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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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733RD MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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THURSDAY

MARCH 5, 2026

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The Advisory Committee met at Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, and via videoconference, at 8:30 a.m. EST, Gregory Halnon, Chair, presiding.

COMMITTEE MEMBERS:

GREGORY H. HALNON, Chair

DAVID A. PETTI, Vice Chair

CRAIG D. HARRINGTON

ANNIE M. KAMMERER

WALTER L. KIRCHNER

ROBERT P. MARTIN

SCOTT P. PALMTAG

THOMAS E. ROBERTS

MATTHEW W. SUNSERI

DESIGNATED FEDERAL OFFICIAL:

LARRY BURKHART

ALSO PRESENT:

MARISSA BAILEY, ACRS Executive Director

P-R-O-C-E-E-D-I-N-G-S

(8:39 a.m.)

CHAIR HALNON: Yes, given that we have no technical topics, I'm going to open the floor for any public comments relevant to the ACRS or other issues for just a few seconds. So is there any public comments? Raise your hand on Teams and then state your name. Okay. Seeing none, let's go ahead with our first topic. Dave, do you want to read the letter in?

VICE CHAIR PETTI: Yes. So I took -- I got a lot of comments from people since our meeting last month, largely just English, although there are two new paragraphs at the end that are completely new. When we get there, I'll note that. I thank everyone. I just found out there were a couple that I didn't get to your comments, so we'll have to --

Okay. Dear Chairman Nieh, during its 732nd and 733rd meeting from February 5th to February 6th, 2026 and March 5th to 7th, 2026, the Advisory Committee on Reactor Safeguards reflected on lessons learned from reviewing new reactor applications. The Committee's discussions occurred against the backdrop of three major themes: A, ensuring that ACRS continues to meet its statutory responsibilities, B, advancing

the administration's goal of safe nuclear energy deployment by collaborating with staff to ensure reviews are timely, efficient, and attentive to unique or significant issues, and C, supporting the NRC's leadership and foremost reputation in nuclear safety.

The Committee's deliberations encompassed the following recent reviews of applications, the NuScale US600 DCA and US460 standard design approval, the Kairos Hermes and Hermes 2 construction permits, and the TerraPower Natrium construction permit at Kemmerer, Wyoming, ongoing construction permit reviews for X-energy's Xe-100 in Seadrift, Texas, and General Electrics' BWRX-300 at Clinch River, Tennessee, and pre-application topical reports from other vendors. Additionally, the Committee considered guidance from the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy Act, ADVANCE Act. Executive Order 14300 brought in the reform of the Nuclear Regulatory Commission and other relevant Commission direction.

Conclusions and a proposed path forward. The ACRS has adopted a more efficient review approach consistent with directions provided in the ADVANCE Act and EO 14300. Two, the Committee has embraced the EO 14300 direction to focus on the unique, novel, and

noteworthy safety significant aspects of each new reactor application of the licensing review with ongoing efforts to streamline its review while still providing a holistic integrated evaluation consistent with its statutory obligations.

Three, the streamlined ACRS review takes an integrated safety case approach focused on fundamental safety functions of the reactor design which is complementary to the detailed regulatory compliance aspects of the reviews performed by the NRR staff. Employing diverse review strategies is especially beneficial for advanced reactors that introduce many first-of-a-kind features. Four, the Committee reviews are increasingly occurring in parallel within NRC, beginning early following application acceptance and continuing interactions with the applicant and staff in a limited number of focused meetings.

While the Committee has demonstrated its ability to complete reviews ahead of established schedules, we continue to identify ways to enhance effectiveness and efficiency. Five, ultimately, it is the completeness and quality of a license application and associated supporting documents that facilitate efficient and streamlined reviews. It is proven

advantageous for unique methodologies and approaches to be addressed in topical reports during the pre-application stage so such new or novel issues are reviewed early on.

Sixty lessons learned are found in the body of the letter. Background, the 1957 amendment to the Atomic Energy Act established the ACRS as an advisory committee responsible for advising the U.S. Atomic Energy Commission on Reactor Hazards and Safety Standards and for reviewing certain reactor license applications under Sections 103 and 104. After the Energy Reorganization Act of 1974, these responsibilities continued with the Nuclear Regulatory Commission.

As the world's oldest committee focused on nuclear safety, the ACRS has played a key role in reactor licensing, writing the development of new safety requirements and design improvements. Its statutory mandate remains essential today, mirroring that with the committee's role at the dawn of commercial nuclear power some 50-plus years ago, serving to bolster public confidence that new and advanced reactor technologies can be deployed safely and efficiently to meet the administration's national energy goals. Lessons learned, the following lessons

learned originate from recently completed reviews of NuScale, Kairos' Hermes and Hermes 2, TerraPower's Natrium, and the in-process reviews of GE's BWRX-300 and X-energy's Xe 100 reactor designs.

In many cases, there were common threads in the applications that led to these lessons learned. And in other cases, it was differences across the applications that highlighted the observation. They have presented generically without referencing specific applicants of the corresponding staff SE.

The items are organized into three major areas, A, safety case development, B, licensing review process, and C, technology specific impacts on the safety review. Safety case development, one, it is to the benefit of the applicant and the staff review to specifically present safety case in as transparent and complete manner as possible. Ample safety margins should be clearly identified to address uncertainties and to compensate for a lack of operating experience and incomplete validation of computational tools.

To the extent possible, the safety case should be made clear to the public. Two, when an applicant is taking a major departure from historical precedent, then the development of critical aspects of the safety case -- implementation of key safety

functions. More detailed focus on the alternative approach being taken, and the technical rationale for the departure as early in the process as possible would benefit the overall licensing review.

Three, working that top down from safety functions and associated principle design criteria to systems that implement those functions. Combined with a bottoms up evaluation of those unique, novel, or noteworthy aspects a specific technology, for example, new fuel, new coolant, new materials, allows a very focused realistic integrated safety review that complements rather than duplicates the staff's chapter-by-chapter review approach. Review strategy diversity is especially important as advanced reactors introduce first-of-a-kind features, greater alliance on inherent paths of safety, limited operational experience, reduced experimental databases and validation, and novel licensing methodologies.

This integrated approach results in significant resource savings and is also consistent with the directions provided both in the ADVANCE Act and by the Commission to reinforce the Committee's ongoing efforts to streamline its reviews. Four, some applicants are changing or even deleting principle design criteria with insufficient technical

justification. This approach dilutes the intent of the criteria that have been established through rigorous processes outlined in Reg Guide 1.232.

For new designs with little or no relevant technical data or operating experience, this inadequate documented technical basis potentially diminishes lines of defense, weakens defense in depth, and thereby increases the potential for reactor accident. Licensing review process, one, many construction permit applications lack sufficient technical analyses and design detail to support a robust safety case and demonstrate the defense-in-depth. As a result, much of the technical burden shifts to the operating license application.

While this is not new or unanticipated, we reaffirm that OLs expected to use more resources and potentially take more time with CP reviews. Two, effective pre-application engagement and technically complete topical reports early in the process lay important foundations for building the safety case in CP and OL applications of advanced reactors. However, overly conceptual topical reports are for limited value, resulting in numerous limitations and conditions imposed by the staff and inefficient use of review time.

These types of TRs may appear to demonstrate progress towards a successful licensing application but in reality do not. It may tie up valuable resources both by the staff and the committee. Topical reports should strategically focus on the foundational aspects of the safety case and provide sufficient detail to clarify overall safety implications.

Three, applications using the technology inclusive content of application project, advanced reactor content of application project, so-called TICAP/ARCAP. Structure should directly incorporate all necessary evidence to support reasonable assurance finds for both the CP and OL. Omitting critical details such as accident analysis that exist in subsidiary documents requires audit time by the staff and is inefficient.

Furthermore, by only presenting high level information without the supporting details, it is difficult to discern safety margins and key components that underpin the safety case. Staff should share results with the ACRS early, especially on unique, novel, and noteworthy items to optimize ACRS review time. Four, we have identified the following aspects from recent licensing reviews as noteworthy.

A, the risk informed approach used in the licensing modernization project, LMP, helps focus on key structures, systems, and components that impact the safety case. The risk optimized safety footprints of current gas and sodium reactor designs compared to historic designs demonstrate an important value of the LMP by focusing on risk significance. B, designs represent small evolutionary changes over previous review designs for use of, quote, delta review process is very useful and efficient.

Furthermore, having a red line strike out showing changes between the previous and current PSARs allows reviewers to quickly identify changes and assess their impact on the overall safety case. C, the use of a defense line methodology is an excellent structured and systematic process to implement a balanced approach to addressing the adequacy of safety function integration in the design, to confirm the completeness of the PRA, to establish the effectiveness of defense-in-depth implementation, particularly for reactor designs to take credit for reduced accident likelihood only as justification for simplified approaches to containment and siting. And that has the potentially to suitably evaluate cliff edge effects.

Technology specific impacts on reactor safety, one, each design has distinct safety attributes with technology features that require experimental confirmation, sometimes only achievable during initial plant startup. While computational methods have advanced, reliable data remains essential for verifying key safety aspects. The staff's documentation at the CP stage of all the R&D items necessary to support the OL application is an essential and noteworthy practice.

Two, the safety case for a specific nuclear technology is shaped by its unique attributes. For liquid metals and molten salts, heat transfer is relatively straightforward unless phase changes occur. Instead, fast reactors require greater attention to reactivity feedback and fire risks. In salt systems, oxidation reduction and corrosion control and freezing molten salts are more important.

Potentially, life limiting material behavior in gas reactors maybe more of a safety issue than the capabilities of heat removal. As a result, direct application of historical regulatory guides, analytical protocols, and safety norms from LWRs without adaptation may not be effective or efficient for advanced reactor licensing. For example, A, a

holistic safety review from an advanced reactor should focus not only on the performance of fuel but also on the safety design limits of other structural and pressure boundary systems because these plant elements may be more limiting in many designs.

B, while Reg Guide 1.203 provides a useful framework for establishing and validating an applicant's analytical evaluation model, many of the details such as the scaling methodology are focused on the complex behavior of water, flashing, critical heat flux, two phase flow in large LWRs where there are smaller safety margins than in advanced reactors. The emphasis for advanced reactors should be on the intent of Reg Guide 1.203. And the specific requirements needed to be balanced against safety margins so the attention remains focused on the most critical safety issues for each technology.

A path forward, the ACRS has adopted a more efficient review approach consistent with the directions provided in the ADVANCE Act and EO 14300. The ACRS will prioritize future reviews based on the unique, novel, and noteworthy safety aspects of advanced reactor designs, including both light water and non-light water reactor technologies. Key features include advanced fuels such as TRISO coated-

particle fuel and metallic fuel, dissolved fuels in salt reactors, innovative neutron moderators, new structural materials, and novel coolants.

These reactors also use new systems for containment, heat removal, and reactivity control, many of which operate passively. Understanding the performance of these technologies under normal and accident conditions is essential to validate safety. To meet the ADVANCE Act and Commission timelines, the Committee will conduct an early independent scoping review to identify the unique, novel, and noteworthy aspects of each application as a focus for the review. The Committee will monitor staff reviews, including audits and requests for information and will endeavor to not duplicate their efforts.

Instead of reviewing every chapter, the Committee will provide an integrated assessment of design elements impacting facility safety. This approach has already been used for the Kemmerer construction permit and is being used in ongoing reviews of Long Mott and Clinch River CPAs. When the founders established the ACRS, the goal was to provide an extra layer of protection for a new and evolving nuclear regulator.

At the time, the complexities of nuclear

technology were unfamiliar. So the ACRS was given a broad mandate to look beyond strict rules and offer expert advice based on knowledge and experience. This approach helps identify potential safety concerns that might not be covered by regulations alone.

Seventy-five years later, the advanced reactor technologies are again presenting similar challenges. The ACRS continues to play its original role offering in-depth experienced based reviews to ensure safety remains the top priority. To serve the public and Commission effectively, the Committee is committed to making its reports clear and well structured.

By building expert consensus and clearly outline key safety issues, the ACRS provides timely evidence based recommendations. Each recommendation is supported by thorough, technically sound explanations that highlight the safety rigor and completeness of licensing actions of rulemaking. Beyond licensing applications, it is essential to demonstrate the capability to safely operate and maintain these new facilities.

This includes establishing a strong safety culture, developing appropriate technical qualifications, gaining operating experience,

providing effective oversight, managing worker radiation doses, displaying commitment to worker health and safety, and providing specialized training such as for sodium environments and creating robust maintenance practices. Additionally, the ACRS will continue to perform assessments to identify ways to enhance its effectiveness and efficiency. We have revised our subcommittee structure by reducing the number of subcommittees focusing on design centered application reviews, reactor safety standards, and reactor operations.

While the Committee has demonstrated its ability to complete reviews ahead of established scheduled, we continue to identify ways to enhance effectiveness and efficiency. Ultimately, it is the completeness and quality of a license applicant and associated supporting documents to facilitate efficient and streamlined reviews. Applicants should be strongly encouraged in pre-application to thoroughly address unique methodologies and approaches in topical reports well ahead of the actual license application submittals. We are not requesting a response to this letter. Sincerely, Greg.

CHAIR HALNON: Thank you, Dave. At this time, we're going to release the court reporter. And

there's no need to have the rest of the meeting transcribed. So Allegra, you are released. I appreciate you jumping on.

(Whereupon, the above-entitled matter went off the record at 8:58 a.m.)