



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

November 29, 2022

The Honorable Christopher T. Hanson
Chair
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

SUBJECT: SUMMARY REPORT – 699th MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, OCTOBER 5-7, 2022

Dear Chair Hanson:

During its 699th meeting, October 5-7, 2022, which was conducted in person and virtually, the Advisory Committee on Reactor Safeguards (ACRS) discussed several matters. The ACRS completed the following correspondence:

LETTER REPORT

Letter Report to Christopher T. Hanson, Chair, U.S. Nuclear Regulatory Commission (NRC) from Joy L. Rempe, Chairman, ACRS:

- Draft SECY White Paper on Licensing and Regulating Fusion Energy Systems, dated October 21, 2022, ADAMS Accession No. ML22290A177.

LETTER

Letter to Daniel H. Dorman, Executive Director for Operations, NRC, from Joy L. Rempe, Chairman, ACRS:

- Safety Evaluation for NuScale Topical Report, TR-0915-17772, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," Revision 3, dated October 19, 2022, ADAMS Accession No. ML22287A155.

MEMORANDUM

Memorandum to Daniel H. Dorman, Executive Director for Operations, NRC, from Scott W. Moore, Executive Director, ACRS:

- Documentation of Receipt of Applicable Official NRC Notices to the Advisory Committee on Reactor Safeguards for October 2022, dated October 18, 2022, ADAMS Accession No. ML22290A206.

HIGHLIGHTS OF KEY ISSUES

1. Draft SECY White Paper on Licensing and Regulating Fusion Energy Systems

After hearing from the NRC staff and stakeholders, the Committee issued its letter dated October 21, 2022, with the following conclusions and recommendations:

- a) A license issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 30 is appropriate for fusion facilities, provided tritium inventories are low (e.g., < 10 g active inventory) and activation is minimal (e.g., < 0.01 MW-yr/m² or 0.1 dpa). This will result in regulatory certainty for near-term applications.
- b) The hybrid approach (Option 3 – byproduct and utilization combined framework) should be pursued for higher consequence fusion energy facilities. The Committee's rationale is summarized below.
 - i. This approach provides needed regulatory flexibility given the diverse fusion design options, their broad range of hazards, and the large uncertainties associated with their performance at engineering- or power plant-scale.
 - ii. This approach implicitly recognizes engineering- or power plant-scale fusion energy systems share many characteristics (e.g., decay heat, mobilizable radionuclides) that may result in hazards more like fission reactors than like accelerators and are also similar to some utilization facilities licensed by NRC.
 - ii. This approach would allow time for development of regulations for future higher consequence facilities as experience is gained with early applications and operation of lower consequence fusion facilities.
 - iv. Scaling of Option 2 (byproduct 10 CFR Part 30 framework) with additional safety requirements as the technology evolves could result in a patchwork of regulations. The resulting 10 CFR Part 30 language may look more like what exists today for a utilization facility under 10 CFR Part 50.
- c) Option 3 would enable an enduring holistic framework to be established for fusion power plants in the future.
- d) The white paper discussion on the hazards of fusion energy systems at engineering- or power plant-scale contains some factual inaccuracies and could benefit from additional context. This should be corrected.

2. Safety Evaluation (SE) for NuScale Topical Report, TR-0915-17772, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor [SMR] Plant Sites," Revision 3

Having previously heard from the NRC staff and NuScale representatives at the September Full Committee meeting, the Committee deliberated on this topic and subsequently issued its letter dated October 19, 2022, with the following conclusions and recommendation:

- a) TR-0915-17772, Revision 3, provides a technically adequate method for assessing plume exposure pathway emergency planning zone (EPZ) size for a NuScale SMR plant design.
- b) The staff's SE approves this NuScale methodology subject to several conditions of use.
- c) The safety evaluation report should be issued.

3. Research Briefing on Materials Harvesting

Representatives from the Office of Nuclear Regulatory Research provided an informational briefing on the topic of material harvesting at nuclear power plants and fielded questions from the Committee.

4. Discussions at the Planning and Procedures (P&P) Session

- a. The Committee discussed the Full Committee and Subcommittee schedules through February 2023 as well as the planned agenda items for Full Committee meetings.
- b. The ACRS Executive Director led a discussion of significant notices issued by the Agency since the last Full Committee meeting in September 2022 (this activity is documented in the memorandum dated October 18, 2022).
- c. Executive Director Moore also noted that there were no regulatory guides to discuss this month.
- d. Member Ballinger led a discussion about a recent meeting of the Fuels, Materials, and Structures Subcommittee. The Subcommittee met on October 4, 2022, to review the Westinghouse Topical Report, WCAP-18546-P, "Westinghouse AXIOM® Cladding for Use in Pressurized Water Reactor Fuel." After hearing from the NRC staff and Westinghouse representatives, the Subcommittee members recommended not referring this meeting topic to the Full Committee. The following was approved by the Committee to be included in this summary report:

The ACRS Materials, Metallurgy, and Reactor Fuels Subcommittee met on October 4, 2022, to review and discuss topical report WCAP-18546-P/NP, "Westinghouse AXIOM® Cladding for Use in Pressurized Water Reactor Fuel" and the corresponding staff's safety evaluation. The Subcommittee had the benefit of interactions with NRC staff and the applicant during the meeting. A large portion of the meeting was held in closed session to protect the proprietary nature of the information being reviewed. The topical report contains technical details on a wide range of fuel qualification issues including: density and

microstructure of AXIOM® cladding, thermal properties, mechanical properties, irradiation programs and operating experience, AXIOM® cladding behaviors (corrosion, hydrogen pickup, rod axial growth, cladding irradiation creep, impact on rod ejection accident), irradiated mechanical properties (axial and ring tensile tests), licensing criteria (fuel rod design, safety analysis: loss of coolant accident (LOCA), non-LOCA, and containment integrity), burnup considerations, nuclear and thermal-hydraulic design, and radiological consequence analysis. The NRC staff concluded that the topical report provides sufficient information on properties and characterization of AXIOM® cladding fuel for use in pressurized water reactors with some limitations provided in the safety evaluation. The Subcommittee found the discussion to be informative and thorough by both the applicant and staff. The Subcommittee did not identify any open issues or unresolved questions and therefore recommended that additional review by the Full Committee of the ACRS is not necessary.

- e. The Committee approved Member Ballinger's attendance at the EPRI Extended Storage Collaboration Program (ESCP) Winter 2022 meeting to be held on November 7 to 10, 2022, in Charlotte, NC.
- f. Chairman Rempe provided a status update on the pre-application activities associated with the X-energy design and the University of Illinois High Temperature Gas Reactor Research and Test Reactor with a note that, for the latter design for which the applicant intends to seek a construction permit, an ACRS report will be required in accordance with 10 CFR 50.58(a).
- g. Member Bier provided an update on the pre-application activities for the General Atomics reactor design.
- h. Member-at-large Petti led a discussion of upcoming activities associated with the 10 CFR Part 53 rulemaking activities. There is an item on the November Full Committee meeting agenda for this topic, and a letter is anticipated.
- i. Member-at-large Petti also provided a status of the Kairos (HERMES) construction permit application and noted that the ACRS should receive safety evaluation reports from the NRR staff soon and the NRR staff plan to issue evaluations by chapter on the preliminary safety analysis report. Subcommittee and Full Committee meetings on this topic will be scheduled during the 2023 calendar year.
- j. Vice Chairman Kirchner, Chair of the NuScale Subcommittee, led a discussion on a NuScale topical report submitted in support of the future uprated NuScale standard design approval application. The staff provided the Committee with an advance safety evaluation for NuScale Topical Report, TR-108553, "Framatome Fuel and Structural Response Methodologies Applicability to NuScale," under ADAMS Accession No. ML22210A064. The staff indicated that ACRS review of this topical report was not necessary based on the changes made to the recently reviewed methodologies as part of the NuScale design certification. The staff provided the safety evaluation to support a briefing by the NRC staff if requested by the Committee. Lead Member Kirchner, in consultation with Members March-Leuba and Ballinger, recommended not to review this topical report. The Committee agreed.

- k. Member Halnon led a discussion on the topic of security issues and the role of ACRS in reviewing such issues. It was reiterated that the Committee's role in reviewing security issues is focused on those with a nuclear safety nexus.
- l. Chairman Rempe led a discussion on the status of outreach efforts to international counterparts regarding the planned multinational event to be held in March 2023. She reminded Committee members that international advisory committee members have requested that an introductory and planning virtual meeting be held prior to the March 2023 event. This virtual meeting with other regulator advisory members is scheduled for December 5, 2022.
- m. Member Bier led a discussion on safety goals. The Committee agreed to form a Subcommittee on this topic, and future meetings will be coordinated.
- n. Member March-Leuba led a discussion on cyber security and plant reliability. It was agreed that an internal meeting would be arranged for interested members to discuss this issue and decide on topics and stakeholders to interact with. Some of these stakeholders could be from internal organizations, such as NSIR and OCIO, and some of these stakeholders could be from external organizations, such as the Cybersecurity and Infrastructure Security Agency (CISA).

The Executive Director noted that there were no documents for reconciliation this month.

5. Scheduled Topics for the 700th ACRS Meeting

The following topics are on the agenda for the 700th ACRS meeting scheduled for November 1-4, 2022:

- SECY Paper on Potential Expansion of Current NRC Policy on Common Cause Failures
- Regulatory Guide (RG) 1.82, Revision 5, "Water Sources for Long-term Recirculation Cooling following a Loss-of-Coolant Accident"
- 10 CFR Part 53, "Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants," Proposed Rulemaking Language

Sincerely,



Signed by Rempe, Joy
on 11/29/22

Joy L. Rempe
Chairman

November 29, 2022

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Accession No: ML22304A700 Publicly Available (Y/N): Y Sensitive (Y/N): N
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