



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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January 4, 2022

MEMORANDUM TO: Steven Lynch, Chief
Advanced Reactor Policy Branch
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

FROM: Prosanta Chowdhury, Project Manager
Advanced Reactor Policy Branch
Division of Advanced Reactors and Non-Power
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Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF NOVEMBER 10, 2021, PERIODIC ADVANCED
REACTOR STAKEHOLDER PUBLIC MEETING

Prosanta Chowdhury

Signed by Chowdhury, P
on 01/04/22

On November 10, 2021, the U.S. Nuclear Regulatory Commission (NRC) staff held an information meeting with a question-and-answer session with stakeholders to discuss advanced reactor topics including:

- The Technology-Inclusive, Risk-Informed Maximum Accident (TI-RI-MA) Approach – An Alternative to Probabilistic Risk Assessment
- An Overview of NRC's Regulatory Requirements and Guidance on Counterfeit, Fraudulent, and Suspect Items
- Advanced Reactor Content of Application – Chapter 11, "Organization and Human-System Considerations," and Chapter 12, "Post-Construction Inspection, Testing and Analysis Program"
- Accelerated Fuel Qualification (AFQ) White Paper
- Update on the Development of a Flexible Operator and Staffing Licensing Framework for Advanced Reactors
- FAQ for Physical Security Cat. II Fuel Cycle Facilities
- Fuel Qualification for Molten Salt Reactors

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The meeting notice is available in the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML21309A773, and the presentation slides are available at ADAMS Accession No. ML21312A055. The Enclosure to this summary provides the attendees for the meeting as captured by Microsoft Teams.

For each topic listed above, the NRC staff provided information and allotted time for stakeholder comments and questions. Stakeholders provided feedback on several of the topics and asked clarifying questions. NRC staff stated that the feedback was appreciated.

The NRC staff provided an overview of the Advanced Reactor Integrated Schedule of Activities on the NRC's public website at <https://www.nrc.gov/reactors/new-reactors/advanced/details#advSumISRA>. The NRC staff noted that the schedule reflects activities that have recently been completed, updated, or added since the September 29, 2021, advanced reactor stakeholder meeting.

The NRC staff presented an overview of technology-inclusive, risk-informed maximum accident (TI-RI-MA) approach – an alternative to probabilistic risk assessment (PRA). This presentation was a continuation of the dialog about graded PRA and the role of the PRA in the licensing process. The NRC staff stated that they were reviewing definitions used in risk-informed regulation and identifying current and proposed uses of PRA. Based on the results of this effort, the NRC staff is developing a tentative TI-RI-MA approach that certain applicants may elect to use in lieu of developing a PRA. The NRC staff stated they would continue to develop guidance and start to develop preliminary rule text.

A stakeholder commented that before the Three Mile Island accident the general assumption was that the worst accident for light-water reactors was the double-ended guillotine accident. Furthermore, the commenter asked if the TI-RI-MA approach represented the modern search for the equivalent of the double-ended guillotine accident. The NRC staff clarified that each designer who wants to use the TI-RI-MA approach will be required to identify and justify a maximum accident (either a maximum credible accident or a maximum hypothetical accident, which may be non-physical). In general, the maximum accident will be design-specific. The stakeholder also noted the importance of guidance in regard to potential new regulations and NRC staff affirmed that guidance was being considered. Another stakeholder asked if the NRC staff had further thoughts about how frequency could be applied to the Quantitative Health Objectives for TI-RI-MA beyond using the estimate of one event per year. NRC staff replied there was no further resolution of this issue yet.

The NRC staff presented an overview of NRC's Regulatory Requirements and Guidance on Counterfeit, Fraudulent, and Suspect Items (CFSI). The NRC staff provided the advanced reactors stakeholders with NRC's regulatory requirements for CFSI and related guidance for addressing these requirements. This presentation also touched upon available training for external stakeholders on CFSI and engagement with the advanced reactor vendors in facilitating their understanding on the subject. The NRC staff provided source of guidance developed by the nuclear industry, international organizations, and Federal agencies other than the NRC. The NRC staff pointed to NRC Information Notice (IN) 2012-22, updated in 2019 ((ADAMS Accession No. ML19017A117), that lists CFSI-related training offerings. In response to an inquiry the NRC staff clarified that there would be no updates to rule language since an NRC regulatory guide endorses an industry guidance document as an acceptable way to meet 10 CFR Part 21 and in this endorsed guidance, the definition of a "deviation" addresses CFSI in the definition of "deviation."

The NRC staff discussed updates being incorporated in the Advanced Reactor Content of Application Project (ARCAP) revised draft white paper Chapter 11, "Organization and Human-System Considerations" and revised draft white paper Chapter 12, "Post-Construction Inspection, Testing and Analysis Program." The NRC staff noted that they updated Chapter 11 guidance to expand the scope of the guidance to include human factors engineering (HFE) guidance to supplement licensing modernization project (LMP) and pending associated Technology Inclusive Content of Application Project (TICAP) guidance. The NRC staff stated that the revised draft white paper also included operator licensing, and operator training and staffing guidance. In the area of operator licensing and training, the staff noted that some of the guidance went beyond what would be expected to be provided in an application. For example, the draft white paper guidance included a discussion of the use of a simulator for operator training experience and examinations during construction and operator licensing prior to fuel load. The NRC staff stated that it developed the guidance to provide a holistic approach for expectations regarding operator licensing and training.

The NRC staff noted that it updated ARCAP Chapter 12 draft white paper guidance to expand the scope beyond initial startup programs. The revised guidance differentiates between 10 CFR Part 52 applicants that must include ITAAC and 10 CFR Part 50 applications that are not required to include ITAAC. The revised ARCAP Chapter 12 white paper consists of guidance related to post-construction inspection, preoperational testing (i.e., tests conducted following construction and construction-related testing, but prior to initial fuel load), analysis verification, and initial startup testing (i.e., tests conducted during and after initial fuel load, up to and including initial power ascension).

General Atomics presented an overview of an Accelerated Fuel Qualification (AFQ) White Paper jointly developed by several industry stakeholders and national laboratories. On October 8, 2021, the industry-led AFQ Working Group provided to the NRC staff a copy of this white paper (ADAMS Accession No. ML21287A646), dated October 1, 2021, which details a formalized methodology for the development and qualification of new nuclear fuels in an accelerated time frame as compared to the current, conventional methodology of fuel qualification. Its goal is to significantly reduce the time to qualify new fuels, from what historically has taken more than 20 years, to an ultimate duration of as few as 5 years.

The presenter stated that the AFQ methodology would bring together a combination of advanced, physics-informed nuclear fuel performance modeling and simulation (M&S) with targeted experiments. The AFQ methodology aims to consolidate and reduce the number of required integral irradiation tests by developing and using mechanistic models that properly represent the physics of fuel performance, and making use of separate-effects tests to inform and validate those models and simulations. An ultimate demonstration of the final fuel design, fabricated according to specification, tested at scale, and tested under prototypical conditions, will continue to be a necessary step in fuel qualification. Shortening the time required to advance to this final demonstration phase is where the major time reduction for developing a new fuel would be gained. The presenter summarized that the AFQ methodology was a suggested guide to the qualification of new nuclear fuels and offers a path to qualify new nuclear fuels in a timely and cost-effective way by leveraging the most advanced M&S and experimental tools that are available today; that the AFQ methodology must be tailored for the specific reactor type, fuel form, and safety case; and that best-practice updates of AFQ implementation can only be enabled by shared experience and data from specific user applications. In response to an inquiry about any specific fuel to test out, the presenter clarified that no fuel type was chosen yet to test out. Future AFQ Working Group workshops will include more in-depth analysis of the available advanced M&S and experimental tools that could be

applicable to a range of new fuel types. Fuel-specific AFQ implementation case studies will also be the subject of future workshops to enable information sharing and additional AFQ toolkit development and updates.

The NRC staff presented an update on the development of a flexible operator and staffing licensing framework for advanced reactors as follows:

Human-System Considerations:

In March 2021, the NRC staff issued a white paper on Risk-Informed and Performance-Based Human-System Considerations for Advanced Reactors. In this paper, the NRC staff discussed the need to develop guidance to support the development of the proposed Part 53, Subpart F language in three key areas: 1) Scalable Human Factors Engineering (HFE) approach, 2) Flexible Operator Licensing, and 3) Flexible Staffing. The Scalable HFE project was discussed at the September 29, 2021, Advanced Reactor Stakeholder Meeting (ADAMS Accession No. ML21301A054).

Tailored Operator Licensing:

Under Part 53, the NRC staff is proposing to substitute the existing prescriptive examination process for operator licensing that is based on Part 55 with requirements that instead enable a flexible approach focused on processes and methodologies. Under such an approach, the facility would propose the specific elements of the examination process, which would then be reviewed and approved by the NRC (using guidance currently under development), to ensure that the proposed examination process reflects sound testing practices. A comment was made by a stakeholder that the terminologies “certified” and “non-licensed” can be confusing and whether these mean the same. The NRC staff clarified that these two terminologies do not mean the same and rather that the proposed “certified” operator position would consist of a non-licensed individual possessing a very specific type of qualification. Another question was asked regarding if NRC approval of training means approval of training program content or of exams. The NRC staff clarified that these two approvals entail different processes. In response to an inquiry about whether there was coordination with the research and test reactors (RTR), the NRC staff explained that there were no similar efforts currently ongoing for RTRs. A further question was asked regarding whether any applicant for a facility license under Part 53 would automatically be eligible to use certified operators in lieu of licensed operators. In response, the NRC staff clarified that specific technical requirements are being considered within Part 53 to screen which plants would be permitted to substitute certified operators for licensed operators.

Flexible Staffing:

Part 53’s approach to licensed operator staffing is intended to allow facilities to propose the staffing model that is appropriate for their concept of operation (versus prescribing the number and roles of operators). It is intended that facilities will need to support their proposed staffing model with relevant HFE-based analyses and assessments to demonstrate that safety functions will be fulfilled. The NRC staff is currently creating guidance augmenting NUREG-1791, “Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m),” (ADAMS Accession No. ML052080125), to provide for a structured methodology for the review of these staffing plans.

The NRC staff provided an overview of recently published publicly available questions and answers regarding how the NRC will address licensing issues for Category II Fuel facilities with respect to Physical Security. The NRC staff shared these two key messages: (1) supplemental security requirements could include measures to provide greater security or control over material in use and storage and vital equipment; and (2) to ensure a timely and efficient review,

applicants planning to possess Category II quantities of Special Nuclear Material (SNM) should engage with NRC staff early in the licensing process; the early establishment of an information security program allows for more detailed information to be shared expeditiously.

Oak Ridge National Laboratory (ORNL) presented on behalf of the NRC staff, an overview of Fuel Qualification for Molten Salt Reactors (MSR). ORNL, under contract with the NRC, has developed a draft NUREG/CR, "Fuel Qualification for Molten Salt Reactors" (Draft Report for Comment), (ADAMS Accession No. ML21245A493), to provide guidance on fuel qualification for MSR. The report supports development of an efficient and appropriate methodology or process for liquid salt fuel system qualification. It describes the technical issues encountered when developing an adequate understanding of the fuel salt's chemical and physical behavior under both normal and accident conditions. ORNL stated that fuel salt supports the plant structures, systems, and components (SSCs) in achieving the fundamental safety functions (FSFs) and regulatory requirements. The guidance in the draft NUREG/CR is intended for applicants and the regulatory review staff. The presentation did not solicit formal comments or feedback; however, stakeholders were invited to ask questions or make comments if they so choose. In response to a question whether there was a deadline for providing comments on the draft NUREG/CR, the NRC staff clarified that no formal feedback was being solicited.

One stakeholder suggested that for future meetings, the NRC staff should identify which topics would be for awareness only and which ones would be for discussion. The NRC staff agreed that this was a good suggestion. Members of the public were in attendance and the NRC did not receive public meeting feedback forms. To see information regarding previously held periodic advanced reactor stakeholder public meetings, please visit the NRC's public website at <https://www.nrc.gov/reactors/new-reactors/advanced/details.html#stakeholder>. The next advanced reactor stakeholder meeting is currently scheduled for January 19, 2022.

Please direct any inquiries to me at 301-415-1647 or via e-mail at Prosanta.Chowdhury@nrc.gov.

Enclosure:
Attendance List

SUBJECT: SUMMARY OF NOVEMBER 10, 2021, PERIODIC ADVANCED REACTOR
STAKEHOLDER PUBLIC MEETING DATED: JANUARY 4, 2022

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OFFICE	NRR/DANU/UARP/PM	NRR/DANU/UARP/BC	NRR/DANU/UARP/PM
NAME	PChowdhury	SLynch	PChowdhury
DATE	12/15/2021	01/04/2022	01/04/2022

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November 10, 2021, Periodic Advanced Reactor Stakeholder Public
Meeting Attendance List

Name	Organization
Ahn, Hosung	NRC
Anzalone, Reed	NRC
Beall, Bob	NRC
Bowen, Jeremy	NRC
Bowman, Eric	NRC
Bussey, Scott	NRC
Chen, Ben	NRC
Chowdhury, Prosanta	NRC
Cubbage, Amy	NRC
Garcia, Ismael	NRC
Grady, Anne-Marie	NRC
Hammelman, James	NRC
Hansing, Nicholas	NRC
Horowitz, Steven	NRC
Humberstone, Matthew	NRC
Jauntirans, Juris	NRC
Jung, Ian	NRC
Keefe, Maxine	NRC
Lynch, Steven	NRC
Marchlewski, Henry	NRC
Mazza, Jan	NRC
McGlinn, William	NRC
Morrow, Stephanie	NRC
Muniz, Adrian	NRC
Nist, Lauren	NRC
Oesterle, Eric	NRC
Phan, Hanh	NRC
Philpott, Stephen	NRC
Prescott, Paul	NRC
Reckley, William	NRC
Regan, Christopher	NRC
Roche-Rivera, Robert	NRC
Rubenstein, James	NRC
Sebrosky, Joseph	NRC
Segala, John	NRC
Seymour, Jesse	NRC
Shams, Mohamed	NRC
Siwy, Alexandra	NRC
Smith, Maxwell	NRC
Stutzke, Martin	NRC
Sun, Casper	NRC

Enclosure

Name	Organization
Thomas, Brian	NRC
Travis, Boyce	NRC
Uribe, Juan	NRC
Valliere, Nanette	NRC
Van Wert, Christopher	NRC
Vechioli Feliciano, Lucieann	NRC
Vitto, Steven	NRC
Wagner, Katie	NRC
Walker, Shakur	NRC
Weerakkody, Sunil	NRC
Widmayer, Derek	NRC
Williams, Donna	NRC
Zhang, Deanna	NRC
Jason A. Christensen	Idaho National Laboratory
Jim C. Kinsey	Idaho National Laboratory
Thomas Hicks	Idaho National Laboratory
David Holcomb	Oak Ridge National Laboratory
Kenneth Thomas (PNNL)	Pacific Northwest National Laboratory
Afzali, Amir	Stakeholder
Amico, Paul	Stakeholder
Andrew Dyszel	Stakeholder
Arndt, Steven	Stakeholder
AUSTGEN, Kati	Stakeholder
Belles, Randy	Stakeholder
Bergman, Jana	Stakeholder
Beth Brewer (NuScale)	Stakeholder
Blake Bixenman - Urenco USA	Stakeholder
Christopher P. Chwasz	Stakeholder
Cook, Stephen	Stakeholder
Courtenay, Christopher C	Stakeholder
Cyril Draffin (USNIC)	Stakeholder
Ewa Muzikova	Stakeholder
frank akstulewicz	Stakeholder
George Flanagan	Stakeholder
Grabaskas, Dave	Stakeholder
Heinrich Engela	Stakeholder
HOLTZMAN, Benjamin	Stakeholder
Ingrid Nordby	Stakeholder
John O	Stakeholder
Jun Liao	Stakeholder
Kiersten Smith	Stakeholder
KISSINGER, Peter	Stakeholder
Klein, Joel	Stakeholder

Name	Organization
Kyra Perkins (NuScale)	Stakeholder
Lahaye, Nicole L	Stakeholder
Lemmer Lusse	Stakeholder
Liao, Jun	Stakeholder
Manoharan, Archie	Stakeholder
Mark Ring	Stakeholder
Mary Neumayr	Stakeholder
Mermigos, James	Stakeholder
Michael Mayfield	Stakeholder
Michelle Byman	Stakeholder
Narasimha Prasad Kadambi	Stakeholder
Nelson, Scott	Stakeholder
NICHOL, Marcus	Stakeholder
Orenak, Michael	Stakeholder
Paese, Richard M	Stakeholder
Patrick Essner	Stakeholder
Paugh, Cherie	Stakeholder
Poore III, Willis	Stakeholder
Rebecca Norris (NuScale)	Stakeholder
Robert Budnitz	Stakeholder
Sarah Fields	Stakeholder
Scott E. Ferrara	Stakeholder
SHAHROKHI Farshid (FRA-CORP)	Stakeholder
Sofu, Tanju	Stakeholder
Stadtlander, Richard A.	Stakeholder
Stephen J. Burdick	Stakeholder
Steven Kraft	Stakeholder
Tammy Morin	Stakeholder
Todd M. Anselmi	Stakeholder
Zach, Andrew (EPW)	Stakeholder

* Attendance list based on Microsoft Teams Participant list. List does not include individuals that connected via phone.