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Sent: Friday, August 18, 2017 4:28 PM
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Cc: Segala, John; Cubbage, Amy
Subject: Licensing Modernization Project - PRA Approach White Paper; NRC Staff Comments/Questions
Attachments: Comments-Questions on LMP PRA WP Aug18.pdf

On June 2 2017, a draft of the Licensing Modernization Project's (LMP's) "Probabilistic Risk Assessment Approach" white paper (ML17158B543) was provided for NRC staff review. This paper was discussed at public meetings as part of the ongoing dialogue in support of the Licensing Modernization Project, during which the NRC staff provided initial observations on this draft white paper and committed to provide written feedback. This email completes that action. The NRC's preliminary feedback on the draft probabilistic risk assessment approach white paper is provided in the attachment to this email. We have also scheduled a public meeting on September 28, 2017, to discuss this feedback and other topics of interest regarding Non-LWRs.

Please contact me if you have any questions.
Thank you,

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Questions/Comments on LMP White Paper on PRA Approach

1) The NRC staff is participating in the efforts to revise the ASME/ANS PRA Standard for Advanced Non-LWR PRA and is planning to review the completed standard for possible approval within the licensing framework for non-LWR technologies. The plan, including the NRC staff review of the pending revisions to non-LWR PRA Standard for endorsement in a regulatory guide or similar guidance document, can be reflected in the white papers and consolidated guidance documents.

2) Within the LMP construct, the PRA is used to identify/revise the list of AOOs, DBEs, and BDBEs and an assessment of those LBEs is used to (1) compare to PRA-related criteria (e.g., frequency/consequence) and (2) select DBAs for traditional deterministic safety analysis (i.e., Chapter 15). To what degree might the analysis of the non-DBA LBEs be considered integral to the PRA versus a separate activity, and would there be a benefit to considering them as parts of the overall PRA activity? What analyses of the non-DBA LBEs (event families) are performed beyond what is done for the specific sequences within the PRA? Would consideration of the non-DBA LBEs as being part of the PRA overly complicate the development of the PRA standard by bringing in a specific licensing approach?

3) How does the LMP PRA and LBE papers relate to current and possible future efforts on developing advanced reactor design criteria (ARDC)? Does the stated PRA objective to provide input for the development of reactor-specific principal design criteria include both the possible validation of the pending ARDC and the development of revised, more risk-informed design criteria for non-LWR technologies?

4) Although the stated focus of the LMP white paper is on how the PRA supports LBE selection and SSC safety classification, the staff sees benefits to discussing the larger regulatory framework (mentioned within the objectives and also as being the subject of a future paper). The PRA and LBE analyses will be supporting various regulatory decisions on the design and operational programs needed for non-LWR technologies. The staff envisions an integrated approach using the PRA (supported by deterministic analyses and engineering judgement) as the common hub for regulatory decisions related to design, siting, and operational programs. These regulatory areas are interrelated and to some degree are developed in an iterative fashion along with the design details. Suggest additional PRA objectives to reflect a more integrated approach and identifying PRA role to support operational programs such as reliability assurance programs as well as other regulatory areas such as preparing environmental reports, supporting siting decisions, and supporting requirements related to emergency planning. For example, another objective of the PRA should be to support the assessment of severe accident mitigation design alternatives (SAMDAs), which is required by 10 CFR Part 51.

5) While the staff acknowledges the benefits of using PRA approaches throughout the design process, many of the mentioned benefits are beyond the regulatory role of the NRC, which focuses on the actual design decisions included in submittals. A potential benefit of the early use of PRA approaches is to help define critical design decisions and associated regulatory issues that should, to the extent possible, be the focus of pre-application interactions between the reactor developer and the NRC staff.

6) The mention of risk metrics and top level regulatory requirements (TLRC) will need to be aligned with revisions to the LBE white paper being made to address comments from the NRC staff.

7) The inclusion of examples is beneficial but the specific discussions may need to be revised as the broader concepts within the LBE and PRA white papers are addressed. The staff's review of the examples was therefore limited and specific comments are being deferred for future discussions.

8) A comparison/crosswalk between the LWR PRA Standard and non-LWR PRA Standard would be helpful in either the context of the white papers and/or the process of revising the non-LWR PRA Standard.

9) As discussed in the staff's comments/questions on the LBE white paper, it would be useful to better understand the role of PRA in broader regulatory framework, including design and operations. Is there a clear distinction between the PRA activities and the analyses of the selected LBEs (see also question 2)? It would also be useful to understand the relationship of the PRA and proposed LBEs to areas such as consensus codes and standards that also use event categories to distinguish between requirements. Has those relationships been identified during the LMP, NGNP or other assessments?

10) The following statement appears in Section 3.2 of the paper: "The PRA will be structured to be able to examine the risk significance of design features and SSCs in the performance of safety functions as called for in the NRC Advanced Reactor Policy Statement." The staff will want to engage with industry on an approach for doing this. In the past the NRC has approved new approaches on an ad hoc basis for new light water reactor designs with risk profiles much lower than operating reactors. In a letter to the NRC Advisory Committee on Reactor Safeguards dated July 16, 2016 (ADAMS Accession No. ML16144A871), the NRC staff made a commitment to pursue a revision of the quantitative risk significance criteria for light water reactors to make them consistent with a broad spectrum of light water reactor designs and absolute levels of overall plant risk. To the extent possible quantitative criteria for determining risk significance in non-light water reactor designs should apply broadly to different designs and be based on absolute levels of overall plant risk.

11) Section 3.5 "Road Map for PRA Evolution as the Design Matures," (page 19) includes the statement: "When the site characteristics or site parameter envelope is established PRA models for seismic and other external hazards can be introduced." The white paper should provide guidance on how to develop the site parameter envelope. With respect to PRA, the site parameter envelope needs to include parameters related to the calculation of offsite consequences (e.g., demographic and meteorological information) and the frequencies of external hazards (e.g., earthquakes, external floods, high winds). Information from currently operating plants may be helpful in specifying the site parameter envelope; in addition, it should be remembered that non-LWRs may be located outside of the continental U.S. (e.g., Alaska).

12) Some issues that do not seem to be discussed in the white paper include the need for maintaining the PRA up to date over the life of the reactor, and how will this occur; and continual reassessing plant risk, licensing basis events, safety classification, etc., using actual operating experience to determine if the plant licensing basis remains valid. Will the guidance address this type of operational program for feeding the results from the updated PRA back into plant operation and determining if revisions to licensing documents are needed?

13) Application of the guidance to some non-LWR technologies is likely to require expanded discussions of regulatory and physical interfaces/boundaries of the fuel production facility, reactor, spent/bred fuel processing, and prep for/offsite transport of bred fuel. The regulatory structure and requirements are different between these arenas and some technologies being proposed have these processes directly coupled together. The other areas also address worker impacts, which can include doses to workers or industrial type worker and offsite impacts when comingled with radioactive materials (typically chemical, criticality, explosion impacts on workers, fire impacts on workers, etc.). Further, the terminology (safety-related/non-safety versus IROFS/management measures etc.) and approaches (PRA versus ISA) currently differ in these different regulatory arenas. It would be helpful to discuss (in this or a separate paper) how applications and NRC reviews could best integrate or harmonize the approaches taken for parts of facilities falling under different or multiple regulatory arenas.

14) Section 3.7.1 “Overall Plant Risk Metrics,” (pages 23 and 24) states: “Because of the use of different materials for the fuel, moderator, and coolant, LWR risk metrics such as core damage frequency [CDF] are not useful or relevant for many advanced non-LWR designs.” It is also noted that the white paper does not discuss whether the PRA will compute the large release frequency (LRF); in fact, LRF does not appear on list of acronyms. The staff uses CDF and LRF to determine if LWR designs properly balance accident preventive and mitigative features. What metrics or considerations are included in the proposed approach to support assessing not only the overall risks, but the contributions of specific features to prevent or mitigate accidents?

15) Section 3.6 “Advanced Non-LWR PRA Elements,” (page 23) states: “For some risk metrics, such as the NRC safety goal QHOs, the risk is aggregated over all the event sequences in the PRA model.” This statement implies that the total site risk (which sums the contributions from all radiological sources at the site, including multi-source accident scenarios) will be compared to the QHOs. This approach may go beyond current NRC requirements given the policy issues raised in SECY-03-047 and SECY-05-0130 concerning integrated risk were not fully resolved. Similar issues related to integrated risks may arise for those technologies with both reactor and fuel processing facilities sharing a site. Are multi-unit or integrated risk questions expected to be handled within the ASME/ANS PRA Standard for non-LWRs or is this a more immediate issue needing to be addressed in the white papers and consolidated guidance document?

16) In terms of the stated output objectives, the NRC staff is not providing formal approval but offers the following observations:

- The staff accepts that insights from PRA approaches should be used for event selection and other decisions related to the design, siting, and operational programs for non-LWR technologies. PRA insights are supported by deterministic analyses and engineering judgement. The specifics of how the PRA is used in various areas will be discussed during future interactions and as part of developing the consolidated guidance documents expected to result from these initial interactions on the white papers. The staff is participating in the efforts to revise the ASME/ANS PRA Standard for Advanced Non-LWR PRA and is planning to review the completed standard for possible approval within the licensing framework for non-LWR technologies.

- Possible issues related to the use of risk insights in the selection and evaluation of LBEs and safety classification of SSCs are identified in the comments/questions above and in the comments/questions provided on the LBE white paper. Some of the issues relate to the use of the frequency-consequence figure as a tool versus acceptance criteria, the analyses of external events, and the role of mechanistic source terms.

- The scope and technical approach for advanced non-LWR PRAs, including the treatment of inherent characteristics, passive SSCs, and uncertainties, will be assessed through the planned NRC staff review of the ASME/ANS Standard for Advanced Non-LWR PRA.

- Non-LWR developers are likely to benefit from introducing PRA approaches at an early stage in the design and increasing the scope and depth of the PRA during the various stages of the design process. The NRC staff focuses on the state of the design and supporting PRA for specific applications or pre-application interactions.

- It is stated in Section 1.5 of the paper that LMP is seeking NRC's approval of the proposed Technology Inclusive- PRA approach for incorporation into appropriate regulatory guidance for advanced non-LWRs. This appears to be an approach for developing PRA and using it in applications. That is too large a scope for this paper but perhaps could be revisited as the consolidated or comprehensive guidance for a licensing framework for non-LWRs is being prepared.