NRR-DMPSPEm Resource

From: Sebrosky, Joseph
Sent: Wednesday, February 6, 2019 12:54 PM
To: 'Gropp Jr, Richard W:(GenCo-Nuc)'
Subject: Clarification questions associated with staff assessment of Peach Bottom seismic probabilistic risk assessment report dated August 28, 2018

Mr. Gropp,
By letter dated August 28, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18240A065), Exelon Generating Company, LLC (the licensee) provided its seismic probabilistic risk assessment (SPRA) report in response to Enclosure 1, item (8) of the March 12, 2012, 10 CFR 50.54(f) letter (ADAMS Accession No. ML12053A340) for Peach Bottom Atomic Power Station, Units 2 and 3 (Peach Bottom). By letter dated July 6, 2017 (ADAMS Accession No. ML17177A446), the NRC issued a generic audit plan and entered into the audit process described in Office Instruction LIC 111, "Regulatory Audits," dated December 29, 2008 (ADAMS Accession No. ML082900195), to assist in the timely and efficient closure of activities associated with the 50.54(f) letter. To support the staff's audit of the August 28, 2018, SPRA report the staff has developed the clarification questions found below. After you have time to review the clarification questions, please let me know when you could support an audit phone call to discuss these questions.
Sincerely,
Joe Sebrosky
Senior Project Manager
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Office of Nuclear Reactor Regulation
301-415-1132

Peach Bottom Atomic Power Station (PBAPS) Plant-Response Model Questions

Question 1 - Topic #15 - Documentation of the Seismic PRA (SPID Section 6.8)
Section 6.8 of the SPID, states that seismic PRA (SPRA) submittals should provide the level of detail needed to determine the validity of the PRA models "to assess the sensitivity of the results to all key aspects of the analysis to make necessary decisions as part of NTTF Phase 2 activities." Section 5.7.4 of the submittal provides the results from several sensitivity studies for uncertainties identified for the seismic PRA. NRC staff notes that in addition to these sensitivities that PBAPS identified other sources of internal events PRA modelling uncertainty in another application (i.e., request to adopt risk-informed categorization dated November 26, 2018). Given that the internal events PRA model provides the foundation for seismic event PRA, it is unclear whether the internal events PRA updates to which the licensee committed before implementation of the categorization program have been incorporated in the seismic PRA model or whether the lack of update could impact the results of PBAPS seismic PRA submittal. Considering these observations, address the following:

a) NRC's safety evaluation of PBAPS's request to adopt risk-informed categorization dated November 26, 2018, states that PBAPS committed to update the PRA model to account for the requirement for two Emergency Diesel Generator (EDG) cooling fans during periods when the outdoor temperature at the PBAPS are above the design temperature of 80°F prior to implementation of their risk-informed program. NRC staff notes that seismic events result in the likely loss of offsite power which increases the importance of EDGs and the cooling fan success criteria results in a failure mode that can have non-negligible contribution at low seismic accelerations. Therefore:
    i. Confirm that this model update of the EDG cooling fan success criteria is included in the seismic PRA or justify that exclusion of this update has a minimal impact on the submittal (i.e., seismic core damage frequency [SCDF] and seismic large early release frequency [SLERF] importance values). One way to provide this justification is to perform a sensitivity study of the updated modelling.
    ii. If the update cannot be justified to have a minimal impact on the submittal, then then provide updated seismic CDF and LERF importance values based on this and any other needed seismic PRA updates.

b) NRC's safety evaluation of PBAPS's request to adopt risk-informed categorization dated November 26, 2018, states that PBAPS committed to remove credit for core melt arrest in-vessel at high reactor pressure vessel (RPV) pressure conditions prior to implementation of their risk-informed program.
   i. Confirm that this model update of removing credit for core melt arrest in-vessel at high RPV pressure conditions in the seismic PRA has been performed or justify that exclusion of this update has a minimal impact on the submittal. One way to provide this justification is to perform a sensitivity study of the updated modelling.
   ii. If the update cannot be justified to have a minimal impact on the submittal, then provide updated seismic CDF and LERF importance values based on this and any other needed seismic PRA updates.

Question 2 - Topic #15 - Documentation of the Seismic PRA (SPID Section 6.8)
Finding F&O 1-5 expresses concern about eliminating failure modes for cases where fragilities for different failure modes are "close together". The disposition of the F&O states that the fragilities for different failure modes for components evaluated using SOV were either "not closely spaced" or were correlated. The suggested resolution recommends justification of the criterion used to define 'close' such that significant additional contributions to failure are considered. Provide and justify the criterion that was used to determine whether fragilities or different failure modes for components were 'closely spaced'?

Question 3 - Topic #15 - Documentation of the Seismic PRA (SPID Section 6.8)
The staff uses importance measures to make decisions based on the licensee's SPRA submittal in response to the 10 CFR 50.54(f) letter. Section 4.4.1 of the submittal describes the 'SSC Screening Approach' used in the SPRA development and discusses the three quantifications performed as part of the approach (termed Q1, Q2, and Q3). The discussion in Section 4.4.1 of the submittal as well as the disposition of finding F&O 3-1 indicates refinements and re-quantification of the model after the peer-review. Tables 5.4-2 through 5.4-5 and 5.5-2 through 5.5-5 provide importance measures from the SPRA based on the quantification. The information provided to the staff as part of its regulatory audit includes information for SLERF quantification for 'Quantification 5' in Appendix K (Section K.7) of the 'Seismic Quantification Notebook'. That information shows that the changes made between 'Quantification 4' and 'Quantification 5' had an appreciable impact on the SLERF quantification as well as corresponding importance measures. Prominent among the changes is the fragility for the group S-PCI which increased by about 4 times between 'Quantification 4' and 'Quantification 5'. However, the information available to the NRC staff does not include either the justification for the changes between 'Quantification 4' and 'Quantification 5' or the technical basis for the changes, especially large changes like the one for S-PCI cited above. Therefore, it is unclear whether the dominant contributors and importance measures presented in the submittal, which appears to be 'Quantification 6', have sufficient technical justification or whether an earlier quantification should be used by the staff for its decision.
Provide the justification as well as the technical basis for appreciable changes to the model in 'Quantification 5', such as that for the S-PCI fragility group, which impacted the dominant risk contributors and the corresponding importance measures. Include sufficient technical basis to support the use of the results presented in the submittal (i.e., after 'Quantification 5') for the staff's decision. If such technical basis cannot be presented, provide the information in Tables 5.5-2 through 5.5-5 of the submittal for 'Quantification 4' and discuss any potential cost-justified substantial safety improvements therefrom (see preamble of Question 6 for background information).

Question 4 - Topic #15 - Documentation of the Seismic PRA (SPID Section 6.8)
The results of the truncation sensitivity study presented in Table 5.7-3 of the submittal shows significant sensitivity to truncation limits for acceleration 'bins' referred to as %G6 and %G7. The 2009 American Society of Mechanical Engineers/American Nuclear Society (ASME/ANS) PRA Standard, as endorsed by Regulatory Guide (RG) 1.200, Revision 2 provides criteria for demonstrating truncation convergence. The change in CDF or LERF should be less than 5% for a decade change in truncation limit.
Further, the staff uses importance measures to make decisions based on the licensee's SPRA submittal in response to the 10 CFR 50.54(f) letter. The use of a different truncation limits, as shown in the sensitivity in Table 5.7-3 of the submittal, has the potential of impacting the dominant risk contributors, the corresponding importance measures and therefore, the staff's decisions.
Considering the significant sensitivity to truncation limits, discuss the impact of chosen truncation limits on the staff's decision (i.e., identifying potential cost-justified substantial safety improvements using importance measures).

Question 5 - Topic #16 - Review of Plant Modifications and Licensee Actions, If Any

Sensitivity case 1d in Section 5.7 of the submittal investigates the impact of refinement of highest acceleration (%G8) 'bin'. The results demonstrate an appreciable impact of such a refinement with a 17% increase in SLERF. As a result, it is expected that the importance measures, including the Fussell-Vesely (F-V), for SSCs based on the sensitivity will be different from the base case.
Section 5.3.2 states that human actions for Diverse and Flexible Coping Strategies (FLEX) actions are not considered to be failed (i.e., human error probabilities (HEPs) are not assigned failure probability of 1.0) for the highest acceleration bin. Substantial uncertainty exists about the feasibility of FLEX actions during a seismic event at acceleration levels far above the design basis. Factors such as environmental conditions, ability to clear debris, equipment status, and status of connecting locations for FLEX equipment contribute to such uncertainty.
The staff uses importance measures to make decisions based on the licensee's SPRA submittal in response to the 10 CFR 50.54(f) letter. The refinement of the highest bin for SLERF determination as well as removing credit for FLEX actions in that bin have the potential of impacting the dominant risk contributors, the corresponding importance measures and therefore, the staff's decisions.
Provide the information in Tables 5.5-2 through 5.5-5 of the submittal resulting from simultaneous refinement of highest acceleration (%G8) 'bin' and removal of FLEX credit for that 'bin'. Include a discussion of any changes to the dominant risk contributors.

Question 6 - Topic #16 - Review of Plant Modifications and Licensee Actions, If Any

The seismic PRA submittal presents the mean seismic CDF and seismic LERF values for both reactor units showing there is a relatively significant level of seismic risk at the plant. Sections 5.4 and 5.5 of the submittal indicates that the mean SCDF is 2.1E-05 per year for both Units 2 and 3; and the mean SLERF is 4.0E-06 and 4.1E-06 per year for Units 2 and 3, respectively. Sections 5.4 and 5.5 of SPRA submittal also present importance values for the risk-significant SSC seismic fragility failure groups, and operator failures. It appears to the NRC staff based on this information that there may be cost-justified substantial safety improvements that may reduce the seismic CDF by 1E-05 per year or the seismic LERF by 1E-06 per year. Reduction in the seismic risk contribution of the following failure event identified in the SPRA submittal appears to have the potential to significantly reduce seismic risk based on the base 3% discount rate case and a 7% discount rate sensitivity study case.

- OSP (Seismic-induced loss of offsite power)

Also, NRC staff notes that Section 5.7 of the submittal indicates for sensitivity Case 4.d that SCDF and SLERF results are sensitive to the seismic capacity of offsite power equipment which suggests that improvements in plant switchyard equipment associated with offsite power may significantly reduce seismic risk.
Considering these observations:

a) Explain whether event OSP includes failures that occur at the plant switchyard as well failures that occur in the electrical grid outside of the jurisdiction of the plant. If OSP includes failures that occur at the plant switchyard then explain whether cost-justified plant improvements associated with plant switchyard equipment could reduce the SCDF contribution by 1E-05 per year and SLERF contribution by 1E-06 per year either alone or in combination with other plant modifications. In evaluation of cost-justified plant improvements associated with plant switchyard equipment, discuss how the cost of plant improvements was considered.
b) Discuss the reason for the difference in the F-V importance values for events OSP and S-CNWG2. Based on Tables 5.4-2 and 5.4-3, the Conowingo dam offsite power fragility group (i.e., S-CNWG2) is modeled with the same fragility parameters as the other off-site power fragility group (i.e., OSP.) Given this matching fragility modeling and the fact that the offsite power sources are redundant to each other, one would expect their failures to exist together in the same cutsets and that the F-V values to be the same for each fragility group. However, the F-V values of the two fragility groups are noticeably different.

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