2015, December 2016 and during the Spring 2017 outage, which is in accordance with the schedule identified in the NEI letter. The staff requested clarification of licensee's regulatory commitments. The licensee's response (ML15229A089) revised its ESEP report and added new regulatory commitments in Section 8.4. Sixty days following completion of the second refueling outage after December 31, 2014 (scheduled for Spring 2017), the licensee will submit a letter to NRC confirming all ESEP modifications are complete.</p>	
<p>Deviation(s) or Deficiency(ies), and Resolution:</p> <p>No deviation or deficiencies were found in the review of this particular section.</p>	
The NRC staff concludes that the licensee: <ul style="list-style-type: none"> • 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

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for VC Summer Nuclear Station, Unit 1

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 the Virgil C. Summer Nuclear Station, Unit 1, in accordance with the guidance, the RLGM used its(scaledrock) SSE at the maximum ratio of 2.0. The application of this staff review is limited to the ESEP interim evaluation as part of the NTTF R2.1: Seismic activities. The staff did not identify deviations or exceptions from the guidance for the purposes this interim evaluation. As noted above, the licensee identified safety enhancing modifications based on the evaluation and committed to complete modifications by within two planned refueling outages of December 31, 2014, which is by Spring 2017. The licensee will report the completion of modifications within 60 days following completion of the second refueling outage after December 31, 2014 (Spring 2017).

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 Virgil C. Summer Nuclear Station, Unit 1.

Principal Contributors: Ray Gallucci, Kevin Roche, On Yee, Pravin Patel, Robert Pettis, Vladimir Graizer, Weijun Wang, Thomas Houston, (NRC Consultant)