

NRR-PMDAPEm Resource

From: Jackson, Diane
Sent: Friday, December 11, 2015 12:50 PM
To: Shams, Mohamed
Cc: Yee, On; Stirewalt, Gerry; Lyons, Sara; Basavaraju, Chakrapani; Graizer, Vladimir; Jain, Bhagwat; DiFrancesco, Nicholas; Wyman, Stephen; Spence, Jane; Devlin-Gill, Stephanie; Roche, Kevin; 50.54f_Seismic Resource; RidsNroDsea Resource
Subject: WOLF CREEK NUCLEAR STATION - TECHNICAL REVIEW CHECKLIST RELATED TO INTERIM ESEP SUPPORTING IMPLEMENTATION OF NTTF R2.1, SEISMIC (TAC NO. MF5634)
Attachments: Wolf Creek R2.1 ESEP NRC review.docx

December 11, 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: WOLF CREEK GENERATING 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. MF5634)

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 WOLF CREEK NUCLEAR STATION 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. The 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. MF5634 for the review of the interim ESEP report for the WOLF CREEK NUCLEAR STATION.

Docket No: 50-482

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MF5634)

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TECHNICAL REVIEW CHECKLIST
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO EXPEDITED SEISMIC EVALUATION PROCESS INTERIM EVALUATION
IMPLEMENTING NTTF RECOMMENDATION 2.1 SEISMIC
WOLF CREEK GENERATING STATION , UNIT 1
DOCKET NO. 50-482

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 Wolf Creek Generating Station, Unit 1

By letter dated December 23, 2014,³ Wolf Creek Nuclear Operating Corporation (the licensee) 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 Wolf Creek Generating Station, Unit 1 (Wolf Creek).

I. Review Level Ground Motion

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|--|---------------------------|
| 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 report⁴ submittal • compared the site ground motion response spectra used to select the ESEP RLGM to the SSE | Yes Yes Yes |
| Wolf Creek used 1.47 x SSE. | |
| Notes from reviewer: None | |
| Deviation(s) or Deficiency(ies) and Resolution: <ul style="list-style-type: none"> • No deviations or deficiencies were identified | |
| 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 connections • considered installed FLEX Phase 2 and/or 3 equipment | Yes Yes Yes Yes Yes Yes Yes |
| Notes from reviewer: None | |
| Deviation(s) or Deficiency(ies) and Resolution: <ul style="list-style-type: none"> • No deviations or deficiencies were identified | |
| The NRC staff concludes that: <ul style="list-style-type: none"> • 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 |

³ ADAMS Accession No. ML14365A262

⁴ ADAMS Accession No. ML14090A441

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process
Technical Review Checklist for Wolf Creek Generating Station, Unit 1

III. Selection of the Equipment List

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|---|---|
| <p>The licensee:</p> <ul style="list-style-type: none"> • developed and provided the ESEL by applying the ESEP • 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 | <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> |
| <p>Notes from reviewer:</p> <p>1. Many components were missing from the ESEL in the initial submittal from the licensee dated December 23, 2014 (ML14365A262), including atmospheric relief valves (ARVs), accumulators, accumulation isolation valves, reactor head vent, and pressurizer power operated relief valve (PORV). The staff requested the licensee to either add these components to the ESEL per the ESEP guidance, along with any associated support equipment, or justify why the components were not included in the ESEL. In a written response dated June 24, 2015 (ML15182A116), the licensee stated that the components in question were not included in the ESEL because of the exemption for “NSSS (Nuclear Steam Supply System) Components” contained in the guidance. The staff determined that this response did not adequately meet the intent of the guidance for this interim evaluation and a supplemental RAI was sent to the licensee. In response to the supplemental RAI per the letter from the licensee dated November 11, 2015 (ML15323A317), the missing components (including ARVs, accumulators, accumulation isolation valves, reactor head vent, and PORV) were added to the ESEL. In the November 2015 response, the licensee also included a regulatory commitment to perform associated walkdowns, HCLPF updates, report required modifications, and provide this information to the NRC. The staff finds that the November 11, 2015, response adequately addressed the question and met the intent of the guidance for this interim evaluation.</p> <p>Deviation(s) or Deficiency(ies) and Resolution:</p> <ul style="list-style-type: none"> • No deviations or deficiencies were identified. | |
| <p align="center"><u>PWR Plants ONLY</u></p> <p>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.</p> | <p>Yes</p> |
| <p align="center"><u>BWR Plants ONLY</u></p> <p>The licensee considered indicators for the following functions: level, pressure, temperature that would be indicative of, but not explicitly identified with, specific instruments: Temperature of suppression pool, RCS, containment; pressure of suppression pool, RCS, and drywell; water level of the suppression pool.</p> | <p>N/A</p> |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process
Technical Review Checklist for Wolf Creek Generating Station, Unit 1

Notes from reviewer:

2. Because all necessary instrumentation did not appear to be included in ESEL in the December 23, 2014, submittal from the licensee, the staff requested confirmation that instrumentation for the following SSCs either were included in, or would be added to, the ESEL: (a) Steam generator water level, (b) steam generator pressure, (c) containment pressure, (d) RCS pressure, (e) RCS temperature. In a written response dated June 24, 2015 (ML15182A115), the licensee stated that steam generator water level, steam generator pressure, and RCS pressure and temperature were not included in the ESEL because of the exemption “NSSS Components” contained in the Augmented Approach Guidelines. In that response, the licensee also outlined three determinations related to containment pressure instrumentation as follows: (i) containment function was not expected to be challenge per the still-in-progress OIP; (ii) there was no credible mechanism to damage containment pressure transmitters; and (iii) the guidance allows the exclusion of structures. The staff determined that this initial response did not adequately address the question or meet the intent of the guidance for this interim evaluation and a supplemental RAI was sent to the licensee. In response to the supplemental RAI per the letter from the licensee dated November 11, 2015 (ML15323A317), the licensee added all necessary instrumentation to the ESEL and included a regulatory commitment to perform associated walkdowns, HCLPF updates, report required modifications, and provide this information to the NRC. The staff finds that the November 11, 2015, response adequately addressed the question and met the intent of the guidance for this interim evaluation.

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

- No deviations or deficiencies were identified.

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| Through a sampling of the ESEP key components, the NRC staff concludes that: | |
| <ul style="list-style-type: none"> • the licensee’s process to develop the ESEL meets the intent of the guidance for the interim evaluation | Yes |
| <ul style="list-style-type: none"> • the desired equipment state for the success path were identified | Yes |
| <ul style="list-style-type: none"> • the licensee considered the support equipment for the ESEL | Yes |
| <ul style="list-style-type: none"> • 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 |

IV. Walkdown Approach

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| The licensee: | |
| <ul style="list-style-type: none"> • described the walkdown screening approach, including walkbys and walkdowns performed exclusively for the ESEP, in accordance with the guidance | Yes |
| <ul style="list-style-type: none"> • 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 | Yes |
| <ul style="list-style-type: none"> • stated that the walkdown was performed by seismically trained personnel | Yes |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Wolf Creek Generating Station, Unit 1

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| <p>Notes from reviewer:</p> <p>1. Because the licensee did not initially indicate that the walkdown personnel were trained in seismic walkdown procedures. The staff requested confirmation that the walkdowns were conducted by personnel who had successfully completed training specific for seismic walkdown procedures. In the written response dated June 24, 2015 (ML15182A116), the licensee confirmed that walkdown personnel were properly trained in seismic walkdown procedures. The staff finds that the response adequately addressed the question and met the intent of the guidance for this interim evaluation.</p> | |
| <p>Deviation(s) or Deficiency(ies) and Resolution:</p> <ul style="list-style-type: none"> • No deviations or deficiencies were identified. | |
| <p>The licensee:</p> <ul style="list-style-type: none"> • Described, if 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 | <p>Yes</p> <p>Yes</p> |
| <p>The licensee:</p> <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) | <p>Yes</p> <p>Yes</p> <p>Yes</p> |
| <p>Notes from reviewer:</p> <p>1. The licensee did not describe adverse material condition of the equipment or all “conditions” of structural items (i.e., spatial interactions between block walls and other components or piping connected to tanks). The staff asked the licensee to clarify the conditions of structural items. In the written response dated June 24, 2015 (ML15182A116), the licensee stated that there are no block walls inside containment and small-bore tubing has adequate flexibility to withstand a seismic event. The staff finds that the response adequately addressed the question and met the intent of the guidance for this interim evaluation.</p> | |
| <p>Deviation(s) or Deficiency(ies) and Resolution:</p> <p>No deviations or deficiencies were identified</p> | |
| <p>The licensee reported no deviations for Wolf Creek</p> | |
| <p>If deviations were identified, there is a discussion of how the deficiencies were or will be addressed in the ESEP submittal report.</p> | <p>N/A</p> |
| <p>The NRC staff concludes that:</p> <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 | <p>Yes</p> <p>Yes</p> |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Wolf Creek Generating Station, Unit 1

V. Capacity Screening Approach and HCLPF Calculation Results

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| <p>The licensee:</p> <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 RLGGM, 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 RLGGM | <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>N/A</p> <p>Yes</p> <p>Yes (CDFM) N/A N/A</p> <p>N/A</p> <p>Yes</p> <p>Yes</p> |
| <p>Notes from reviewer: None</p> | |
| <p>Deviation(s) or Deficiency(ies) and Resolution:</p> <ul style="list-style-type: none"> • No deviations or deficiencies were identified | |
| <p>The NRC staff concludes that:</p> <ul style="list-style-type: none"> • the licensee described the implementation of the capacity screening process consistent with the intent of the guidance • the licensee presented capacity screening and calculation results, as appropriate, in the ESEP report • the method used to develop the ISRS is consistent with guidance for use in the ESEP • for HCLPF calculations, the licensee used HCLPF calculation methods as endorsed in the guidance • no anomalies were noted in the reported HCLPF | <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> |

VI. Inaccessible Items

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|---|---------------------------------|
| <p>The licensee:</p> <ul style="list-style-type: none"> • provided a list of inaccessible items • provided a schedule of the planned walkdown and evaluation for all inaccessible items • provided Regulatory Commitment to complete walkdowns | <p>No</p> <p>N/A</p> <p>N/A</p> |
| <p>Wolf Creek will complete walkdowns and evaluations and provide results by:</p> | <p>N/A</p> |

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Technical Review Checklist for Wolf Creek Generating Station, Unit 1

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| <p>Notes from reviewer:</p> <p>1. In Subsection 7.1 of Section 7.0, the licensee stated that sufficient access was provided for all ESEL items and no additional walkdowns were needed.</p> <p>Deviation(s) or Deficiency(ies) and Resolution:</p> <ul style="list-style-type: none"> No deviations or deficiencies were identified | |
| <p>The NRC staff concludes that the licensee:</p> <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 | <p>N/A</p> <p>N/A</p> <p>N/A</p> |

VII. Modifications to Plant Equipment

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| <p>The licensee:</p> <ul style="list-style-type: none"> 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 | <p>No</p> <p>N/A</p> <p>N/A</p> <p>N/A</p> |
| <p>Wolf Creek will ...</p> <ul style="list-style-type: none"> Complete modifications by: N/A Report completion of modifications by: N/A | <p>N/A</p> <p>N/A</p> |
| <p>Notes from reviewer:</p> <p>1. In Subsection 8.2 of Section 8.0, the licensee stated the following: "No ESEL items had HCLPF seismic capacities below the RLGM and, as such, no modifications are planned."</p> <p>Deviation(s) or Deficiency(ies) and Resolution:</p> <ul style="list-style-type: none"> No deviations or deficiencies were identified | |
| <p>The NRC staff concludes that the licensee:</p> <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 | <p>N/A</p> <p>N/A</p> |

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

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Technical Review Checklist for Wolf Creek Generating Station, Unit 1

additional assurance while the plant seismic risk evaluation is being conducted. In the case of Wolf Creek, in accordance with the guidance, the RLGGM used a scaled SSE at the ratio of 1.47. The application of this staff review is limited to the ESEP interim evaluation as part of NTTF R2.1: Seismic activities. As noted in the review checklist, the staff did not identify deviations or exceptions taken from the guidance and the licensee did not identify any necessary modifications. The licensee did not identify any modifications based on the interim evaluation.

In summary, the licensee, by implementing the ESEP interim evaluation, has demonstrated additional assurance which supports continued plant safety while the longer-term seismic evaluation is completed 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 Wolf Creek Generating Station.

Principal Contributors: Vladimir Graizer, Kevin Roche, Sara Lyons, Jinsuo Nie, B.P. Jain, Basavaraju Chakrapani, Kaihwa Hsu, Gerry Stirewalt, Carl Costantino (NRC Consultant)