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10 CFR 50.90
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RS-21-009

January 22, 2021

U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

LaSalle County Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Response to Request for Additional Information Regarding the License Amendment Request to Adopt 10 CFR 50.69 (EPID L-2020-LLA-0017)

References:

1. Letter from D. Murray (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, Application to Adopt 10 CFR 50.69, "Risk-informed categorization and treatment of structures, systems, and components for nuclear power reactors," dated January 31, 2020 (ML20031E699)

2. Letter from B. Vaidya (Project Manager, U.S Nuclear Regulatory Commission) to B. Hanson (Exelon Generation Company, LLC), "LaSalle County Station, Unit Nos. 1 And 2 – Request For Additional Information Regarding License Amendment Request To Renewed Facility Operating Licenses To Adopt 10 CFR 50.69, 'Risk-Informed Categorization And Treatment Of Structures, Systems, And Components For Nuclear Power Reactors' (EPID L-2020-LLA-0017)," dated September 3, 2020 (ML20240A218)

3. Letter from B. Vaidya (Project Manager, U.S Nuclear Regulatory Commission) to B. Hanson (Exelon Generation Company, LLC), "LaSalle County Station, Units 1 And 2 - Correction To Request For Additional Information Regarding License Amendment Request To Renewed Facility Operating Licenses To Adopt 10 CFR 50.69, 'Risk-Informed Categorization And Treatment Of Structures, Systems, And Components For Nuclear Power Reactors' (EPID L-2020-LLA-0017)," dated September 17, 2020 (ML20253A342)

4. Letter from B. Vaidya (Project Manager, U.S. Nuclear Regulatory Commission) to B. Hanson (Exelon Generation Company, LLC), "LaSalle County Station, Unit Nos. 1 and 2 – Request for Additional Information Regarding License Amendment Requests for Amendments to Renewed Facility Operating Licenses to Adopt 10 CFR 50.69, 'Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Reactors' and to Adopt TSTF-505, Revision 2, 'Provide Risk-

Informed Extended Completion Times – RITSTF Initiative 4B' (EPID L-2020-LLA-0017 AND EPID-L-2020-LLA-0018)," dated September 29, 2020 (ML20247J408)

5. Letter from D. Gullott (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information regarding LaSalle License Amendment Request to Renewed Facility Operating Licenses to Adopt 10 CFR 50.69, 'Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Reactors' (EPID L-2020-LLA-0017)," dated October 1, 2020 (ML20275A292)

6. Letter from D. Murray (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information regarding LaSalle License Amendment Request to Renewed Facility Operating Licenses to Adopt 10 CFR 50.69, 'Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Reactors' (EPID L-2020-LLA-0017)," dated October 16, 2020 (ML20290A791)

7. Letter from D. Murray (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "LaSalle County Station, Unit Nos. 1 and 2 – Response to Request for Additional Information Regarding License Amendment Requests for Amendments to Renewed Facility Operating Licenses to Adopt 10 CFR 50.69, 'Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Reactors,' and to Adopt TSTF-505, Revision 2, 'Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4b' (EPID L-2020-LLA-0017 and EPID-L-2020-LLA-0018)," dated October 29, 2020 (ML2030A307)

8. Email from B. Purnell (U.S. Nuclear Regulatory Commission) to J. Taken (Exelon Generation Company, LLC), "LaSalle County Station, Units 1 and 2 – Request for Additional Information Regarding the License Amendment Request to Adopt 10 CFR 50.69 (EPID L-2020-LLA-0017)," dated December 11, 2020 (ML20346A104)

In Reference 1, Exelon Generation Company, LLC (EGC) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for an amendment to Renewed Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station, Units 1 and 2 (LSCS).

EGC's proposed license amendment request (LAR) would modify the licensing basis by the addition of a license condition to allow for the implementation of the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.69, "Risk-informed categorization and treatment of structures, systems and components for nuclear power reactors."

References 2 through 7 provide detail of various requests for additional information and EGC responses to those requests.

Reference 8 provides details of the request for additional information addressed in this letter. On December 9, 2020, a clarification call between the NRC and EGC was held. No changes to the proposed RAIs were required. NRC and EGC agreed that response to the RAIs would be submitted no later than January 25, 2021.

EGC has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in Reference 1. The supplemental information provided in this letter does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. Furthermore, the supplemental information provided in this letter does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

Attachment 1 to this letter contains the requests for additional information followed by EGC responses. Attachment 2 contains the proposed Electric Power Research Institute (EPRI) markups. Attachment 3 contains a list of acronyms used in this letter.

There are no regulatory commitments contained in this response.

Should you have any questions regarding this submittal, please contact Jason Taken at 630-806-9804.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 22nd day of January, 2021.

Respectfully,

Dwi Murray
Sr. Manager, Licensing
Exelon Generation Company, LLC

Attachment 1: Response to Request for Additional Information
Attachment 2: Proposed EPRI Markups
Attachment 3: List of Acronyms

cc: NRC Regional Administrator – Region III
NRC Senior Resident Inspector – LaSalle County Station
NRC Project Manager, NRR – LaSalle County Station
Illinois Emergency Management Agency – Division of Nuclear Safety

ATTACHMENT 1

LaSalle County Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Response to Request for Additional Information

ATTACHMENT 1

Response to Request for Additional Information

APLC 50.69-ROUND 2 RAI NO. 01-01:

To support the U.S. Nuclear Regulatory Commission (NRC) staff's regulatory finding on Title 10 of the Code of Federal Regulations (CFR) 50.69 (e) for the proposed alternative seismic approach, Probabilistic Risk Assessment Licensing Branch C (APLC) Request for Additional Information (RAI) No. 01 (ADAMS Accession No. ML20240A218) requested an explanation of statements made by the licensee in Section 3.2.3 of the enclosure to the license amendment request (LAR; ADAMS Accession No. ML20031E699). These statements related to the licensee assessing the need to "update, as appropriate, the structure, system, and component (SSC) categorization" for the proposed alternative seismic approach in accordance with 10 CFR 50.69(e) if the "LSCS [LaSalle County Station] seismic hazard changes from medium risk (i.e., Tier 2) at some future time."

In its response to APLC RAI No. 01 (ADAMS Accession No. ML20275A292), the licensee stated that for the case where the seismic hazard is reduced such that it meets the criteria for the "Tier 1" approach in Electric Power Research Institute (EPRI) Report 3002012998, if categorization changes are warranted, "they will be implemented." Further, the licensee stated that "seismic considerations for subsequent system categorization activities will be performed in accordance with the guidance in EPRI 3002012988 Section 2.2, Low Seismic Hazard/High Seismic Margin Sites."

Similarly, in the response to APLC RAI No. 01, the licensee stated that for the case where the seismic hazard increases such that a seismic probabilistic risk assessment (SPRA) becomes necessary to demonstrate adequate seismic safety, if categorization changes are warranted, "they will be implemented." Further, the response states that "seismic considerations for subsequent system categorization activities will follow the guidance be performed [sic] in accordance with NEI 00-04 criteria, as recommended in EPRI 3002012988 Section 2.4, High Seismic Hazard/Low Seismic Margin Sites."

Regulatory Position C.9 of RG 1.201, Revision 1 (ADAMS Accession No. ML061090627), states, in part: "As part of the NRC's review and approval of a licensee's or applicant's application requesting to implement §50.69, the NRC staff intends to impose a license condition that will explicitly address the scope of the PRA and non-PRA methods used in the licensee's categorization approach. If a licensee or applicant wishes to change its categorization approach and the change is outside the bounds of the NRC's license condition (e.g., switch from a seismic margins analysis to a seismic PRA), the licensee or applicant will need to seek NRC approval, via a license amendment, of the implementation of the new approach in their categorization process."

Section 2.3, "Description of the Proposed Change," of the enclosure to the LAR proposes the addition of a condition to the renewed operating license of LSCS, Units 1 and 2, to document the NRC's approval of the use of 10 CFR 50.69 for the licensee. The proposed license condition explicitly identifies the proposed alternative seismic approach, and states, "prior NRC approval, under 10 CFR 50.90, is required for a change to the categorization process specified above (e.g., change from a seismic margins approach to a seismic probabilistic risk assessment approach)."

The licensee's response to APLC RAI No. 01 appears to be inconsistent with the licensee's proposed license condition because the statements made by the licensee in the response indicate that the licensee will start to and continue to use process(es) outside the bounds of the proposed alternative seismic approach (i.e., the "Tier 2" approach), such as the "Tier 1" approach and SPRA, without prior review and approval by the NRC staff.

Confirm that the licensee will request prior NRC approval, consistent with the proposed license condition, if the licensee's feedback process determines that a process different from the proposed alternative seismic approach is warranted for seismic risk consideration in categorization under 10 CFR 50.69. Alternatively, provide details of all the approaches, with the corresponding bases and justifications, that the licensee's proposed 10 CFR 50.69 program will use for seismic risk consideration, and provide the associated conforming modifications to the proposed license condition.

EGC RESPONSE:

Exelon Generation Company, LLC (EGC) confirms that prior NRC approval will be requested, consistent with the proposed license condition, if EGC's feedback process determines that a process different from the proposed alternative seismic approach is warranted for seismic risk consideration in categorization under 10 CFR 50.69.

APLC 50.69-ROUND 2 RAI NO. 4E-01:

The staff requested information through APLC 50.69 RAI No. 4e (ADAMS Accession No. ML20240A218) to support its finding on 10 CFR 50.69 (b)(2)(ii) for the proposed alternative seismic approach. APLC 50.69 RAI No. 4e requested information on the use of failure probabilities other than the 1E-4 value and how the use of the "other" value would be accepted by the NRC staff. In its response in supplement dated October 16, 2020 (ADAMS Accession No. ML20290A791), the licensee states that "more realistic seismic-induced failure probabilities may be developed for the surrogates." Step 7 in Attachment 2 to the licensee's supplement dated October 16, 2020 also states that "other appropriately justified values may be used" for the failure probability used in the surrogate sensitivity.

In its response to APLC 50.69 RAI No. 4b, the licensee provided justification for the 1E-4 failure probability for the surrogate event. Specifically, the licensee explained that the 1E-4 failure probability for the surrogate event was actually based on the occurrence frequency for seismically induced loss-of-offsite power (LOOP). The licensee's justification included convolution of the hazard and LOOP fragility from three plants. The licensee's justification, as noted in the response to APLC 50.69 RAI No. 4b, is only for the 1E-4 failure probability for the surrogate event. Further, the example demonstration of the categorization results from the proposed alternative seismic approach in response to APLC 50.69 RAI No. 4d also used only 1E-4 as the failure probability for the surrogate event.

The licensee's response to APLC 50.69 RAI No. 4e did not address how the proposed approach provides the NRC staff with the ability to review and approve the justification for any failure probability other than 1E-4. Further, the licensee's response to APLC 50.69 RAI No. 4e overlooks the justification that the failure probability is coupled to the seismically induced LOOP occurrence frequency. As a result, use of failure probabilities other than the 1E-4 value can potentially challenge or negate the licensee's justification for the 1E-4 value provided in response to APLC 50.69 RAI No. 4b as well as APLC 50.69 RAI No. 4d and therefore, the basis for the staff's decision on the acceptability of the proposed alternative seismic approach.

In addition, the licensee's response to APLC 50.69 RAI No. 4e adds new information to its proposed alternative seismic approach that was not present in the LAR or the EPRI report supporting the LAR. The new information, added to step 5c in the EPRI report, states that the proposed alternative seismic approach was modified to include clarification that instead of screening SSCs out, the SSC may remain in the modified full power internal events (FPIE) model but with a seismic-induced failure probability from a plant-specific fragility analysis. The response does not provide any details on the purpose of and justification for this addition. In response to APLC 50.69 RAI No. 7, the licensee provided justification for not retaining changes to the FPIE PRA arising from the surrogate sensitivity due to the system-based categorization and impacts on importance measures. It is unclear how the proposed modification to the licensee's alternative seismic approach that "SSC may remain in the modified FPIE model but with a seismic-induced failure probability" is consistent with the licensee's justification in APLC 50.69 RAI No. 7.

a. Confirm that the licensee will only use a failure probability of 1E-4 for the surrogate event in its proposed alternative seismic approach, and that the discussion on the use of "more realistic seismic-induced failure probabilities" does not apply to the licensee's proposed alternative seismic approach. If the licensee intends to use values other than 1E-4 for the surrogate event in its proposed alternative seismic approach, identify the value(s) and provide justification for that value(s) addressing APLC 50.69 RAI No. 4b and APLC 50.69 RAI No. 4d.

EGC RESPONSE:

EGC confirms that a failure probability of 1E-4 will be the only value used for the surrogate event and no alternate values will be used. The use of "more realistic seismic-induced failure probabilities" as discussed in EGC's RAI response letter of October 16, 2020 (Reference [1]) no longer applies. In addition, Step 7 of Section 2.3.1 of the EPRI report (Reference [2]) has been marked-up to delete use of "other appropriately justified values." The mark-up is provided in Attachment 2 of this letter.

b. Clarify whether the licensee's alternative seismic approach will use the new guidance for step 5c in Section 2.3.1 of the EPRI report. If the licensee will use the new guidance, provide justifications for the modification to the licensee's alternative seismic approach in step 5c (i.e., "instead of screening SSCs out, the SSC may remain in the modified FPIE model but with a seismic-induced failure probability") and for its consistency with the licensee's response to APLC 50.69 RAI No. 7.

EGC RESPONSE:

EGC clarifies that the new guidance previously submitted in EGC's RAI response letter of October 16, 2020 (Reference [1]) for step 5c in Section 2.3.1 of the EPRI report (Reference [2]) regarding retaining screened out SSCs in the FPIE PRA model will not be utilized. Screened out SSCs will be excluded from the FPIE model used in the surrogate study. Step 5c and Appendix B (Introduction and Section B.1) of the EPRI report have been marked-up to delete the option to retain the associated SSCs in the FPIE PRA. The mark-ups are provided in Attachment 2 of this letter.

APLC 50.69-ROUND 2 RAI NO. 4F-01:

The staff requested information through APLC 50.69 RAI No. 4f (ADAMS Accession No. ML20240A218) to support its finding on 10 CFR 50.69 (b)(2)(ii) for the proposed alternative seismic approach. APLC 50.69 RAI No. 4f requested justification for the use of the risk achievement worth (RAW) value of 20 to determine the categorization outcome from the surrogate sensitivity study. In its response in supplement dated October 16, 2020 (ADAMS Accession No. ML20290A791), the licensee cited the discussion of common-cause failures in NEI 00-04, Section 5.1, and stated that "RAW values for correlated events and interaction events are by definition RAW values of common cause events."

Interaction events can include instances where only a single SSC is impacted rather than multiple SSCs or SSCs in different 'trains' of a system. These cases are not known beforehand and the proposed alternative seismic approach, via the walkdown, can identify such cases during the categorization process. For such cases, the statement in NEI 00-04, Section 5.1, that "a set of components or an entire system was made unavailable" and therefore, the RAW value for common cause events appears to be inappropriate. For such cases, use of a RAW value of 20 appears to be a deviation from the endorsed NEI 00-04 guidance (i.e., the use of RAW value of 2 for single SSC failures). The licensee's response to APLC 50.69 RAI No. 4f does not discuss such cases or justify the use of RAW value of 20 for such cases.

Confirm that the RAW value for single component failures in NEI 00-04 will be used in the proposed alternative seismic approach for interaction failures that do not impact either multiple SSCs or SSCs in separate 'trains' of a system (including SSCs in a single 'train' system). Alternately, justify the apparent deviation from NEI 00-04 for the proposed alternative seismic approach in the use of the common cause events RAW value for interaction failures that do not impact either multiple SSCs or SSCs in separate 'trains' of a system (including SSCs in a single 'train' system).

EGC RESPONSE:

EGC is confirming that the RAW value for single component failures in NEI 00-04 will be used in the proposed alternative seismic approach for seismic induced failures of single components resulting in total loss of system function.

The Seismic Correlated Failure Assessment described in Section 2.3.1 of the EPRI report (Reference [2]) is focused on identifying and evaluating the potential categorization impacts based on insights from the trial categorization studies described in Section 3 of the report. As stated in Section 3.6.1:

> "Therefore, the seismic risk insights provided only limited unique insights into the 50.69 categorization process. And those unique insights were generally

> associated with SSCs that would be treated as seismically correlated failures in an SPRA. This suggests that the SSCs most important in responding to a seismic event are included within the set of SSCs necessary to respond to other events."

There were no single SSC interaction failures associated with a unique seismic HSS designation in the trial categorization studies. While the trial studies did not identify any SSC failures in single train systems that were uniquely HSS due to seismic, a review of the Plant C trial categorization did identify one unique case where an ACCW tank anchorage failure leads to a total loss of system inventory, thus failing that system's functions (e.g., thermal barrier cooling). When taken concurrently with other seismic issues such as loss of offsite power and loss of seal injection, the ACCW tank is defined as HSS for LERF. Therefore, single component failures in the system due to either seismic interaction or direct component failure modes, that result in total loss of a multi-train system and where there is not another system that independently provides the same function are included in the correlation study.

Given this insight, Section 2.3.1 of the report describes the Seismic Correlated Failure Assessment to account for the unique seismic insights attributed with those correlated failures treated in SPRAs. Following through on that concept, the following ideas are highlighted in the Seismic Correlated Failure Assessment.

- Step 5 notes that the purpose is "…to identify SSCs that could experience seismic correlated failures or could be subject to seismic interactions that would lead to failure of <u>more than one</u> SSC within the system being categorized."

- Step 5a states to "Assess if the subject SSCs would likely experience correlated failures during a seismic event."

- Step 5b is being amended to state "Also include single component failures in the system due to either seismic interaction or direct component failure modes, that result in total loss of a multi-train system and where there is not another system that independently provides the same function."

- Step 9 was previously clarified in EGC's RAI 4f response (Reference [1]) to state "The maximum RAW value of the surrogate event and any other non-seismic common cause failure events involving that SSC will be compared to the criterion for common cause SSCs in the FPIE PRA from NEI-00-04 (that is RAW > 20)." An additional clarification is being added to state "The maximum RAW value for seismic induced failures of single components resulting in total loss of system function will be compared to the PRA criterion from NEI 00-04 (RAW > 2)."

Following this process, the RAW value of 20 would be applied to events addressing the failure of multiple SSCs and the RAW value of 2 would be applied to events addressing the failure of a single SSC.

The potential for seismic induced failures and consequences are considered by the IDP in its deliberations for the final safety significance determination of a function/SSC. Specifically, NEI 00-04 Section 9.2 discusses the IDP's assessment of low safety significant (LSS) functions/SSCs against the maintenance of safe shutdown capability, prevention of core damage, and maintenance of containment integrity. To perform its assessment, the IDP considers risk information, defense in depth, and safety margins.

In consideration of risk information, the consequences of active and passive failures of functions/SSCs are evaluated for their resultant consequences on the plant. Item 3 of Section 9.2.2 (review of LSS SSCs) states, for example, that the IDP confirm "…that failure of an active function / SSC will not directly or indirectly (e.g., through spatial effects) fail a basic safety function. This applies to any function/SSC under consideration, including functions/SSCs that are assumed to be inherently reliable or those that may not be explicitly modeled in the PRA."

For defense-in-depth, the IDP considers that the defense-in-depth philosophy is maintained using the five defining statements under "Review of Defense-in-Depth Implications." Item 3 states, for example that defense-in-depth is maintained if "System redundancy, independence, and diversity are preserved commensurate with the expected frequency of challenges, consequences of failure of the system, and associated uncertainties in determining these parameters."

Regarding safety margins, the IDP confirms that existing safety analyses (design basis conditions and requirements for any safety-related SSCs) are not impacted by implementation of a §50.69 program.

In addition, EGC has implemented 50.69 at multiple sites and has confirmed that categorization is a robust process and no single consideration (e.g., seismic risk) dominates the results for a single SSC. This supports EGC's assertion that the proposed seismic alternative approach, including this particular RAI response is sufficient for this LAR application.

In conclusion, the EPRI report was modified per mark-ups in Attachment 2 of this letter to reflect that a RAW value of 20 would be applied to events addressing the failure of multiple SSCs and the RAW value of 2 would be applied to events addressing the failure of a single SSC.

REFERENCES

1. LaSalle County Station, Units 1 and 2, Renewed Facility Operating License Nos. NPF-11 and NPF-18, NRC Docket Nos. 50-373 and 50-374, "Response to Request for Additional Information: LaSalle License Amendment Request to Renewed Facility Operating Licenses to Adopt 10 CFR50.69, "Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Reactors," (ADAMS Accession No. ML20290A791), dated October 16, 2020.

2. Electric Power Research Institute (EPRI) 3002017583, Alternative Approaches for Addressing Seismic Risk in 10 CFR 50.69 Risk-Informed Categorization, Technical Update, February 2020.

ATTACHMENT 2

LaSalle County Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Proposed EPRI Markups

Alternative Approaches for Addressing Seismic Risk in 10 CFR 50.69 Risk-Informed Categorization

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5. For system components not screened out in Step 3, perform a seismic walkdown focused on the three activities listed below. The purpose of this step is to identify SSCs that could experience seismic correlated failures or could be subject to seismic interactions that would lead to failure of more than one SSC within the system being categorized. The following elements contribute to identifying these conditions.
   a. Assess if the subject SSCs would likely experience correlated failures during a seismic event. Seismic correlation walkdown reviews are performed as part of an SPRA and the guidance associated with performing that correlation walkdown is documented in Appendix A.
   b. Assess potential seismic interactions to identify conditions that could fail multiple components in the system. Also include single component failures in the system due to either seismic interaction or direct component failure modes, that result in total loss of a multi-train system and where there is not another system that independently provides the same function. Guidance for this seismic interaction walkdown review is also contained in Appendix A.
   c. Screen out SSCs that are determined to be sufficiently rugged such that they would not be significant contributors to seismic risk in an SPRA. This screen focuses on the SSC seismic capacity associated with functional failures and anchorage. The screen can also be applied to identified seismic interactions provided the seismic capacity of the interacting item (for example, block wall) has a seismic capacity that meets the screening level. Appendix B contains a description of the approach recommended for this screening.

      ~~As an alternate to screening out an SSC, the SSC can be retained in the FPIE model with a seismic-induced failure probability developed for the surrogate by performing a plant-specific fragility analysis as described in Appendix B.~~
6. SSCs that are determined through the walkdown to be of high seismic capacity and not included in seismically correlated groups or correlated interaction groups can be screened out from further seismic considerations since their non-seismic failure modes are already addressed in the FPIE PRA and fire PRA. Those remaining components identified in Step 5 with seismic correlated failures or seismic interaction failures of multiple components proceed forward for inclusion of associated seismic surrogate events in the Tier 2 adjusted PRA model.

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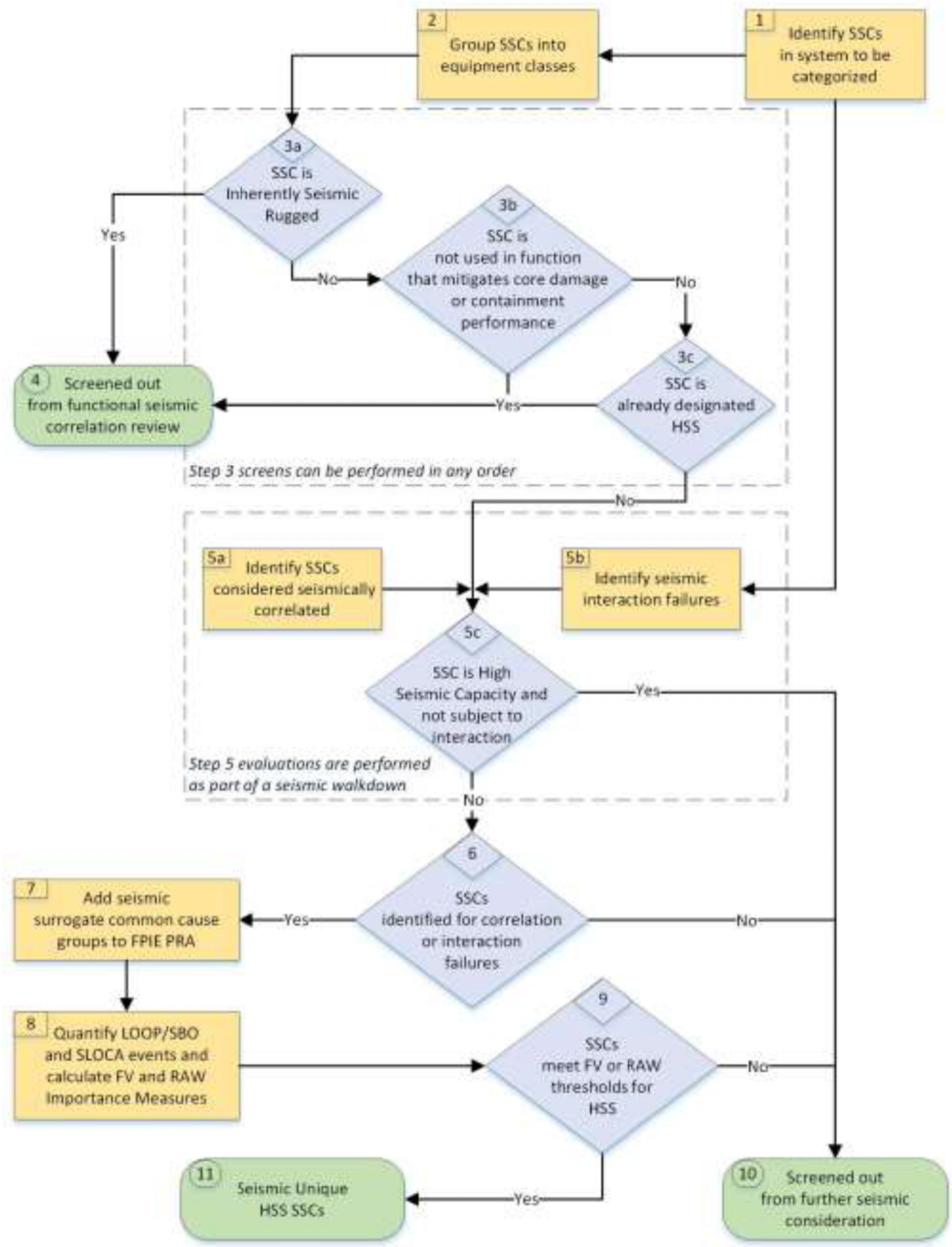

Figure 2-3
Seismic Correlated Failure Assessment

Commented [RJ13]: RAI Response 6c

7. Add new seismic surrogate events to the FPIE PRA logic model for the potential seismically correlated and seismic interaction conditions identified in the previous steps. New seismic surrogate events should be added to the PRA under the appropriate areas in the logic model. For example, a new seismic surrogate basic event that models seismic correlated failure of two tanks would be added to the PRA logic model under the gates that model the individual tank failures. Seismic interaction surrogate events should be added to the model such that they fail the SSCs affected by the interaction. For example, a seismic interaction surrogate event that models a block wall falling onto two nearby pumps should be added to the PRA logic model under the gates that model the pumps.

   The probability for the new seismic surrogate basic events should be set to a value equivalent to a "typical" total seismic hazard exceedance frequency above which SPRAs would typically model loss of offsite power and for which correlated failures may be likely. The recommended value is 1.0E-04~~, but other appropriately justified values may be used~~.

8. Quantify the FPIE PRA model for LOOP and small LOCA initiated accident sequences using the modified model containing the seismic surrogate events for the system being analyzed and calculate the component-based risk importance measures for the system components encompassed by the seismic surrogate events. Since the majority of seismic risk in many SPRAs are the LOOP and small LOCA accident sequences, these events are the most appropriate events for performing this correlation study. The process is as follows.

   a. The recommended event frequency for the LOOP initiator is 1.0 and for the small LOCA initiator is 1.0E-02. The LOOP frequency value of 1.0 is recommended since the probability of the surrogate events (from Step 7) is the total seismic hazard exceedance frequency above which SPRAs would typically model loss of offsite power. The basis for the small LOCA frequency of 1.0E-02 is that seismically-induced small LOCAs require failures that SPRAs show typically occur at much lower frequency than seismically-induced LOOP.

      For multi-unit sites, the LOOP initiator selected for adjustment is the LOOP initiator that is modeled as a site LOOP condition (that is, loss of offsite power to all reactor units onsite).

      The small LOCA initiator selected for adjustment is a water break small LOCA (that is, NSSS break below TAF).

   b. Set the frequency for all initiators other than LOOP and small LOCA initiators selected for adjustment in step 8a to 0. Note that many FPIE PRAs have multiple LOOP initiating events (for example, grid centered, switchyard centered, etc.) as well as multiple small LOCA initiators (small LOCAs above the top of active fuel (TAF) and small LOCAs below TAF). Only one each of these needs to be set to 1.0 as described in step 8a, above, while all the other initiators in the FPIE PRA should be set to an occurrence frequency of 0 (or a logical value of FALSE).

Commented [RJ14]: RAI Response 6c

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c. Since a seismic event that causes a small LOCA is also assumed to cause a LOOP, update the PRA model to account for this. This is typically done by setting a conditional LOOP probability to 1.0, but can be done in any appropriate manner.

d. Many FPIE PRA models credit restoration of offsite power in the LOOP/SBO accident sequences as well as other functional recoveries (for example, EDG recovery, DC power recovery). These credits should not be taken in this Tier 2 adjusted PRA quantification process since recovery of offsite or DC power after a seismic event is not generally credited in a seismic event. This is typically performed by setting the probabilities of the basic events in question to a value of 1 (or a logical value of TRUE). If the run time for emergency AC power (for example, EDGs, fuel oil pumps) was adjusted, the run time should be set to the PRA mission time.

e. In addition to the LOOP and small LOCA accident sequences, the quantification of the Tier 2 adjusted PRA should also include the accident sequences transferring out of these event tree structures (for example, LOOP/SBO, LOOP/SBO-ATWS, small LOCA-ATWS).

f. The Tier 2 adjusted PRA model is quantified including the seismic surrogate events applicable only to the components in the system being categorized. Seismic surrogate events that may have been identified for in previous system categorizations should not be added into the quantification or set to zero if already existing in the PRA model being used for the Tier 2 quantification.

g. Consistent with the NEI 00-04 process, the risk importance information from the Tier 2 adjusted quantification should be presented on a component basis and include the various applicable failure modes. In the case of the Tier 2 process, the list of components for which component risk information is produced is constrained to the system components encompassed by the identified and modeled seismic surrogate events. These component-based risk importances should include the seismic surrogate risk contributions as well as the non-seismic failure mode contributions used in the plant 50.69 categorization process.

9. For all SSCs that are included in a surrogate event (either a correlated failure event or an interaction failure event) the F-V value for the surrogate event will be added to the F-V values for the non-seismic failure events for that SSC. The resulting F-V will be compared to the criterion for SSCs in the FPIE PRA from NEI-00-04 (F-V > 0.005). The maximum RAW value of the surrogate event and any other non-seismic common cause failure events involving that SSC will be compared to the criterion for common cause SSCs in the FPIE PRA from NEI-00-04 (that is RAW > 20). The maximum RAW value for seismic induced failures of single components resulting in total loss of system function will be compared to the PRA criterion from NEI 00-04 (RAW > 2). The maximum RAW value for any non-seismic-related, non-common cause failure events of that SSC will be compared to the PRA criterion from NEI 00-04 (RAW > 2). If the SSC exceeds the threshold for any of these four criteria, it will be categorized as HSS.

10. Since this process is a pseudo-deterministic evaluation process rather than a full risk informed process, these seismically correlated group HSS designations should be treated similar to HSS designations using the IPEEE SMA SSEL. Therefore, seismically correlated group HSS designations should not be subject to reconsideration by the

Commented [RJ17]: RAI Response 4a

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Deleted: <#>In place of explicit convolution modeling of offsite power recovery curves and emergency AC failure rates, many FPIE PRAs use what are termed surrogate run times (for example, 4 to 8 hrs) for emergency AC power equipment (for example, EDGs, fuel oil transfer pumps) basic event failure probability calculations to minimize conservatism in the calculated PRA results. Given that offsite power recovery is assumed failed in this Tier 2 process, any such surrogate run times based on functional recovery credit should be increased to the PRA full mission time (typically 24 hours) in the Tier 2 adjusted PRA quantification. This adjustment is typically performed by revising the run exposure time used in the probability calculation formula for each of the affected basic events.¶

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Deleted: each component-based risk importance result produced in step 8seismic surrogate event, compare the results to the F-V and RAW HSS criteria for common cause components in the FPIE PRA from NEI 00-04 (that is, F-V > 0.005 or RAW>2 for non-CCF failure modes and RAW > 20 for CCF failure modes). The RAW > 20 HSS criterion applies to the seismic surrogate failure modes and the non-seismic CCF failure modes. The RAW > 2 HSS criterion applies to the non-seismic non-CCF failure modesFor seismic surrogate events, if the F-V or RAW criteria are met, all SSCs modeled by that surrogate event should be considered HSS

Commented [RJ20]: RAI Responses 10b and 10c

Table 3-8
Plant C Passive or Implicitly Modeled SSCs

Scope	Description
Buildings	Building failures are not typically modeled in the FPIE PRA given their relatively low probability of random failure. The SPRA models building failures as failing key SSCs within the building or as leading directly to core melt or large early release. Therefore, in the comparison with the FPIE PRA or Fire PRA, the seismic fragility groups that model building failures were mapped to basic events in the FPIE and Fire PRA that model failure of the SSCs within the building. See Section 3.6.6 for additional discussion of categorization of Civil Structures.
Relays	The SPRA models relay chatter which impacts specific SSC functions due to spurious actuations (for example, starting/stopping of pumps, opening/closing of valves). Therefore, the seismic fragility groups that model relay chatter are mapped to the basic events of the corresponding SSC functions that are impacted in the FPIE and Fire PRA.
Piping	Piping failure is modeled in the FPIE as part of the internal flooding portion of the model as well as failure of the RCS piping resulting in the various size LOCAs. The SPRA models piping failures of the RCS with seismic fragility groups for the various size LOCAs. Therefore, these groups are mapped to the corresponding LOCA basic events in the FPIE PRA.

3.4.6 Analysis and Conclusions

As shown in Table 3-9, most SSCs modeled by the seismic fragility groups that are HSS in the SPRA are also HSS in the FPIE and/or the Fire PRA. The 28 seismic fragility groups in the SPRA model over 63 SSCs, of which 23 are also HSS in the FPIE and/or Fire PRA. Eight have non-seismic failure mechanisms (marked as Random Failure in Table 3-9) that are HSS in the SPRA and are also HSS in the FPIE and/or the Fire PRA.

There are five seismic fragility groups that are HSS in the SPRA but not for the other considered risk categories (FPIE PRA, Fire PRA, Implicit Modeling, Passive Categorization). These five fragility groups represent correlated seismic failures or seismic induced internal flooding or loss of inventory failures. In one case it was observed that failure of a single component resulted in total loss of system inventory thus failing that system's functions (for example, thermal barrier cooling). When taken concurrently with other seismic issues such as loss of offsite power and loss of seal injection, the ACCW tank is defined as HSS for LERF. Therefore, single component failures that result in total loss of system inventory for cases where there is not another system that independently provides the same function are included in the correlation study.

Commented [RJ22]: Text added as part of Second Round RAI response 4F-01

These insights contributed to the creation of the approach described briefly in Section 2.3.1 and in more detail in Appendix A to account for the possibility of seismically correlated failures or seismic interaction related failures.

System	Seismic Fragility Group	Description of Fragility Group	Component from Fragility Group that Governs the Fragility			HSS in Risk Evaluations					Correlation Review	Comments
			Component Description	Component ID	Failure Mode of SSC	Seismic PRA	FPIE PRA	Fire PRA	Implicit Modeling	Passive Cat.		
Component Cooling Water	S_1CCTK -4	CCW Surge Tank	CCW Surge Tank	1DCBYB3BYA - 1DCBYB3BYA	Anchorage	✓					✓	Correlated Failure drives the SSC to HSS
Emergency Diesel Generator	S_1DG	Diesel Generator	Diesel Generator	1DGG4001 - 1DGG4002	Functional (After)	✓	✓	✓				
	S_1DGD M-VENT	DG Vent Damper for Fans 1-4	DG AIR Supply Damper for Fans	1DGDM12050 - 1DGDM12054	Functional (After)	✓		✓				
	S_1DGFN -FAN	DG BLDG ESF Supply Fan	DG BLDG ESF Supply Fan	1DGFNB700200 0 - 1DGFNB700400 0	Functional (After)	✓					✓	Correlated Failure drives the SSC to HSS
Containmen t Heat Removal	S_1FC-ACU-FLD	Anchorage Failure of ACU with NSCW FLD	CTB AUX Cooling Unit	1ACUA7002000	Anchorage	✓					✓	Flooding causes LUHS drives the SSC to HSS. Considered as a flooding interaction in the Correlation Review.
Nuclear Service Cooling Water	S_1SWFN -NSCW-FANS	NSCW Tower Fans	fan-NUC SERV Cool Tower	1NSCWW4001F 01 - 1NSCW4002F04	Anchorage	✓	✓					
Auxiliary Component Cooling Water	S_1XCTK -4	ACCW Surge Tank	ACCW Surge Tank	1XCTKT4001	Anchorage	✓					✓	Failure results in total loss of cooling water inventory, failing the system's functions. Concurrent with other seismic induced failures, leads to HSS designation for LERF. Addressed as part of the Correlation Review.

Commented [RJ23]: Text revised as part of Second Round RAI response 4F-01

Deleted: Correlated Failure drives the SSC to HSS

a. Similar SSCs with similar failure modes but located in different structures, and

b. Similar SSCs with similar governing failure modes located in the same structure, but with significantly different seismic responses.

These correlation guidelines are provided to assist in the identification of SSCs judged to be seismically correlated. Additional guidance is provided in [18] and [31] to support the decisions made on the walkdown. Following completion of the walkdown, the list of correlated SSCs identified should be placed into Step 6 from Figure 2-3.

The second part of the 50.69 categorization walkdown includes the evaluation for seismic interactions which could cause correlated failures within the system being categorized. Potential seismic interactions should be evaluated during the system walkdown to assess whether any credible interactions could result in correlated failures of equipment within the system being categorized. As mentioned above, the approaches for evaluating seismic interactions are well documented in technical references and will not be repeated in this appendix. For purposes of describing the process recommended in this appendix, it is informative to define terminology associated with seismic interaction assessments:

- Interaction Source – the source is a structure, system or component (SSC) that causes the seismic interaction. The sources of seismic interactions can be based on falling items, deflecting items or flood initiators. So an example of a typical seismic interaction source would be an unreinforced block wall or a failed water storage tank that floods an area.
- Interaction Target – the target is the SSC that is being evaluated and is required to maintain its safety function or pressure boundary as part of the seismic risk assessment being conducted. For purposes of this 50.69 correlation evaluation, the equipment in the system being categorized will generally be considered as the targets.

The process for assessing the potential for correlated seismic interactions during the walkdown should consist of the following steps:

1. Review available documentation (general arrangement drawings, previous seismic walkdown documentation, etc.) in advance of the walkdown to support the seismic interaction assessments
2. Perform a confirmatory walk down of the system being categorized to confirm the characteristics described below.
3. Determine if any credible seismic interactions exist in the vicinity of the SSCs being categorized. The walkdown team should screen out those seismic interaction sources not deemed credible based on their experience and training. The walkdown team should also screen out credible sources that would not be expected to damage/fail the target equipment in the system being categorized.
4. As part of the seismic interaction review, attention should be paid to include single component failures in the system due to either seismic interaction or direct component failure modes, that result in total loss of a multi-train system and where there is not another system that independently provides the same function.

Commented [RJ25]: Text added as part of Second Round RAI response 4F-01

B CRITERIA FOR CAPACITY-BASED SCREENING FOR HIGH CAPACITY SSCS

Seismic risk insights from past SPRA and SMA studies have shown that high seismic capacity SSCs from the SPRA Seismic Equipment List (SEL) do not typically contribute to the seismic risk. Similarly, those seismic interaction scenarios (for example, block walls, falling objects, and displacements which cause impact with nearby elements) which can be demonstrated to have high seismic capacities, have also not resulted in significant risk contribution in past seismic studies. Therefore, these high seismic capacity SSCs and interactions are unlikely to be categorized as HSS and can be screened out from the 50.69 seismic categorization process. This high seismic capacity screening fits into Step 5c of the flow chart in Figure 2-3. The process for screening individual SSCs documented in EPRI 1025287 [11] (the SPID) will form the backbone for this screening approach. Following this approach, SSCs with a HCLPF capacity greater than the calculated screening level HCLPF could be categorized as low safety significant (LSS).

~~As an alternate to screening out an SSC, the SSC can be retained in the FPIE model using a surrogate event with a seismic-induced failure probability based on specific fragility analyses.~~

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B.1 Approach

As part of the effort to develop the SPID [11], seismic capacity-based criteria were developed to determine which SSCs should have component specific calculated fragility values to ensure that proper focus was given to those SSCs with the potential to be risk-significant. These criteria were developed using a parametric/sensitivity study [33] which provided the basis for the SPID recommendations. SSCs with capacities above the calculated screening level are not expected to have significant impact on the result of the SPRA analyses, the ranking of accident sequences, or the calculated sequence- or plant-level seismic CDF or LERF values. As such, SSCs with capacities above that screening level would also not be expected to be high safety significant (HSS) components within the 50.69 categorization process.

Section 6.4.3 of the SPID [11] identifies the approach to develop a screening HCLPF value for these higher capacity fragilities. Following the SPID approach, a screening HCLPF value is calculated by convolving the fragility of a single element with the site-specific hazard curve such that the SCDF is at most about 5E-7 per year. This can be done with trial and error runs using a quantification code or with a spreadsheet with an estimated composite variability (for example, β_c= 0.4) as described in [11]. This 5E-7 screening criteria was developed for the higher seismic hazard plants where seismic typically has a corresponding higher resulting risk. For a medium to low seismic hazard site this screening level of 5E-7 could potentially be unconservative, therefore an SCDF value of approximately ½ of the SPID value, or 2.5E-7 is judged to be more appropriate for purposes of this 50.69 categorization screening assessment. ~~As an alternate to screening out an SSC, the SSC can be retained in the FPIE model by calculating a site-specific HCLPF as described below and convolving it with the site seismic~~

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~~hazard curve to obtain seismic-induced failure probability that may be used rather than the 1.E-04 default value.~~

To apply his approach, a seismic fragility must be developed for each SSC that is being assessed as part of the categorization process and compared to screening level developed as described above. Criteria for performing fragility calculations are provided in Section 3.3, Separation of Variables Fragility Approach, and Section 3.4, Hybrid Fragility Approach, of EPRI 3002012994 [34]. These fragility methods define the state of practice in use for SPRAs today.

For nuclear plants without existing SPRAs, one challenge will be to produce in-structure seismic responses for use in these fragilities. Development of finite element models and generation of new seismic response analyses using the current seismic hazard shape at the plant site is one option, however, more simplified and conservative approaches could be used when justified by experienced engineers within the structural dynamics field. Sections 6.4 and 6.7 of EPRI 3002012994 [34] provide the most up to date criteria for scaling in-structure response spectra, consistent with the state of practice for SPRAs today.

B.2 Justification

While the SPID capacity-based screening approach is intended as a tool to be used for seismic risk assessments to focus fragility resources on risk-significant SSCs, the concept can be extended to 50.69 categorization. The capacity-based screening approach from the SPID is purposely conservative and is based on a single element leading directly to core damage. In addition, the recommended approach in this Appendix conservatively reduces the SPID target SCDF of 5E-7 by 50%, resulting in a more conservative SCDF value of 2.5E-7. If it is possible to demonstrate a component has a HCLPF above the calculated screening threshold, that component is not expected to be risk-significant in an SPRA. So even in the absence of a formal risk assessment, it is possible to identify certain SSCs with high seismic capacity that would not be expected to be risk-significant.

B.3 Conclusion

Use of the capacity-based screening approach based on a similar approach documented in the SPID is an acceptable method to screen SSCs into the LSS category for 50.69 categorization. When SSCs are determined to have HCLPFs greater than this screening level HCLPF, it can be concluded that they would not be risk significant in an SPRA; therefore, those SSCs can be classified as LSS rather than HSS.

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Deleted: The fragility methodology is well established and there are numerous references in the literature describing the methods. Four EPRI reports that collectively capture the fragility process are listed in Table B-1

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Seismic Fragility References¶
Topic

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Scaling of existing plant seismic response analyses where the shapes of the uniform hazard response spectra (UHRS) are similar [35, 19]¶
Estimation of high frequency seismic response using an approach in EPRI 3002004396 [37] which describes a process to estimate seismic responses for hard rock sites that have ground response spectral peaks in the high frequency part of the response spectrum¶
In addition, it may also be possible for fragility analysts to conservatively estimate seismic demands using simplified approaches documented in ASCE 7 [38] for justifying additional SSCs that would have HCLPF capacities above the screening threshold. Assessments made would have to be necessarily conservative (biased towards higher in-structure response spectra (ISRS)) and account for potential variability of ISRS results based on the use of these approximate methods

ATTACHMENT 3

LaSalle County Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

List of Acronyms

ATTACHMENT 3

List of Acronyms

ACCW	Auxiliary Component Cooling Water
ADAMS	Agencywide Documents Access and Management System
EPRI	Electrical Power Research Institute
FPIE	Full Power Internal Events
HSS	High Safety Significance
IDP	Integrated Decision-Making Panel
LAR	License Amendment Request
LERF	Large Early Release Frequency
LOOP	Loss of Offsite Power
LSCS	LaSalle County Station
LSS	Low Safety Significance
NRC	Nuclear Regulatory Commission
PRA	Probabilistic Risk Assessment
RAW	Risk Achievement Worth
RAI	Request for Additional Information
SPRA	Seismic Probabilistic Risk Assessment
SSC	Structures, Systems and Component