

NRR-PMDAPEm Resource

From: Seber, Dogan
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To: Shams, Mohamed
Cc: Titus, Brett; Marshall, Michael; Wyman, Stephen; Spence, Jane; Devlin-Gill, Stephanie; Rodriguez, Ricardo; Roche, Kevin; Lyons, Sara; Candelario, Lissette; Schleicher, Lisa; Hoang, Dan; Hsu, Kaihwa; McCoppin, Michael; RidsNroDsea Resource; 50.54f_Seismic Resource
Subject: COLUMBIA GENERATING STATION- TECHNICAL REVIEW CHECKLIST RELATED TO INTERIM EXPEDITED SEISMIC EVALUATION PROCESS (TAC NOS. MF7289)
Attachments: Columbia R 2 1 Seismic ESEP NRC Review _Final.docx

May 31, 2016

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

FROM: Dogan Seber, Acting Chief
Geosciences and Geotechnical Engineering Branch 2 (RGS2)
Division of Site Safety and Environmental Analysis
Office of New Reactors

SUBJECT: COLUMBIA GENERATING STATION- 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 MF7289)

The NRC technical staff working through the Geosciences and Geotechnical Engineering Branch 2 (RGS2) completed the Technical Review Checklist of the COLUMBIA GENERATING 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. This addresses the staff review of the Expedited Seismic Evaluation Process (ESEP) Interim Evaluation 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 reviewer 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 ESEP interim evaluation 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. MF7289 for the review of the ESEP Interim Evaluation report for the COLUMBIA GENERATING STATION.

Docket Nos: 50-397

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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
COLUMBIA GENERATING STATION
DOCKET NO. 50-397

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. United States licensees with a reevaluated seismic hazard exceeding the SSE submitted an ESEP interim evaluation.

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 Columbia Generating Station

By letter dated January 20, 2016³, Energy Northwest(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 the Columbia Generating Station (Columbia).

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⁽¹⁾ | Yes |
| <ul style="list-style-type: none"> identified location of the control point and is consistent with March submittal⁽²⁾ | Yes |
| <ul style="list-style-type: none"> compared the site ground motion response spectra used to select the ESEP RLGM to the SSE. | Yes |
| Columbia had maximum scaled SSE ratio of 2.4 at 3.33 Hz | |
| Notes from the Reviewer: <ol style="list-style-type: none"> The ESEP report does not include a table listing the RLGM, but the RLGM values can be calculated by multiplying the Spectral Acceleration of the SSE in ESEP Table 4-2 by 2 or extracted from ESEP Figure 5-1. Since this ratio is greater than 2, the licensee used a factor of 2 to scale their SSE. | |
| Deviation(s) or Deficiency(ies), and Resolution: 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

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| The licensee: | |
| <ul style="list-style-type: none"> described the success path | Yes |
| <ul style="list-style-type: none"> described normal and desired state of the equipment for the success path | Yes |
| <ul style="list-style-type: none"> ensured that the success path is consistent with the plant's overall mitigating strategies approach or provided a justification for an alternate path | Yes |
| <ul style="list-style-type: none"> stated that the selection process was in accordance with the guidance or meets the intent of the guidance | Yes |
| <ul style="list-style-type: none"> used installed FLEX Phase 1 equipment as part of the success path | Yes |
| <ul style="list-style-type: none"> included FLEX Phase 2 and/or 3 connections ⁽¹⁾ | No |
| <ul style="list-style-type: none"> considered installed FLEX Phase 2 and/or 3 equipment ⁽¹⁾ | No |
| Notes from the Reviewer: <ol style="list-style-type: none"> The staff asked the licensee for information regarding the Phase 3 core cooling strategy and the inclusion of Phase 3 components on the ESEL. In its response dated May 17, 2016 (ML16139A074), the licensee communicated its plans to continue using Phase 2 strategies during Phase 3, so no additional equipment needed to be included in the ESEL. The licensee also stated it has the necessary procedures to request, receive, connect, and operate the NSRC equipment, if | |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Columbia Generating Station

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| <p>necessary. The staff finds the licensee response acceptable for the purpose of this interim evaluation.</p> <p>Deviation(s) or Deficiency(ies), and Resolution: No deviations or deficiencies were identified.</p> | |
| <p>The NRC staff concludes that:</p> <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. | <p>Yes</p> <p>No</p> |

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 the Reviewer:</p> <ol style="list-style-type: none"> Hardened containment vent and support equipment is not included in ESEL because it is already required by NRC Order EA-13-109 which is tracked separately. The licensee credits automatic realignment of the reactor core isolation cooling system (RCIC) suction from condensate storage tank (CST) to suppression pool (SP); however, the CST and CST flowpath to RCIC are not credited or seismically robust. The NRC staff requested that the licensee clarify the success path in the event that the CST remains intact, but the CST flowpath fails closed (or restricted). In its response dated May 17, 2016 (ML16139A074), the licensee clarified that the level switches used in the RCIC system to monitor the CST level and initiate the opening of the RCIC suppression pool suction isolation valve on low CST are located on a Seismic Category 1 standpipe in the Reactor Building, not on the CST. The licensee indicated that if the CST flowpath fails closed (or is restricted), the RCIC pump suction will cause the water level in the standpipe to decrease, and an automatic realignment on low CST level to the suppression pool will occur. In the event automatic realignment did not occur, the RCIC system would trip on low RCIC pump suction pressure. At that point, operators would follow procedures to correct the cause of the trip. Since the cause of the trip is due to low suction pressure from the CST, the operators would align the RCIC pump suction to the suppression pool. The operators would then place RCIC in operation with suction from the suppression pool. The staff finds the licensee response acceptable for the purpose of this interim evaluation. The licensee indicated that they have changed their Phase 3 mitigating strategy and that their next submittal of the 6-month status report will reflect the current Columbia FLEX mitigation strategy as required by EA-12-049 (ML16139A074). <p>Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were identified.</p> | |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Columbia Generating Station

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| <u>For PWR Plants Only</u> | |
| 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. | N/A |
| <u>For BWR Plants Only</u> | |
| 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. | Yes |
| Notes from the Reviewer: None Deviation(s) or Deficiency(ies), and Resolution: No deviations or deficiencies were identified. | |
| 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 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

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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 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 Yes |
| Notes from the Reviewer: None Deviation(s) or Deficiency(ies), and Resolution: No deviations or deficiencies were identified. | |
| The licensee: <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 | Yes Yes |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Columbia Generating Station

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| <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>N/A</p> |
| <p>Notes from the Reviewer: None</p> <p>Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were identified.</p> | |
| <p>The licensee reported deviations for Columbia.</p> | <p>No</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>N/A</p> |

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

Technical Review Checklist for Columbia Generating Station

V. Capacity Screening Approach and High Confidence/Low Probability of Failure (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 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 | <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p> <p>N/A</p> <p>Yes</p> <p>Yes</p> |
| <p>Notes from the Reviewer: None</p> <p>Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were identified.</p> | |
| <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 ⁽¹⁾ provided a schedule of the planned walkdown and evaluation for all inaccessible items provided Regulatory Commitment to complete walkdowns | <p>Yes</p> <p>No</p> <p>No</p> |
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| Columbia will provide results or complete walkdown by: N/A | N/A |
| Notes from the Reviewer: 1. A total of twenty three (23) items in the ESEL were inaccessible during walkdowns due to their location within the primary containment. The licensee provided a description of circumstances and method of evaluation for each of the items. The licensee indicated that each of these inaccessible items were evaluated in accordance with EPRI NP-6041. The licensee confirmed installed conditions by the use of photograph from a June 2013 plant outage, plant design drawings and/or similarity to other components. The staff finds the licensee's description and basis an acceptable approach for this interim evaluation. | |
| Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were identified. | |
| The NRC staff concludes that the licensee: <ul style="list-style-type: none"> listed inaccessible items committed to provide the results (e.g., walkdowns, walkbys, etc.) of the remaining inaccessible items consistent with the guidance substitutions, if needed, were appropriately justified | Yes N/A N/A |

VII. Modifications

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| The licensee: <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. | No N/A N/A N/A |
| Columbia will: <ul style="list-style-type: none"> complete modifications by N/A report completion of modifications by: <u>N/A</u> | |
| Notes from the Reviewer: None | |
| Deviation(s) or Deficiency(ies), and Resolution: No deviation or deficiencies were identified. | |
| 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 | N/A N/A |

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

NTTF Recommendation 2.1 Expedited Seismic Evaluation Process

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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 Columbia, it had maximum scaled SSE ratio of 2.4 at 3.33 Hz. Since this ratio is greater than 2, the licensee used a factor of 2 to scale their SSE. 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 were taken from the guidance.

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 Columbia Generating Station.

Principle Contributors:

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