

**From:** [Bamford, Peter](#)  
**To:** [Grzeck, Lee](#)  
**Cc:** [Todd, Laura Frances](#)  
**Subject:** RE: RE: RE: Oconee SPRA Document Requests and Initial Questions  
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**Attachments:** [ONS SPRA Questions 04\\_22\\_19.pdf](#)

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Lee, attached please find a set of questions from our PRA group regarding the Oconee SPRA submittal. Should any of the questions need clarification, please let me know and I will arrange a conference call with our staff. We are requesting a response within 30 days, so if you cannot provide responses by 5/22/2019, please let me know that as well. You can place your responses to each question on the Certrec IMS ePortal.

We have two other NRC groups in addition to the PRA group reviewing the submittal (fragility and hazard), so it is possible that more questions could follow.

Thanks.

Peter Bamford  
Senior Project Manager  
Nuclear Regulatory Commission (NRR/DLP/PBMB)  
(301)415-2833

## Oconee Nuclear Station (ONS) Seismic Probabilistic Risk Assessment – Questions from NRC PRA Group

### Question 1 – Topic 12: Selection of Dominant Risk Contributors that Require Fragility Analysis Using the Separation of Variables Methodology (Screening, Prioritization, and Implementation Details (SPID) Section 6.4.1)

Section 4.4.1 of the submittal states, “[f]or the newly identified top contributors that were conservatively biased, more detailed fragilities were developed as separation of variables (SOV) or conservative deterministic failure margin (CDFM) fragilities.”

This issue was the topic of seismic probabilistic risk assessment (SPRA) peer review Facts and Observations (F&O) 23-3 regarding supporting requirements (SRs) C-SFR-E2 and C-SFR-E3, which states that top risk contributors for seismic large early release frequency (SLERF) are not realistic and some risk contributors for seismic core damage frequency (SCDF) are also not realistic. The disposition to this F&O states that, following a refinement process, “top fragility contributors were either realistic or, if they were not, the degree of conservatism was justified for its relative impact on the overall risk results.” However, the fragilities for at least one-half of the top 10 seismic-induced failures reported in Tables 5.4-2 and 5.5-2 of the submittal used representative fragilities. The NRC staff notes that conservatisms, such as representative values, can mask the significance of other structures, systems, and components (SSCs). The NRC staff is not assessing the impact on SCDF and SLERF, but whether the modeling of these SSCs is masking the risk importance of other SSCs, thereby impacting the decision on this submittal.

- a. Based on F&O 23-3 description, disposition, and the discussion above, provide justification for not performing a more detailed fragility analysis (e.g., CDFM or SOV approaches) for the SSCs in Tables 5.4-2 and 5.5-2 for which a representative fragility was used,. The justification should discuss the risk importance as compared to degree of conservatism and the impact of the modeling choice on the decision based on this SPRA submittal (i.e., appreciable changes to the importance measures of risk contributors in Tables 5.4-2 and 5.5-2).
- b. Fragility sensitivity analyses on SCDF and SLERF were performed for a majority of these SSCs, as reported in Table 5.7.1 of the SPRA submittal. Provide Tables 5.4-2 and 5.5-2 for Sensitivity Case SY-1p (reactor coolant pump and reactor coolant loop piping) and discuss the impact of the results to the decision based on the SPRA submittal (i.e., appreciable changes to the importance measures of risk contributors in Tables 5.4-2 and 5.5-2).

### Question 2 – Topic 13: Evaluation of LERF (SPID Section 6.4.1)

For F&Os 25-3 and 25-4, regarding SR C-SPR-E6, the peer review assessed this SR to be Capability Category (CC)-I because the SPRA uses a conservative method for evaluating LERF and does not quantify the LERF contributors identified in the PRA standard. The dispositions to these F&Os state that the LERF analysis performed in accordance with NUREG/CR-6595 considers it to be sufficient since it is identified in Regulatory Guide (RG) 1.174, Revision 3. Table B-4 of RG 1.200, in relation to SR LE-A1, states that NUREG-6595 is inadequate for CC-

II. Furthermore, several SRs in Part 5 of the 2013 ASME/ANS PRA Standard (i.e., Addendum B), endorsed by the SPID, allow the use of NUREG-6595 sequences to meet CC-I only, whereas Section 6.6.1 of the EPRI SPID stipulates that the SPRA evaluations are expected to meet CC-II. Finally, RG 1.174, Revision 3 states that the approach described in NUREG/CR-6595 may be used to quantify LERF only in those cases when the plant is not close to the CDF and LERF acceptance guidelines.

- a. Provide justification, such as a sensitivity study, that the use of NUREG/CR-6595, which results in lack of realism in the SLERF analysis, does not impact the decision for this SPRA submittal (i.e., identifying potential substantial safety enhancements using importance measures from the SPRA).

Based on the SPRA results provided in Sections 5 and 6 of the SPRA submittal, the NRC staff notes that SLERF (Table 5.5-2) is dominated by the seismic failure of engineered safeguards terminal cabinets (ESTCs) at each unit that fail the letdown isolation valves. Section 6 of the submittal appears to indicate that the licensee will be implementing a plant modification at each unit to provide a means of alternate letdown isolation that, according to Sensitivity Case MOD in Table 5.7.1, is expected to substantially reduce SLERF.

- b. Provide a description of the PRA model revisions made to model this plant modification. Include a justification for the SLERF reduction from the proposed modification reported in Sensitivity Case MOD.

The staff notes that the licensee has not provided a regulatory commitment to perform this modification on the Oconee units. The staff also notes that there is an ongoing industry effort that is, in part, projected to provide a standard protocol for treatment of the Fukushima 50.54(f) responses regarding commitments. Depending on how Duke responds to this industry effort, as it applies to the Oconee SPRA submittal, the NRC staff may have further questions regarding crediting of these modifications as part of its decision on this submittal.

### **Question 3 – Topic 14: Peer Review of the Seismic PRA, Accounting for NEI 12-13 (SPID Section 6.7)**

The dispositions to F&O 25-14 and 26-2, related to SRs C-SPR-B1 and C-SPR-A1, respectively, regarding applicability of the accident sequences, system logic, and initiating events in the internal events PRA model to the SPRA, state that the majority of the items did not require updating the SPRA model. However, for the remaining items, the disposition states that they were considered for inclusion. It is unclear to the NRC staff how the systematic review was performed to identify the items for inclusion in the SPRA. The rationale for exclusion of any of the identified items from the SPRA used for this submittal is also unclear. In light of these observations:

- a. Describe the systematic review performed to identify the internal events modeling assumptions identified as not applicable to the SPRA and disposition the cited F&Os.
- b. For the items that were considered to be applicable to the SPRA but excluded from the SPRA used for this submittal, provide justification, such as a sensitivity study, that the exclusion of these items do not impact the decisions for this submittal (i.e., identifying potential substantial safety enhancements using importance measures from the SPRA ).

**Question 4 – Topic 14: Peer Review of the Seismic PRA, Accounting for NEI 12-13 (SPID Section 6.7)**

Section 5.4 of the submittal states that the risk importance measures were determined using the “ACUBE” results. However, the disposition to F&O 25-1, related to SR C-SPR-E3, states the required truncation value based on convergence was not achieved in accordance with SR QU-B3 of the ASME/ANS PRA standard. F&O 25-1 basis states that Supporting Requirement QU-B3 requires that convergence be demonstrated by the change in the final CDF value be no greater than 5% of the previous decade.” The suggested resolution for F&O 25-1 states “Investigate and document possible model or quantification structural changes to increase efficiency,” however, the disposition does not discuss model or quantification structural changes undertaken to address the F&O. The disposition also states that the truncation value used to quantify seismic risk could only achieve a difference of 5.4 and 9 percent for CDF and LERF, respectively, and that based on no changes in the risk results and insights with the lowest achievable truncation, the levels chosen were deemed reasonable. The NRC staff notes that risk results using truncation values that do not achieve convergence can be unstable (i.e., inaccurate), potentially impacting the dominant risk contributors, the corresponding importance measures and therefore, the NRC staff’s decisions.

- a. Discuss whether the model or quantification structural changes were undertaken to address the concern raised in F&O 25-1.
- b. Provide justification to support the assertion that no changes in the risk results and insights were noted with the lowest achievable truncation level such that the decision based on this SPRA submittal would not be impacted (i.e., appreciable changes to the importance measures of risk contributors).

**Question 5 – Topic 14: Peer Review of the Seismic PRA, Accounting for NEI 12-13 (SPID Section 6.7)**

F&O 25-10, related to SR C-SPR-A2, concerns the identification of seismically-induced fires. The F&O description discusses the process documented in a report titled “Oconee Nuclear Plant Seismic-Induced Flood and Fire Assessment.” Although the F&O disposition provided in the submittal appears to not identify any additional fire scenarios the staff’s review notes that the licensee’s process did identify four seismically-induced fire scenarios. It is unclear to the NRC staff if these scenarios were incorporated into the SPRA model used for the submittal or the rationale for their exclusion. In light of these observations:

- a. Provide clarification if the SPRA used for this submittal included the four seismically-induced fire scenarios. If the scenarios were included, based on the “suggested resolution” for F&O 25-10, clarify whether a focused-scope peer-review was performed or justify not performing such a review.
- b. If the scenarios were not included in the SPRA model, provide justification, such as a sensitivity study, that the exclusion of these scenarios does not impact the decision

based on this SPRA submittal (i.e., appreciable changes to the importance measures of risk contributors).

**Question 6 – Topic 14: Peer Review of the Seismic PRA, Accounting for NEI 12-13 (SPID Section 6.7)**

F&O 25-13, related to SR C-SPR-B6, concerns the criteria used to screen 124 relays from the SPRA model. The disposition states that an updated analysis was performed that determined 80 of the 124 relays were screened based on recovery from the relay chatter consequence. The remaining forty-four relays were screened based on circuit analysis. The F&O is related to SR SPR-B6 according to which the SPRA should include effects of such relays in the system analysis. It is unclear to the NRC staff how the operator actions associated with the 80 relays were evaluated and whether they were incorporated into the SPRA model used for the submittal. In light of these observations:

- a. Clarify if the SPRA model used for the submittal was updated to include the operator actions for recovery from all the 80 relay chatter events. If the operator actions were included, provide confirmation that the approach used to evaluate the operator actions and develop the corresponding human error probabilities (HEPs) are consistent with the peer-reviewed SPRA and existing plant procedures.
- b. If the SPRA model did not include operator actions for recovery from any of the 80 relay chatter events, provide justification, such as screening criteria consistent with the ASME/ANS PRA Standard, to exclude these events from the model or a sensitivity study to show that their exclusion does not impact the staff's decision based on the results of the SPRA submittal.
- c. Clarify if sensitivity studies SY-3a, SY-3b and HR-2b included the operator actions for recovery of the 80 relay chatter events mentioned in F&O 25-13. If not, incorporate these operator actions into the SPRA model and provide updated results for the three sensitivity cases or justify that the exclusion of the operator actions for the recovery of the 80 relay chatter events will not change the outcome of three sensitivity studies.

**Question 7 – Topic 14: Peer Review of the Seismic PRA, Accounting for NEI 12-13 (SPID Section 6.7)**

It appears that all internal events findings not related to LERF have been closed out via the closure review process in Appendix X to NEI 05-04/07-12/12-13. The staff's review noted that risk significant differences exist between the units, such as the reactor coolant pump (RCP) seal modeling and internal flooding. To address this issue, the closure review team stated that individual unit models were developed for these two items. However, Section 4.1.1 of the SPRA submittal states that the SPRA model uses a Unit 1 lead unit concept. It is unclear to the NRC staff how the lead unit for the SPRA was determined and how differences between the units as well as shared systems were captured. In light of these observations:

- a. Justify the use of Unit 1 as the SPRA lead unit model. Include in this discussion what modifications were made to the underlying IEPRA logic used in the SPRA model to maintain fidelity to the original IEPRA model development.

- b. Discuss the differences between the units in terms of variability in SSCs, their design, and their locations, and how the differences were captured in the SPRA used in the submittal. Include justification that these unit differences do not impact the decision regarding the SPRA submittal. It is recognized that the results of Sensitivity Case OU represents one such difference, however, the impact of other differences is unclear.
- c. The submittal does not include any discussion of sensitivity analysis for the internal flooding differences which can impact the identification and modeling of seismically-induced flood sources. Clarify how the SPRA PRA lead unit model addresses the seismically-induced flooding differences between units. Provide justification, such as a sensitivity study, that unit differences related to risk of internal flooding do not impact the decision regarding the SPRA submittal (i.e., appreciable changes to the importance measures of risk contributors).
- d. Discuss, with justification, whether and how the impact of a seismic event on shared plant systems (e.g., cross connects and storage tanks) as well as common equipment used by multiple plants was considered and included in the SPRA used for this submittal.

#### **Question 8 – Topic 15: Documentation of the Seismic PRA (SPID Section 6.8)**

Section 5.6 of the submittal provides uncertainty analysis SCDF and SLERF results for the 5%, 50% (median), and 95% percentile values. The ASME/ANS PRA standard for SR QU-A3 for CC-II requires that the mean risk values be provided. Furthermore, according to the NRC staff memorandum dated August 29, 2017 (ADAMS Accession No. ML17146A200), the NRC staff utilize the mean SCDF and SLERF to develop a recommendation on whether a plant should move forward as a Group 1, 2, 3 plant. Provide the mean values for SCDF and SCLERF.

#### **Question 9 – Topic 15: Documentation of the Seismic PRA (SPID Section 6.8)**

According to Section 5.1.2 of the SPRA submittal, Diverse and Flexible Coping Strategies (FLEX) is credited in the SPRA to provide primary injection for small-small loss of coolant accident (SSLOCA) mitigation. In addition, F&O 25-7 and Section 5.3.2 of the submittal discuss that the Phase 3 FLEX equipment and supplies from the Regional Response Center (RRC) will be available within 24 hours to justify the assumption that actions to stabilize the plant would be successful to prevent reaching core damage after 36 hours for SSLOCA scenarios in which there is no depressurization. Sensitivity Case HR-2a (Table 5.7.1 of the SPRA submittal) shows that there is no change in either SCDF or SLERF from removing credit for FLEX. Clarify if this result accounts for removing credit for both onsite and offsite FLEX equipment. If not, identify which FLEX credit is not included in Sensitivity Case HR-2a and provide justification, such as a sensitivity analysis that removes both onsite and offsite FLEX equipment credits simultaneously, that crediting FLEX does not impact the NRC staff's decision regarding the SPRA submittal (i.e., appreciable changes to the importance measures of risk contributors).

**Question 10 – Topic 15: Documentation of the Seismic PRA (SPID Section 6.8)**

Sections 5.4 and 5.5 of the submittal state that the SCDF and SLERF are  $3.2E-05$  and  $1.3E-05$  per year, respectively. However, the top fifteen SCDF cutsets listed in Table 5.4-1 cumulatively add to  $3.29E-05$  per year (top twenty cutsets cumulatively equal  $4.19E-05$  per year). Similarly, the top eight SLERF cutsets listed in Table 5.5-1 add to  $1.37E-05$  per year (top ten cutsets equal  $1.65E-05$  per year). It is unclear to the NRC staff why the cumulative risk values of a few cutsets are greater than the stated total risk values. Furthermore, it is unclear whether there is a discrepancy in the cutset values, which could skew the SPRA submittal results as it is the usual practice to determine F-V values using quantification cutsets. In light of these observations:

- a. Provide clarification of the apparent discrepancy between total seismic risk values and the associated cutset values.
- b. Describe what quantification cutsets were used to determine risk-importance measures. If a different set of cutsets were used other than those provided in the submittal, then provide those cutsets.

**Question 11 – Topic 15: Documentation of the Seismic PRA (SPID Section 6.8)**

The results of Sensitivity Case IE-1d provided in Section 5.7 of the submittal shows a significant increase in SCDF when the number of hazard intervals is increased from 10 to 12. However, insufficient information is provided in the submittal to determine whether the dominant contributors and importance measures are correspondingly impacted significantly. Considering the significant sensitivity to the number of hazard intervals, provide justification that the chosen number of hazard intervals does not impact the decision for this submittal (i.e., identifying potential substantial safety improvements using SPRA results and importance measures). This justification could include providing Tables 5.4-1, 5.4-2, 5.4-3, 5.5-1, 5.5-2, and 5.5-3 results for the sensitivity case and discussing the significance of these results (Tables 5.4-2, 5.4-3, 5.5-2, and 5.5-3) to the decision regarding the SPRA submittal (i.e., appreciable changes to the importance measures of risk contributors).

**Question 12 – Topic 16: Review of Plant Modifications and Licensee Actions, If Any**

Table 5.7.1 of the SPRA submittal provides a summary of SPRA sensitivity cases with the associated changes in SCDF and SLERF. It is unclear to the NRC staff how some values in Table 5.7.1 were derived as the calculated values do not appear to be correlated as they should. As an example, the entry for HR-2b shows SCDF of  $1.33E-03$ /year, delta SCDF of  $1.29E-03$ /year, and % delta SCDF as 3662%. The staff is unable to reproduce the % delta SCDF value for HR-2b in Table 5.7.1.

Clarify the derivation of the values in Table 5.7.1 or provide an updated version of Table 5.7.1, if necessary.