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Lessons Learned from SPRA Peer Reviews and F&O Closure

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Seismic Reviews through the PWROG

- From 2013 to 2017, the PWROG has supported 8 SPRA peer reviews for a total of 12 PWR units.
 - 1 PR using Addendum A and 7 PRs using Addendum B of the PRA Standard
- In 2018 & 2019, 8 more SPRA peer reviews are currently scheduled through the PWROG program.
 - At least 2 Utilities have already asked to be peer reviewed against the Code Case
- All reviews performed to date are full scope (SHA, SFR, SPR)
 - All brand new S-PRAs with one exception (1 SPRA previously reviewed against Addendum A and re-reviewed after major enhancements against Addendum B)
 - PWROG encourages PRA configuration control element to be peer reviewed every time an entire new hazard is added to the PRA scope.
- Since release of Appendix X to NEI 12-13, the PWROG has also supported F&O Closure (independent assessment & focus scope reviews as needed) for 4 S-PRAs (5 PWR units and 1 BWR unit).

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Seismic Peer Reviews through the PWROG – Process and Teams

- PWROG follows NEI-12-13 guidance (including now Appendix X) with enhanced requirements on leads/reviewers qualifications and guidance on peer review readiness process.
- Many process/working observers attended reviews and F&O closure activities
 - Process observers → PMs for S-PRAs, NRC, Japan
 - Working observers → Analysts for S-PRAs, reviewers in training
- The core team for a number of the PRs to date (first wave) was made of members of the ASME/ANS JCNRM writing team for Part 5 of the Standard
 - Writing team had first hand consistent experience of trends and problematic SRs and fed back that experience directly in the Code Case and next edition update
 - Second wave PRs are expanding the pool of qualified reviewers

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F&O Closure Observations

- All seismic F&Os successfully closed through the new Appendix X process
 - Some disagreement on the interpretation of "maintenance" vs. "upgrade"
 - In all cases, the review team had a more conservative interpretation and proceeded with a focused scope review.
 - Not a seismic-specific observation.
- Substantial fragility update observed in some cases
 - SCDF/SLERF reduced up to 70% with more refined fragility analysis of risk-significant contributors.
- Extensive sensitivity analysis credited to "break the loop"
 - Continuous refinements of fragilities constantly bring up new unrefined (or less refined) fragility.

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Input to Code Case

- Standard writing team used lessons learned from first wave of SPRA peer reviews to update Part 5 for the Code Case.
- Clarifications in SHA regarding other non-vibratory consequential hazard and emphasis on a better hand-off of these scenarios among parts.
- Clarification on uncertainties of the PSHA as different from uncertainties of the SHA.
- More reliance on the risk quantification to define and monitor screening criteria, as well as to define risk-significant so that a workable prioritization can be done for realistic (and effort intensive) fragilities.
- More details on the definition and modeling of consequential hazards (e.g., SIFF).
 - Will continue to monitor this for unintended consequences
- Clarification on Reference Earthquake did not make its way in the Code Case
 - Still being debated (may be ready for the next edition).

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Conclusions

- PWROG has been active in SPRA Peer Reviews over the last 5 years and has additional Peer Reviews planned in the near future.
- SPRA Peer Reviews have been important in raising the state-of-practice in seismic PRAs.
- Participation by Standards Writers on SPRA Peer Review teams has allowed direct feedback to improve Part 5 of the PRA Standard.
- Average of 90% of supporting requirements have been met at Capability Category II or above.
 - Indicates S-PRA are generally considered technically adequate to support risk informed applications.

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