



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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September 13, 2023

MEMORANDUM TO: Steven T. Lynch, Chief
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FROM: Anders F. Gilbertson, Senior Project Manager
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A handwritten signature in cursive script, appearing to read "Anders Gilbertson".

Signed by Gilbertson,
on 09/13/23

SUBJECT: SUMMARY OF THE APRIL 18, 2023, PUBLIC MEETING ON
PROBABILISTIC RISK ASSESSMENT IMPLEMENTING THE
LICENSING MODERNIZATION PROJECT METHODOLOGY IN
SUPPORT OF CONSTRUCTION PERMIT APPLICATIONS
UNDER TITLE 10 OF THE *CODE OF FEDERAL
REGULATIONS* PART 50

Meeting Information:

Public Meeting Notice Agencywide Documents Access and Management System (ADAMS)
Accession No.: ML23096A094

Staff Presentation Slides ADAMS Accession No.: ML23101A123

Meeting Attendees: See the enclosure for a list of meeting attendees.

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Meeting Summary:

On April 18, 2023, the U.S. Nuclear Regulatory Commission (NRC) staff held a hybrid public information meeting with a question-and-answer session. The purpose of the meeting was to share NRC staff (staff) initial perspectives on probabilistic risk assessment (PRA) used to implement the Licensing Modernization Project (LMP) methodology in support of non-light-water reactor (non-LWR) construction permit (CP) applications under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, “Domestic Licensing of Production and Utilization Facilities.” The staff conducted the meeting in accordance with NRC Management Directive 3.5, “Attendance at NRC Staff-Sponsored Meetings” (ADAMS Accession No. [ML21180A271](#)).

The staff gave opening remarks on the general purpose and description of their efforts to develop guidance on PRA implementing the LMP methodology in support of non-LWR CP applications under 10 CFR Part 50. The staff noted important relationships and emphasized their intent to be consistent with industry guidance on the LMP methodology in the Nuclear Energy Institute (NEI) guidance document NEI 18-04, Revision 1, “Risk-Informed Performance-Based Guidance for Non-Light Water Reactor Licensing Basis Development,” and the Technology-Inclusive Content of Application Project (TICAP) guidance in NEI 21-07, Revision 1, “Technology Inclusive Guidance for Non-Light Water Reactors; Safety Analysis Report Content for Applicants Using the NEI 18-04 Methodology,” and noted coordination of their efforts with related agency efforts on light-water reactor (LWR) PRA supporting CP applications under 10 CFR Part 50.

The staff provided an overview of relevant regulations, regulatory guidance, industry guidance, and consensus standards to set the context for discussions with specific attention to key industry and regulatory guidance documents. These guidance documents include the NEI guidance documents and Regulatory Guide (RG) 1.233, Revision 0, “Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors,” which provides NRC endorsement of NEI 18-04, Revision 1. These documents were developed over the past several years and published in support of a technology-inclusive, risk-informed, and performance-based approach to licensing new non-LWRs; however, the staff noted the genesis of the licensing approach dates to the early 1980s. The staff also highlighted related staff efforts to evaluate the applicability of requirements from the non-LWR PRA consensus standard, ASME/ANS RA-S-1.4–2021, “Probabilistic Risk Assessment Standard for Advanced Non-Light Water Reactor Nuclear Power Plants,” which was jointly prepared by the American Society of Mechanical Engineers (ASME) and the American Nuclear Society (ANS). This consensus standard on PRA is endorsed by the NRC in trial RG 1.247, “Acceptability of Probabilistic Risk Assessment Results for Non-Light-Water Reactor Risk-Informed Activities.” The staff’s efforts to evaluate applicability of requirements relates to the stages of different licensing processes and in the context of both LMP-based and non-LMP-based types of license applications. The staff shared that the evaluation effort may result in a separate guidance document.

A key motivation for the staff’s guidance development effort is that prospective non-LWR applicants that are expected to submit CP applications supported by a PRA using the two-step licensing process under 10 CFR Part 50 and no previous CP applications have been supported by a PRA. This is important because a significant amount of time has passed since any new license application for a power reactor has been submitted under 10 CFR Part 50 and substantial evolutions of the NRC’s regulatory framework and practices have occurred since the last issuance of a CP for a power reactor, especially as it relates to the evolution of risk-

informed regulatory activities and the use of PRA. The staff pointed out that, although it was never submitted to the NRC, a CP application supported by a PRA was developed for the Clinch River breeder reactor in the early 1980s and the PRA was relatively well-developed based on the preliminary design information available at the time. The staff also related that there have been recent CP applications under 10 CFR Part 50 for non-power production or utilization facilities (NPUFs); however, these applications offer only limited insights into the needs for a PRA implementing the LMP methodology in support of a CP application for a power reactor due to differences in regulatory requirements and the nature of the NPUF designs.

The staff presented a conceptual diagram to illustrate the relationship between the evolving maturity of a PRA and the development of a PRA-informed plant design during the stages of the two-step licensing process under 10 CFR Part 50. The staff emphasized that the evolution of the PRA maturity will likely change in a stepwise manner relative to design progress; applicants using the two-step licensing process under 10 CFR Part 50 assume a certain amount of enterprise risk depending on the level of information available to inform the PRA and design process at the time of the CP application; and the maturity of the design and PRA are expected to generally converge at the time of the operating license (OL) application.

The staff discussed various key regulations and Commission Policy statements relevant to the implementation of the LMP methodology in support of CP applications under 10 CFR Part 50 to point out key language that has informed staff perspectives. Specifically, the staff noted regulations related to the scope of a CP application and how implementation of the LMP methodology can help demonstrate that Commission Policy issues are addressed. The staff shared that it is studying language from certain regulations to better understand the implications for a PRA implementing the LMP methodology, items in a preliminary safety analysis report that are expected to be informed by a PRA supporting the LMP methodology implementation, and what the staff would approve in support of issuing a CP. The staff provided examples of items it would expect to be approved for the CP, which include but are not limited to principal design criteria (PDC), the design bases, and the relationship between the two that must be provided in the CP application. The staff recognized that PDC are in part derived from the PRA and the three processes associated with the LMP methodology, which are licensing basis event (LBE) selection, classification of structures, systems, and components (SSCs), evaluating adequacy of a design's defense in depth (DID). As such, the PDC proposed in a CP application would be preliminary and could be subject to change. The staff explained it is working to determine if or what conditions may need to be imposed on a CP, such as it relates to adhering to approved PDC, adhering to the three processes of the LMP methodology and adherence to the applicant's plan for finalizing the design and PRA.

The staff discussed differences between specific and broader uses of the term PRA used in the context of different regulatory activities. The staff pointed out these uses because the broader meaning of PRA is implied by requirements under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and guidance the NRC's Standard Review Plan (NUREG-0800), Chapter 19, "Severe Accidents," related to standard design certifications whereas the specific meaning of PRA is affiliated with the general use of the ASME/ANS non-LWR PRA consensus standard and guidance in RG 1.247 (need to further complete this point). The staff also presented and asked for feedback on a diagram showing where the staff would expect to find PRA-related information in an applicant's safety analysis report (SAR). During the question-and-answer portion of the meeting, the staff received the following feedback related to this question. Regarding source terms, a participant indicated that information in an SAR about the design-basis accident (DBA) source term might show up as PRA-related information if the

PRA and DBA source terms are the same. Regarding SSC classification, it was emphasized that process is supported by but is not a direct result of the PRA.

The staff highlighted several pieces of guidance from NEI 21-07, Revision 1, to describe the staff's perspectives on how that guidance would be implemented in support of a CP application. The staff asked the stakeholders about the meaning of the phrase, "use another PRA methodology," especially as it relates to the previous discussion on the specific and broader meanings of the term PRA and noted that the staff is focusing on the meaning of "addressing" or "including" items in the PRA. During the question-and-answer portion of the meeting, the staff received feedback that the phrase in question was intended to emphasize that using the ASME/ANS non-LWR PRA consensus standard, ASME/ANS RA-S-1.4-2021, is only one approach and that another approach could be used. The staff noted that, while that the PRA supporting implementation of the LMP methodology at the time of the CP application may not be full-scope, the LMP guidance in NEI 21-07, Revision 1, and NEI 18-04, Revision 1, allow the use of deterministically or probabilistically derived design-basis external hazard levels, referred to as design-basis hazard levels (DBHLs) in NEI 21-07, Revision 1. The use of DBHLs allow imposition of initial design requirements for protection against risk contributors not yet modeled in the PRA supporting the CP application.

The staff provided a comparison of processes in the LMP methodology to those used to meet requirements of 10 CFR 50.69, "Risk-informed categorization and treatment of structures, systems and components for nuclear power reactors," and that, like those programs and the related regulatory guidance in RG 1.201 for their implementation, supplemental evaluations that are not based on a PRA may be used to complement the use of the PRA. However, the staff also noted that 10 CFR 50.69(c), "SSC Categorization Process," paragraph (i) requires, at a minimum, an internal events, at-power PRA. The staff further highlighted that the risk assessment application process described in the ASME/ANS non-LWR PRA standard, ASME/ANS RA-S-1.4-2021, provides for the use of supplemental evaluations instead of directly modeling a risk contributor in the PRA; however, ASME/ANS RA-S-1.4-2021 does not provide requirements for performing such supplemental evaluations. The staff asked whether there are industry efforts to develop methods for risk-informed or other types of supplementary evaluations, such as adapting and extending the currently LWR-centric seismic margin assessment method to non-LWRs and noted that it has not seen anything yet to that effect. During the question-and-answer portion of the meeting the staff did not receive any feedback indicating such industry efforts were in progress or being considered.

The staff provided a discussion of RG 1.247 with respect to the scope of a PRA implementing the LMP methodology and that RG 1.247 broadly talks about an acceptable PRA needing to address all radiological sources, all hazards, all plant operating states, and consist of a full analysis from initiating events to consequences. However, the staff pointed out that the acceptability of a PRA used in a regulatory application will be assessed against guidance specific to the application under consideration. The staff also noted that the PRA should always reflect information available for the design or constructed plant, but re-emphasized the understanding that the PRA cannot be continually updated to reflect the evolution of the plant design and that the PRA will represent a discrete point in that evolution.

The staff presented a process diagram to discuss the following key aspects of the PRA development and LMP implementation processes using the two-step licensing process under 10 CFR Part 50 that have informed staff perspectives. Identifying all radiological sources, hazards, plant operating states is consistent with the scope of the CP application implied by 10 CFR 50.34(a), "Preliminary safety analysis report," paragraph (4), regardless of how they are

dispositioned at the time of the CP application. As such, some CP application scope items may be addressed in a PRA model, a supplementary evaluation, or a DBHL. Screening analyses performed as part of the development of the PRA model are considered preliminary at the time of the CP application and would need to be revisited when the maturity of the PRA and other analyses are sufficient to confirm the validity of the screening bases. Items the staff anticipates approving as part of the CP include, but are not limited to, PDC, design bases, and relationships between the two; processes for LBE selection, SSC classification, and DID adequacy evaluation; the plan for finalizing the design and PRA, and any requests for finality of a design specification or feature. Similar to programs implementing 10 CFR 50.69, approval of a CP implementing LMP is expected to focus largely on approval of the underlying processes given the nature of the regulatory finding needed under 10 CFR 50.35, "Issuance of construction permits," paragraph (a). Implementation of the LMP methodology allows for the use of SSC reliability and capability targets as a substitute for meeting a single-failure criterion. Given it is implied in the guidance on LMP and TICAP, the staff asked the stakeholders whether the PRA would eventually be developed to model all risk contributors or would supplementary evaluations and DBHLs still be used to support the OL application as an alternative to modeling all risk contributors in the PRA. During the question-and-answer portion of the meeting, the staff received feedback that fully developing the PRA to support the OL application may not always be in a developer's interest if the developer can achieve their objectives and meet regulatory requirements using non-PRA methods. The staff acknowledged this dynamic and noted that the flowchart presented the notion that the PRA would be fully developed in support of the OL application to stimulate discussion but emphasized that the staff has not reached a position on this issue.

The staff shared perspectives on what potential license conditions for a CP might look like and presented an example license condition for a recent operating reactor license amendment related to a program implementing requirements under 10 CFR 50.69. The staff acknowledged that the example license condition is more specific than is expected to be needed for a CP; however, it is a point of reference that helps frame staff perspectives on the issue. Finally, the staff provided a summary of initial perspectives on what is needed for a PRA implementing the LMP methodology in support of a non-LWR CP application under 10 CFR Part 50 and how that may ultimately inform approval of and conditions on a CP.

In addition to the aforementioned points related to specific staff questions, the staff received the following additional stakeholder feedback during the question-and-answer portion of the meeting on the staff's presentation as well as related comments and questions.

- The staff received feedback that the license condition for the 50.69 license amendment may not be a good model to follow for what the staff are looking to achieve. The staff emphasized that the example was more to illustrate there is a precedent for such a license condition versus it serving as more of a potential model for a condition the staff would consider for non-LWR CP applications implementing the LMP methodology under 10 CFR Part 50.
- Regarding the use of PRA in implementing the LMP methodology, the staff received feedback that LMP is not and was never intended to be solely driven by the PRA and that the PRA results and other processes like the DID adequacy evaluation process inform decisions with consideration of the scope and limitations of the PRA. In implementing LMP, some decisions may be initially based on deterministic, conservative design information that would later be compared to and confirmed using the PRA.

- The staff received the following feedback regarding the use of DBHLs and supplementary evaluations. DBHLs are not intended to be an alternative evaluation method but are used to help initially determine plant capabilities and is fundamental to the SSC classification process. There is the general notion that the internal events PRA would be used to establish required safety functions and safety-related SSC classifications, as complimented by design requirements informed by DBHLs for hazards other than internal events. This dynamic is meant to help prevent a developer from having to wait to develop PRA models for other hazards than internal events before proceeding with the design process. DBHLs and supplementary evaluations are not intended to always be replaced by PRA modeling in support of the OL application. Developing a PRA model for a specific hazard could reveal that not all safety-related SSCs are not needed for that hazard. However, developing the PRA is generally more onerous than using a deterministic DBHL given the LMP methodology considers both successes and failures in the PRA for the evaluation of LBEs. The staff responded to feedback on this topic by emphasizing that it would always allow the use of a deterministic DBHL, but that a PRA would be expected to be used to confirm such deterministic decisions. Related to this topic, the staff asked what other non-PRA methods might be used to produce event sequences to support implementation of the LMP methodology and received feedback emphasizing that decisions may defer to, for example, conservatively classifying an SSC as safety-related before waiting to develop a PRA or using a non-PRA method to otherwise develop and evaluate event sequences to make a more refined decision.
- Regarding the use of the LMP methodology for non-LWRs and uses of PRA for LWRs, the staff received feedback that a significant difference to consider between the two is that LMP explicitly considers frequency of occurrence and radiological consequences versus LWR PRAs which are typically focused on frequency of occurrence.
- Regarding developer communications with the regulator, the staff received feedback that it is well understood that good communication with the regulator is inherently necessary for a successful licensing strategy. As such, it was emphasized that no additional requirements on communications between developers and the regulator are needed.
- Regarding general references and guidance, the staff received feedback that the Staff Requirements Memorandum on SECY-98-0144, "Staff Requirements – SECY-98-144 – White Paper on Risk-Informed and Performance-Based Regulations," is an important document to consider for risk-informed and performance-based regulation.
- Regarding enterprise risk, the staff received feedback that, while necessary to consider for the two-step licensing process under 10 CFR Part 50, it may be untenable for some developers. The staff responded to this comment by emphasizing that 10 CFR Part 52 was established largely to help minimize a developer's enterprise risk.
- Regarding the use of the LMP methodology and the two-step licensing process under 10 CFR Part 50 for first-of-a-kind designs, the staff received feedback expressing concern about the likelihood that developer commitments to design decisions supporting the CP application would actually be reversed by the staff at the time of the OL application, even when a more mature PRA has been developed and is available to assess plant risk. The commenter asked whether the staff would otherwise seek to impose conditions on a CP to preemptively avoid such situations. The staff responded to the comment by noting that consideration of the enterprise risk assumed by a developer cannot be over-emphasized as

the NRC has no obligation to issue an OL under the two-step licensing process if the conditions and requirements for doing so are not met. The staff also noted that implementation of the LMP methodology can increase confidence that risk insights would be appropriately considered early in the design process and provide a more comprehensive basis for understanding severe accidents.

- Regarding use of the PRA, the staff received feedback suggesting it consider how their guidance might address the potential for manipulation of a PRA and its results to achieve a desired outcome versus promoting more objective acceptance of the feedback from the PRA in the design process.
- The staff responded to a question about the level of detail expected in staff guidance on PRA implementing the LMP methodology for non-LWR CP applications under 10 CFR Part 50 by indicating that this public meeting is only the first of what the staff expects will be several interactions on this topic and are still working to determine the appropriate level of detail for the proposed guidance. The staff indicated it continues to evaluate relationships to other guidance in existence and under development and as it considers the role of PRA in the implementation of the LMP methodology in the two-step licensing process under 10 CFR Part 50.
- The staff responded to a question about whether it would consider accepting a CP application that does not use PRA by explaining that, for the implementation of the LMP methodology, use of a PRA is an essential aspect of implementing the methodology and that the topic was outside the scope of the meeting.
- The staff responded to a question on the use of PRA for non-LMP-based types of license applications and the performance-based aspects of the LMP methodology as being outside the scope of the public meeting and potentially deferring to a subsequent public interaction.
- The staff responded to a question about its guidance addressing procurement and pre-construction activities occurring simultaneously by indicating the staff is still in the early stage of developing the guidance and considering all feedback but continued to emphasize the general importance of pre-application interactions with the staff on those types of issues.
- The staff responded to a question that an applicant's plan for completing the PRA could simply be a statement that the PRA would be updated to meet the non-LWR PRA consensus standard. However, the staff indicated it would be helpful to know the plan for the ultimate scope of the PRA being contemplated, given the developer may opt to use supplementary evaluations for a given risk contributor versus explicitly modeling it in the PRA. The staff responded to a related question that it would generally be sufficient to address the scope of the PRA with information at the level of the hazards, sources, and plant operating states, and with re-emphasis on the importance of pre-application interactions with the staff.

The staff shared its general plans for preliminary guidance, anticipated availability to the public, and subsequent public interactions on the topic. The staff provided an opportunity for public comments and, having received none, the meeting was concluded. No regulatory decisions were made as a result of this meeting.

Enclosures: List of Meeting Attendees

SUBJECT: SUMMARY OF THE APRIL 18, 2023, PUBLIC MEETING ON PROBABILISTIC RISK ASSESSMENT IMPLEMENTING THE LICENSING MODERNIZATION PROJECT METHODOLOGY IN SUPPORT OF CONSTRUCTION PERMIT APPLICATIONS UNDER TITLE 10 OF THE *CODE OF FEDERAL REGULATIONS* PART 50 DATED: SEPTEMBER 13, 2023

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DATE	07/05/2023	09/12/2023	09/13/2023

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List of Meeting Attendees
PUBLIC MEETING ON PROBABILISTIC RISK ASSESSMENT IMPLEMENTING THE
LICENSING MODERNIZATION PROJECT METHODOLOGY IN SUPPORT OF
CONSTRUCTION PERMIT APPLICATIONS UNDER
TITLE 10 OF THE CODE OF FEDERAL REGULATIONS PART 50
APRIL 18, 2023

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Alissa Neuhausen	NRC	Steven Lynch	NRC
Amy Cabbage	NRC	Sunwoo Park	NRC
Anders Gilbertson	NRC	Tony Nakanishi	NRC
Anne-Marie Grady	NRC	William Reckley	NRC
Beth Reed	NRC	Alex Huning	--
Candace de Messieres	NRC	Amir Afzali	--
Courtney Banks	NRC	Andrew Scheg	GEH
David Desaulniers	NRC	Arlette Howard	--
Hanh Phan	NRC	Ben Chen	--
Hossein Nourbakhsh	NRC	Brandon Chisholm	--
James O'Driscoll	NRC	Brandon Hartle	X-energy
John Segala	NRC	Brandon Norris	X-energy
Joseph Sebrosky	NRC	Brian Johnson	TerraPower
Julie Ezell	NRC	Brian Krystek	GEH
Keith Tetter	NRC	Brian McDermott	--
Lauren Mayros	NRC	Carl Friesen	--
Malcolm Patterson	NRC	Charles Standridge	--
Mallecia Sutton	NRC	Charlotte Geiger	--
Marie Pohida	NRC	Charlyne Smith	Breakthrough Institute
Marty Stutzke	NRC	Christopher Courtenay	--
Michael Orenak	NRC	Colt Cupit	GEH
Mihaela Biro	NRC	Dave Grabaskas	ANL
Ossy Font	NRC	David Koenigsfeld	--
Reed Anzalone	NRC	DeLeah Lockridge	--
Scott Tonsfeldt	NRC	Derrick Watkins	--
Stacey Rosenberg	NRC	Donald Behnke	--
Drew Nigh	X-energy	Meredith Heh	--

Edwin Lyman	UCS	Mihai Diaconeasa	--
Eric Deeken	--	Mike Montecalvo	TerraPower
Eric Oesterle	--	Mohamed Talaat	--
Eric Thornsby	--	Olivier Retourne	--
Ethan Graven	--	Owen Scott	--
Ewa Muzikova	USNC	Pamela Fergen	TerraPower
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Heather Detar	--	Raymond Schiele	--
Huy Tran	--	Richard Anoba	--
Ian Gifford	--	Rob Burg	--
Ingrid Nordby	X-energy	Robert Florian	--
Jack Kirkwood	GEH	Ross Moore	--
James Nevins	GEH	Scott Brinkman	GEH
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John Biersdorf	--	Stephen Kimura	--
John Richards	EPRI	Steve Vaughn	X-energy
Jonathan Li	GEH	Steven Nesbit	SNC
Joomyung Lee	--	Steven Pope	--
Julia Sharma	X-energy	Thomas Hicks	--
Karl Fleming	--	Tom Elicson	--
Kati Austgen	NEI	Tom King	--
Leslie Holden	TerraPower	Tony Jackson	--
Lester Towell	--	Travis Chapman	X-energy
Lindsay Martin	TerraPower	Yolanda Combrink	--
Marc Hotchkiss	--	Yvonne Mirowski	--
Mark Cursey	X-energy		