



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

August 22, 2017

Mr. Fadi Diya  
Senior Vice President and  
Chief Nuclear Officer  
Ameren Missouri  
Callaway Plant  
P.O. Box 620  
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 – NRC RESPONSE TO REQUEST FOR  
EXTENSION OF SEISMIC PROBABILISTIC RISK ASSESSMENT SUBMITTAL

Dear Mr. Diya:

The purpose of this letter is to provide the U.S. Nuclear Regulatory Commission (NRC) staff's response to the letter received from Union Electric Company, doing business as Ameren Missouri (the licensee), on June 15, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17166A474), related to post-Fukushima seismic hazard reevaluations. This letter requests an extension of the submittal date of the seismic probabilistic risk assessment (SPRA) associated with the seismic hazard reevaluation for Callaway Plant, Unit 1 (Callaway). The request was made in order to fully complete SPRA modeling and analysis in order to more realistically quantify the seismic risk at Callaway. The NRC staff has determined that extending the submittal date of the SPRA is acceptable.

#### BACKGROUND

By letter dated March 12, 2012, the NRC issued a request for information under Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (hereafter referred to as the 50.54(f) letter), to all nuclear power reactor licensees and construction permit holders in response to lessons learned from the March 2011 accident at Japan's Fukushima Dai-ichi nuclear power plant (ADAMS Accession No. ML12053A340). Enclosure 1 of the 50.54(f) letter requested that licensees perform seismic hazard reevaluations using present-day methodologies and guidance, and then assess the impact of the reevaluated hazard on the plant (e.g., through an SPRA). The NRC staff would review the completed responses to these assessments to determine if there is a need for any additional regulatory actions, such as a plant-specific backfit.

Concurrent with the reevaluation of seismic hazards, licensees were required to develop and implement mitigating strategies under NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A735). In order to proceed with the implementation of Order EA-12-049, licensees used the current design basis seismic hazard or the most recent seismic hazard information, which may not be based on present-day methodologies and guidance, in developing their mitigation strategies.

By letter dated October 27, 2015 (ADAMS Accession No. ML15194A015), the NRC made a determination of which licensees were to perform: (1) an SPRA; (2) limited scope evaluations; or (3) had no further actions to perform based on a comparison of the reevaluated seismic hazard and the site's design-basis earthquake. As documented in that

letter, Callaway is expected to complete an SPRA, which will also assess high frequency ground motion effects, and a limited-scope evaluation for the spent fuel pool (SFP). These seismic evaluations are expected to be submitted to the NRC by December 31, 2017. Because the SPRA results are used to develop the seismic Mitigation Strategies Assessment (MSA), the seismic MSA is also due at that time.

By letter dated June 15, 2017, the licensee requested an extension of the submittal date for the SPRA until December 31, 2018. Although not specifically mentioned in the letter, this request also includes, by inference, an extension to the completion and submittal of the corresponding seismic MSA. The letter also specifically states that the SFP evaluation will still be submitted by December 31, 2017.

## EVALUATION

The staff's evaluation of the licensee's request for extension of the seismic reevaluations considered several factors including: (1) the schedule of the Callaway submittal, including deferment, as it relates to the NRC's overall SPRA submittal schedule; (2) the additional defense-in-depth capabilities achieved through Order EA-12-049 and Order EA-12-051, "Reliable Spent Fuel Pool Instrumentation" (ADAMS Accession No. ML12056A044); (3) the magnitude of the reevaluated seismic hazard at Callaway versus the design-basis earthquake; (4) the seismic design margin currently existing in nuclear power plants; and (5) the documented ability of Callaway, specifically, to cope with earthquakes larger than the design-basis earthquake. Below is a brief description of each consideration.

As shown in the NRC's October 27, 2015, letter, licensees were requested to perform specific evaluations based on a number of criteria associated with the magnitude of their reevaluated seismic hazard and how it compared to their design basis seismic hazard. A subset of licensees were requested to perform SPRAs. Callaway was one of the sites requested to perform an SPRA. Within this subset, there is a range of dates by which licensees are to submit their SPRA evaluations. The range of dates begins in March 2017 and continues through December 2019. The ordering of licensee submittals within this range of dates was not based on safety or seismic risk concerns. That is to say, the plants are not graded within this submittal date range in order of increasing or decreasing seismic risk. The Callaway extension request moves the SPRA submittal within the existing date range and not beyond the last date in the range. Therefore, the NRC staff's basis for continued safe operation, which is stated in a May 9, 2014 (ADAMS Accession No. ML14111A147), letter, is still applicable.

The staff also considered the additional defense-in-depth that has been achieved for coping with an extended loss of alternating current power and loss of normal access to the ultimate heat sink due to external events, including those caused by seismic and flooding events, as a result of Callaway's compliance with Orders EA-12-049 and EA-12-051. The NRC staff issued Callaway's safety evaluation regarding implementation of these mitigating strategies and the reliable spent fuel pool instrumentation on February 2, 2017 (ADAMS Accession No. ML17010A332). NRC inspectors are scheduled to verify implementation at Callaway in August 2017. The completion of this work results in a safety benefit and an enhanced ability to mitigate beyond-design-basis events at Callaway during the period of deferment.

Another significant consideration of the NRC staff was the relationship between the existing design-basis earthquake and the reevaluated seismic hazard at the Callaway site. As documented in the licensee's December 22, 2014, Expedited Seismic Evaluation Process (ESEP) report (ADAMS Accession No. ML14363A311), the maximum ratio of the reevaluated Ground Motion Response Spectrum (GMRS) when compared to the site's design-basis Safe Shutdown Earthquake (SSE) is 2.31. Figure 5-1 from the ESEP report shows a comparison of the Review Level Ground Motion (RLGM) that was used as the seismic hazard for the ESEP

evaluation to the GMRS and the SSE. As described in the following paragraphs, there is inherent seismic margin in the design of nuclear power plants, and Callaway has performed analyses demonstrating that safe shutdown equipment at the plant can cope with an earthquake at least two times the SSE.

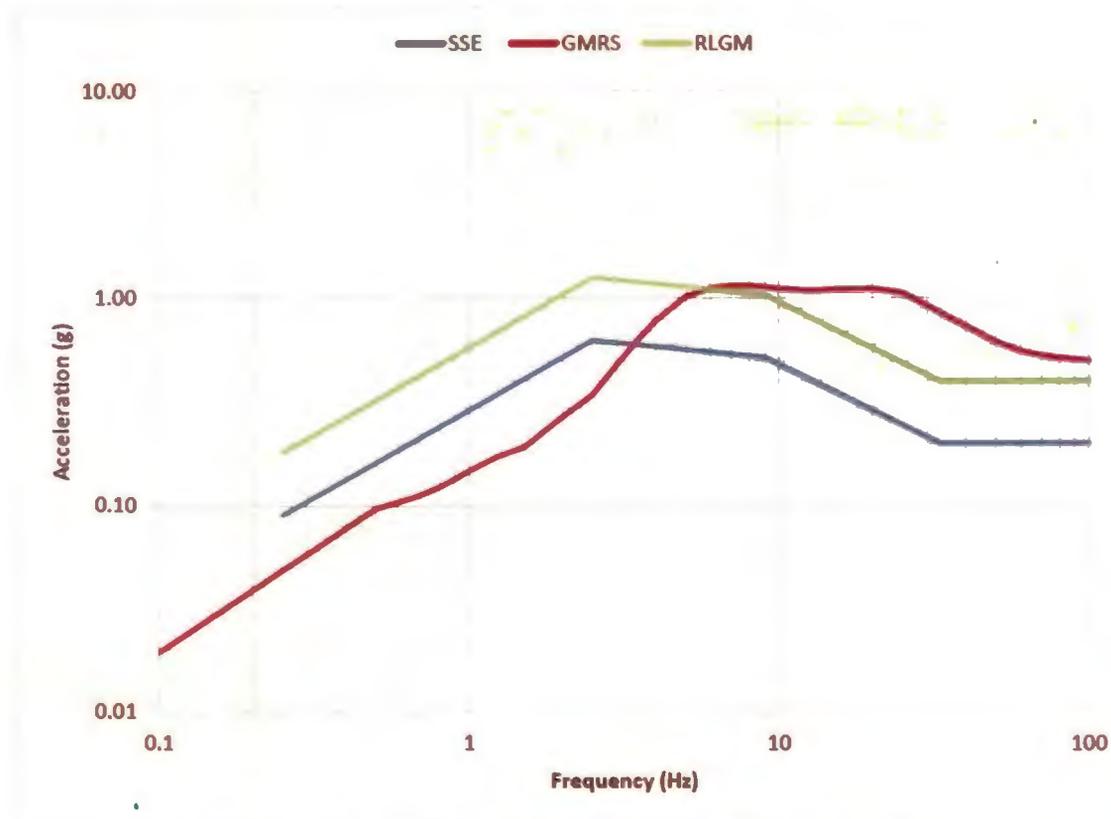


Figure 5-1: Callaway RLG vs GMRS

Information regarding the seismic design margin in nuclear plants, including NRC and industry studies summarized in the NRC's May 9, 2014, letter, outlines a number of reasons for continued operation while seismic reevaluations are continuing. These reasons include a safety margin in the design such that plants can withstand potential earthquakes exceeding the original design-basis and that the fleet-wide seismic core damage risk as a result of the reevaluated hazard did not pose a concern regarding adequate protection.

The ability of Callaway, specifically, to cope with earthquakes larger than the design-basis earthquake is documented in the December 22, 2014, ESEP report (ADAMS Accession No. ML14363A311). The staff's assessment can be found in a letter dated October 14, 2015 (ADAMS Accession No. ML15282A044). The staff's assessment concluded that the licensee demonstrated a set of mitigation strategies equipment, which could be used to maintain or restore core cooling and containment function, has additional safety margin such that this equipment can cope with an earthquake two times the SSE for Callaway.

In summary, Callaway's deferral request does not move the SPRA submittal outside the date range allotted to all plants who are to perform an SPRA. Compliance with NRC Orders EA-12-049 and EA-12-051 has provided a safety benefit and an enhanced ability to mitigate beyond-design-basis events at Callaway during the period of deferment. The combination of

the magnitude of the GMRS as compared to the SSE, the seismic capacity inherent in the design of nuclear power plants, and the Callaway-specific evaluation of the seismic capacity of safe-shutdown equipment as documented by the ESEP provides additional assurance that Callaway can cope with an earthquake larger than the design basis earthquake while the longer term seismic risk evaluations are ongoing. For these reasons, the staff finds that deferment of the SPRA submittal to support SPRA modeling refinements and analyses, in order to more realistically quantify the seismic risk at Callaway, is acceptable.

### CONCLUSION

Based on the staff's evaluation, and after consultation with the Acting Director of the NRC's Office of Nuclear Reactor Regulation, the NRC concludes that the licensee's proposal to defer submittal of the SPRA related to the 50.54(f) letter request for information for seismic events and the deferral of the corresponding seismic MSA are acceptable. Accordingly, the required response date for these activities are deferred until December 31, 2018. As stated in the June 15, 2017, letter, the staff expects that Callaway will still submit the aforementioned SFP evaluation by December 31, 2017.

If you have any questions, please contact Brett Titus, Senior Project Manager, at (301) 415-3075 or via e-mail at [Brett.Titus@nrc.gov](mailto:Brett.Titus@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Jane E. Marshall" with a stylized flourish at the end.

Jane E. Marshall, Director  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket No. 50-483

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CALLAWAY PLANT, UNIT 1 – NRC RESPONSE TO REQUEST FOR EXTENSION OF SEISMIC PROBABILISTIC RISK ASSESSMENT SUBMITTAL DATED AUGUST 22, 2017

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