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

July 8, 2025

Commissioner Annie Caputo
Commissioner Bradley R. Crowell
Commissioner Matthew J. Marzano
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

SUBJECT: SUMMARY REPORT – 725th MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, MAY 6 THROUGH 9, 2025

Dear Commissioners:

During its 725th meeting held May 6 through 9, 2025, 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 to David A. Wright, Chairman, U.S. Nuclear Regulatory Commission (NRC), from Walter L. Kirchner, Chairman, ACRS:

- "Report on the Safety Aspects of the NuScale US460 Small Modular Reactor Standard Design Approval Application," dated May 21, 2025, Agencywide Documents Access and Management System (ADAMS) Accession No. ML25136A329.

LETTER

Letter to Dr. Mirela Gavrilas, Executive Director for Operations, U.S. Nuclear Regulatory Commission (NRC), from Walter L. Kirchner, Chairman, ACRS:

- "Natrium Topical Report, 'Radiological Source Term Methodology Report'," dated June 9, 2025, ADAMS Accession No. ML25140A136.

MEMORANDAS

Memoranda to Dr. Mirela Gavrilas, Executive Director for Operations, U.S. NRC, from Marissa G. Bailey, Executive Director, ACRS:

- Documentation of Receipt of Applicable Official NRC Notices to the Advisory Committee on Reactor Safeguards for May 2025, dated May 19, 2025, ADAMS Accession No. ML25136A315,

- May 2025 Advisory Committee on Reactor Safeguards (ACRS) Full Committee – Topical Reports, dated May 19, 2025, ADAMS Accession No. ML25136A316, and

- Regulatory Guides (RGs), dated May 19, 2025, ADAMS Accession No. ML25136A308.

HIGHLIGHTS OF KEY ISSUES

a. Report on the Safety Aspects of the NuScale US460 Small Modular Reactor Standard Design Approval Application (SDAA)

The Committee deliberated on the subject topic and issued its letter dated May 21, 2025, with the following conclusions and recommendations:

1. The NuScale US460 small modular reactor is an integrated, natural-circulation, advanced pressurized water reactor. The design incorporates unique passive safety features, providing enhanced margins of safety and long coping times without the need for electrical power or operator intervention.

2. The NuScale US460 SDAA is a complete, well documented application, backed by validated methodologies and extensive experimental testing. There is reasonable assurance that the plant can be constructed and operated without undue risk to the health and safety of the public.

3. The NRC staff's safety evaluation report for the NuScale US460 SDAA should be issued.

4. A Standard Design Approval for the NuScale US460 application should be issued.

b. TerraPower Natrium Topical Report on Source Term Methodology

The Committee deliberated on the subject topic and issued its letter dated June 9, 2025, with the following conclusions and recommendation:

1. Natrium would be the first sodium-cooled fast reactor (SFR) to implement a functional containment strategy. Although the Natrium functional containment shares many similarities with previous SFR containment designs, additional justification for departures from historical precedent is warranted during the upcoming construction permit application (CPA) review, because of the lack of detailed information and the use of non-safety designations for certain important components.

2. Sufficient data exists to support a mechanistic source term for more likely events inside the design basis (i.e., Anticipated Operational Occurrences (AOOs) and Design Basis Accidents (DBAs). However, were eutectic fuel melting to occur (at ~700°C) in low-frequency events, the uncertainty in both the accident phenomenology and the release and transport of fission products in the vessel would significantly increase. These uncertainties make it difficult to assess the adequacy of the proposed source term methodology for fuel melt events. Addressing the uncertainties noted in this letter as part of the source term estimates in an operating license application will help establish sufficient confidence.

3. The safety evaluation should be issued, and the staff should consider the limitations noted in this letter during their CPA review.

In addition, while Member Martin supported the issuance of the staff's safety evaluations, he made observations during ACRS's deliberations, which he felt warranted further regulatory consideration by NRC staff related to the application of risk-informed performance-based (RIPB) licensing, as described in Regulatory Guide (RG) 1.233. Member Martin stated this issue raised questions with potential long-term implications for plant safety, regulatory transparency, and public confidence for advanced reactor applicants.

Regulatory Guide 1.233, which endorses NEI 18-04, acknowledges that the Maintenance Rule (10 CFR 50.65) remains applicable to safety-related and risk-significant structures, systems and components (SSCs), including those classified as non-safety-related with special treatment (NSRST). However, it does not address how the rule should be interpreted or adapted within a risk-informed licensing framework —particularly for SSCs that are not traditionally subject to condition monitoring yet are credited in Probabilistic Risk Assessment (PRA) or mechanistic source term evaluations.

To clarify the intent of this observation, he highlighted two concerns he felt warranted further consideration in the context of risk-informed, performance-based (RIPB) licensing frameworks:

1) Reduced safety margins under Licensing Modernization Project (LMP) based designs may constrain operational flexibility, particularly the ability to conduct online preventive maintenance without exceeding risk thresholds. Unlike traditional designs where PRA overlays deterministic conservatism, LMP explicitly allocates safety margin during the design phase, potentially leaving little room to accommodate SSC unavailability during operations.

2) The NSRST classification framework may need to be revisited or clarified to ensure that all SSCs contributing meaningfully to defense-in-depth or risk mitigation—regardless of safety classification or modeling detail—are appropriately scoped under the Maintenance Rule (10 CFR 50.65).

The central question is whether a plant licensed using RIPB principles, supported by best-estimate methods and structured defense-in-depth assessments, will retain sufficient operational margin to support online maintenance, as envisioned in the Maintenance Rule. In the legacy light-water reactor (LWR) fleet, maintenance flexibility is often enabled by excess conservatism built into deterministic design requirements, with PRA confirming wide safety margins. In contrast, RIPB frameworks allocate safety margin explicitly during design. While that may be sufficient from a licensing perspective, it could limit the feasibility of performing maintenance without exceeding real-time risk thresholds. The NRC may wish to assess whether additional guidance is needed to support configuration risk management and maintenance oversight in plants licensed under this framework. As future applicants and licensees seek to optimize cost and performance, it is reasonable to expect increasing pressure to reduce conservatism, making it all the more important that the regulatory framework anticipate how such margin reductions may affect operational flexibility and oversight.

In parallel, there is a need to examine how the Maintenance Rule defines its scope for non-safety-related SSCs in RIPB designs. Section 50.65(b) currently identifies SSCs based on procedural roles (e.g., emergency operating procedures), scram initiation, or support of safety-related functions. However, in a fully integrated PRA, safety classification plays no role in identifying risk significance, and defense-in-depth relies in part on non-safety SSCs whose role or function may be implicit in a PRA. Such SSCs may include those whose failure could impair other non-safety but risk-significant functions or otherwise contribute to accident progression. Such implied SSCs could warrant NSRST designation based on their role in maintaining defense-in-depth. This position is consistent with statements made in TerraPower's approved Nuclear Island/Energy Island Topical Report (ADAMS Accession No. ML24011A321), which describe the Maintenance Rule as applying only to safety-related and NSRST SSCs. This observation is not a critique of the NSRST framework itself, but a caution that the classification process may need to evolve to remain inclusive of the full range of defense-in-depth contributors in PRA-informed designs, consistent with RG 1.233's guidance that SSCs providing essential support for SR or NSRST functions should be classified accordingly.

c. Seabrook Nuclear Station Alkali-Silica Reaction (ASR) Topic

Vice Chairman Halnon led a discussion of this topic including a summary of the Plant Operations Subcommittee meeting that was held near the Seabrook Nuclear Station on April 17, 2025, the transcript may be found at ADAMS Accession No. ML25134A252. This discussion also covered a site visit by the Subcommittee on that same day.

C-10, a public interest group that includes local residents of Seabrook, provided written comments and questions prior to the meeting. Dr. Victor Saouma, a consultant for C-10 on this topic, provided a presentation to the Committee. These documents may be found at ADAMS Accession No. ML25156A010.

The topic of most discussion was testing results from 2021 at the National Institutes of Standards and Technology (NIST) and whether or not the results could be directly applicable in predicting the ASR phenomenon at Seabrook.

The Committee continued to discuss this issue and identified the need to hear from the NRC staff who were involved in evaluating the NIST test results. It was agreed that the Committee may request the staff to provide their views, focused on the applicability of the NIST test results to the Seabrook ASR phenomenon, at a future ACRS meeting.

d. Discussions During the Planning and Procedures Session

1. The Committee discussed the full committee (FC) and subcommittee (SC) schedules through October 2025 as well as the planned agenda items for FC meetings.

2. The ACRS Executive Director led a discussion of significant notices issued by the Agency since the last Full Committee meeting in April 2025. The Executive Director documented this activity in a memorandum dated May 19, 2025, ADAMS Accession No. ML25136A315.

3. The Committee briefly discussed the SC meetings that were held since the last ACRS FC meeting in February 2025, which included the following:

   - April 17: Plant Operations SC meeting on the Seabrook ASR topic [Vice Chairman Halnon], and

   - May 6: Accident Analysis: Thermal Hydraulic SC meeting on the Framatome Topical Report on APOLLO-2A/ARTEMIS B [Member Palmtag].

4. The Executive Director also led a discussion of draft and final RGs regarding possible review by the Committee. The Executive Director documented this activity in a memorandum dated May 19, 2025, ADAMS Accession No. ML25136A308.

5. The Executive Director also led a discussion of three topical reports that were reviewed by a lead member who gave a recommendation to the Committee about the need to review the documents. The Executive Director documented this activity in a memorandum dated May 19, 2025, ADAMS Accession No. ML25136A316.

6. Member Sunseri led a discussion about potential future reviews of power uprate requests which would include the Committee only reviewing those requests that are new and novel. The staff would inform the Committee of their reviews on the new and novel aspects of the request and the Committee would decide whether to review or not.

7. Chairman Kirchner led a discussion about review of the NuScale standard design approval application chapter memoranda for Chapter 1, “Introduction and General Description of the Plant,” (Chairman Kirchner), and Chapter 4, “Reactor,” (Member Palmtag). The memos were finalized.

8. Member Roberts led a discussion about his presentation as a panel member for the American Nuclear Society Conference session on Digital I&C and Human Factors Engineers topics scheduled June 15 through 18, 2025. The Committee had no significant comments.

9. A closed session was conducted to discuss proprietary and administrative information.

10. The following topic was on the agenda of the 726th ACRS Full Committee meeting, which was held on June 4 through 6, 2025:

    - Draft Interim Staff Guidance on Content of Risk Assessment and Severe Accident Information in Light-Water Power Reactor Construction Permit Applications.

Sincerely,

Walter L. Kirchner Signed by Kirchner, Walter on 07/08/25

Walter L. Kirchner
Chairman

Enclosure:
List of Acronyms

July 8, 2025

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Accession No: ML25174A313 **Publicly Available (Y/N):** Y **Sensitive (Y/N):** N
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LIST OF ACRONYMS

ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ANS	American Nuclear Society
AOOs	Anticipated Operational Occurrences
ASR	Alkali Silica Reaction
CPA	Construction Permit Application
DBAs	Design Basis Accidents
FC	Full Committee
LMP	Licensing Modernization Plan
LWR	Light-Water Reactor
NIST	National Institutes of Standards and Technology
NRC	Nuclear Regulatory Commission
NSRST	Non-Safety-Related with Special Treatment
PRA	Probabilistic Risk Assessment
RG	Regulatory Guide
RIPB	Risk-Informed, Performance-Based
SC	Subcommittee
SDAA	Standard Design Approval Application
SFR	Sodium-Cooled Fast Reactor
SSCs	Structures, Systems and Components