



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

August 12, 2024

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

**SUBJECT: SUMMARY REPORT – 717<sup>th</sup> MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, JULY 10-12, 2024**

Dear Chair Hanson:

During its 717<sup>th</sup> meeting, July 10 through 12, 2024, which was conducted in person and virtually, the Advisory Committee on Reactor Safeguards (ACRS) discussed several matters. The ACRS completed the following correspondence:

**LETTER REPORTS**

Letters to Christopher T. Hanson, Chair, U.S. Nuclear Regulatory Commission (NRC) from Walter L. Kirchner, Chair, ACRS:

- Report on the S1B Nuclear Propulsion Plant for Columbia Class [Submarines], dated July 12, 2024 (Nonpublic), and
- Safety Evaluation of the Kairos Non-Power Reactor Hermes 2 Construction Permit Application, dated July 17, 2024, ADAMS Accession No. [ML24197A152](#).

**MEMORANDUM**

Memorandum to Raymond V. Furstenau, Acting EDO, NRC, from Scott W. Moore, Executive Director, ACRS:

- Documentation of Receipt of Applicable Official NRC Notices to the Advisory Committee on Reactor Safeguards for July 2024, dated July 17, 2024, ADAMS Accession No. [ML24198A076](#).

**HIGHLIGHTS OF KEY ISSUES**

- a. Report on the S1B Nuclear Propulsion Plant for Columbia Class [Submarine]

The Committee met in a closed session and completed its review as documented in its classified letter report dated July 12, 2024.

b. Safety Evaluation of the Kairos Non-power Reactor Hermes 2 Construction Permit Application

The Committee heard from licensee representatives and NRC staff, and it issued a July 17, 2024, letter, with the following conclusions and recommendations:

1. Because the design of Hermes 2 builds extensively on the design of Hermes 1, the staff performed a “delta” review of Hermes 2 by (a) comparing the applicant’s preliminary safety analysis report (PSAR) with the corresponding PSAR for Hermes 1, and (b) using the guidance provided in NUREG-1537 for non-power reactors as the basis for their evaluation. We note that this was an efficient and effective approach to conducting the Hermes 2 safety evaluation.
2. The Committee agrees with the staff that there is confidence the facility can be constructed in accordance with relevant regulations and the design bases outlined in the PSAR. Detailed design, analysis, and technology qualification will be completed prior to the operating license (OL) review.
3. The Committee’s review indicated that the design changes in Hermes 2 have no adverse influence on the safety functions or their implementation. The Hermes 1 Maximum Hypothetical Accident (MHA) was still found to be bounding for Hermes 2, and the effects of two Hermes 2 reactors with a greater lifetime were appropriately accounted for in the source term estimates. The planned metallic materials and graphite testing will address potential corrosion and radiation damage concerns to accommodate the longer planned lifetime for Hermes 2.
4. A number of issues noted in the letter report should be considered by the staff prior to the issuance of the OL. These issues are related to the consequences of a postulated superheater tube rupture into the atmospheric-pressure intermediate salt loop; REDOX control in the Flibe (a molten salt coolant which is a eutectic mixture of LiF and BeF<sub>2</sub>); and corrosion and tritium control in BeNaF (a mixture of BeF<sub>2</sub> and NaF), the salt used in the intermediate loop.
5. The construction permit application for Hermes 2 should be approved.

c. Research Review Topic: Risk Assessment and Human Factors for Non-Light Water Reactors

The Committee heard from representatives of the Office of Nuclear Regulatory Research about research activities associated with probabilistic risk assessment and human factors issues for non-light water reactors. This effort was part of the information gathering being undertaken by the Committee to support the triennial review report.

d. Discussions at the Planning and Procedures Session

1. The Committee discussed the Full Committee (FC) and Subcommittee (SC) schedules through December 2024 as well as the planned agenda items for Full Committee meetings.

2. The ACRS Executive Director led a discussion of significant notices issued by the Agency since the last FC meeting in June 2024. The Executive Director documented this activity in a memorandum dated July 17, 2024, ADAMS Accession No. [ML24198A076](#).
3. The Executive Director noted that there were no regulatory guides (RG)/draft regulatory guides to review this month.
4. Vice Chair Halnon led a discussion of the planned trip to Region II sites for the week of July 22, 2024. This visit will include a visit to a Tennessee Valley Authority operating plant (Sequoyah Nuclear Plant, Units 1 and 2), the NRC’s Technical Training Center, and Region II offices including a Plant Operations Subcommittee meeting while at Region II.
5. Member Roberts led a discussion of the plan for the Committee’s review of the TerraPower Natrium™ Construction Permit Application (CPA) and associated topical reports (TRs).

Member Roberts provided the staff’s proposed schedule for the CPA review as follows:

- Draft Safety Evaluation (SE): March 2025
- Advanced SE: November 2025 (begin management, legal, and ACRS Review)
- Final SE: August 2026

The PSAR the Committee will review for this CPA is based on TICAP/ARCAP, with a different chapter structure than prior PSARs. Since this will be the first such PSAR reviewed by the Committee, early discussion of chapter and section assignment review responsibilities is warranted. A draft assignment matrix has been shared with the Members. These assignments are broken down by Chapter and Section of the PSAR. Feedback is requested.

There are 10 additional TRs to review (three have already been reviewed – fuel qualification and primary design criteria, which resulted in Letter Reports, and volcanic hazard assessment that was reviewed on July 9, 2024, and is documented in this month’s summary report). The proposed plan is as follows:

Type	Item	Subcommittee Date ( <b>Bold</b> if scheduled)	Full Committee Date ( <b>Bold</b> if scheduled)	Comments
TR	Plume Exposure Pathway Emergency Planning Zone Method	<b>9/19/2024</b>	<b>10/2/2024</b>	Likely a Summary Report Writeup
TR	Human Factors Engineering Program Plan and Method	<b>01/10/2025</b>	<b>2/2025</b>	<b>Currently scheduled but ACRS will discuss this TR during the September Planning and Procedures</b>

				meeting whether they will want to review this TR.
TR	Volcanic Hazards Assessment	7/9/2024	See Section 12 of this Summary Report	See Section 12 of this Summary Report
TR	*Radiological Source Term Methodology, Rev. 1***	4/2025 2/2025	2/2025 3/2025	Likely a Letter Report
TR	*Design Basis Accident Transient Method for In-Vessel Events without Release**	11/2024 2/2025	12/2024 3/2025	Likely a Summary Report writeup
TR	*Radiological Release Consequences Method**	2/2025	3/2025	Likely a Summary Report writeup
TR	*Stability Method**	12/2024 2/2025	2/2025 3/2025	Likely a Summary Report writeup
TR	Design Basis Accident Transient Method for In-Vessel with Release and Ex-Vessel with and without release	TBD	TBD	Submitted ~March 2024. Possibly combine with CPA ACRS chapter meetings.
TR	Partial Flow Blockage	TBD	TBD	
TR	Seismic Isolation Strategy	TBD	TBD	
TR	Digital Instrumentation and Control Architecture and Design	TBD	TBD	
CPA	Construction Permit	TBD	TBD	Submitted 3/29/2024

- Recommend review separately
- Review four analysis methodology TRs at a single SC meeting, notionally in February 2025. Likely to write a letter on one of them in April FC and document review of the other three in March planning and procedures minutes.
- Review additional four TRs in conjunction with PSAR review in late 2025.
- Recommend NOT review for the HFE TR in September FC.

The Committee discussed the above plan to review the TRs and agreed with Member Roberts' recommendations.

6. Member Martin led a discussion about the Global Nuclear Fuel Americas, LLC TR, "Proposed Administrative Amendment 52 to NEDE-24011-P-A-27, 'General Electric Standard Application for Reactor Fuel (GESTAR II)'." The GESTAR II Amendment 52 is

presented as an administrative amendment that incorporates details related to the use of additive fuel pellets and to include the use of Ziron cladding material. These fuel features were previously approved by the NRC in 2015 and 2019, respectively. Among the motivations for these changes to GESTAR II is a desire to deliver fuel with these features to the Southern Nuclear Company's Edwin I. Hatch Nuclear Plant, Unit 2 for the Cycle 29 reload in September 2024. Given the administrative and editorial nature of the changes, Member Martin recommends that ACRS not review this amendment. The Committee agreed with this recommendation.

7. Member Ballinger led a discussion about the details concerning the site visit by several members to the General Electric-Hitachi Global Nuclear Fuel Americas, LLC, fuel fabrication facility scheduled for September 17, 2024. The ACRS staff will provide additional information on logistics to support the trip.

The following persons are scheduled to attend:

Members

Ron Ballinger  
 Matt Sunseri  
 Bob Martin  
 Tom Roberts  
 Craig Harrington  
 Greg Halnon  
 Scott Palmtag  
 Steve Schultz - Consultant

Staff

Scott Moore  
 Rob Krsek  
 Derek Widmayer  
 Christopher Brown  
 Mike Greenleaf, RGN II

8. Chair Kirchner led a discussion of assignments for design center subcommittee Chairs and the Committee agreed on the following assignments.
  - General Electric Hitachi Nuclear Energy BWRX-300 – Member Harrington
  - Westinghouse AP300 – Member Sunseri
  - Westinghouse eVinci – Member Roberts
  - Holtec SMR-300 – Vice Chair Halnon
  - Terrestrial Energy (TEUSA) Integral Molten Salt Reactor – Member Palmtag

It was also discussed and agreed that power uprate applications would be covered by the Plant Operations SC. The [ACRS Subcommittee Structure document](#) will be updated in July 2024 and is publicly available.

9. Chair Kirchner and ACRS Technical Assistant Rob Krsek, led a discussion of proposed revisions to the [ACRS Member Guidance document](#) including:
  - New Exhibit 1— ACRS Letter Report Template
  - New Exhibit 2 — Design Center TR prioritization and grouping
  - New Exhibit 3 — Nth-of-a-kind reviews
  - New Section IV — License Renewal/Subsequent License Renewal review guidance

The changes associated with license renewal and nth-of-a-kind reviews are a result of discussions with the Commission during the meeting on June 7, 2024. The [ACRS](#)

[Member Guidance document](#) is publicly available to further enhance communications with advanced reactor developers, applicants and licensees on how and when they will engage ACRS during the licensing process and will be updated with these changes in July 2024.

10. Chair Kirchner led a discussion of a Proposed Special Session at the 2025 Regulatory Information Conference (RIC). The ACRS is considering organizing a special session on the role of ACRS during the 2025 RIC. ACRS can request that it be a special plenary, but NRR/RES organizers make that final decision. If not a plenary, the same could be held as a panel during one of the technical tracks. Following is the draft proposed session:

***Title of Session:***

Essential Role of ACRS in Safety-Licensing Review of New Reactor Facilities

***Introduction and Q&A Moderator:*** Commissioner

***Panelists:***

Former Commissioners

Current/former ACRS members

Representatives of the public

Representatives of Nuclear Industry

The Committee agreed that pursuing such a proposal would be a good idea.

11. Executive Director Moore led a discussion about a recently issued Office of Inspector General (OIG) Evaluation Report on Information Technology Asset Management. On Monday, July 8, 2024, OIG issued an evaluation report on NRC's Information Technology Asset Management. ACRS was not the subject of the evaluation, but the results are applicable agencywide. In the evaluation, OIG substantiated four allegations. In particular, OIG found that some NRC IT assets (four laptops) were not returned upon employee separation from NRC. OIG made six recommendations for NRC to improve asset management. Our office has a robust, well established separation process for members and consultants, and on ACRS' 2024 property inventory, PMDA accounted for 100% of ACRS' assigned equipment. OIG's evaluation serves as a reminder to all that equipment management is essential, NRC equipment remains the property of the agency, and all equipment must be returned upon separation.
12. The Design Centered Subcommittee for the TerraPower Natrium™ reactor design met on July 9, 2024, to review the draft SE for TerraPower, LLC (TerraPower), Topical Report (TR), NAT-3226, Revision 0A, entitled, "An Analysis of Potential Volcanic Hazards at the Proposed Natrium™ Site near Kemmerer, Wyoming." The ACRS heard from the NRC staff and TerraPower representatives.

The presentations from both the applicant and the NRC staff covered the volcanic hazard assessment described in the TR. The TR justifies screening out phenomena such as lava flows while screening in the potential for ash-fall at the site due to a distant volcano. The TR also included a high-level discussion of the potential consequences of ash-fall and some possible mitigating actions that could be taken. The NRC staff draft SE noted that this discussion does not go into detail of how these characteristics would impact safety-related structures, systems, and components (SSCs) at the Natrium™ site nor does it propose specific mitigating actions to ensure safety-related SSCs continue to perform their intended safety functions during an ash-fall event. The draft SE therefore

includes limitations and conditions stating that any user of the topical report must address the plant risks and potential mitigations.

This TR describes the first volcanic hazard assessment completed per Regulatory Guide (RG) 4.26, entitled, "Volcanic Hazards Assessment for Proposed Nuclear Power Reactor Sites." The Committee reviewed this regulatory guide in 2021, and one of our recommendations observed that trial use of the guide was needed and that timely revisions should be made as needed based on that experience. During the SC meeting, NRC staff stated that lessons learned from this topical report will be evaluated for revision to the regulatory guide. For example, the regulatory guide calls out a 7-step process to evaluate both the volcanic hazard and the associated plant risk; the TR as approved by the draft SE addresses only the volcanic hazard and the NRC staff considers that approach to be appropriate since assessing the associated plant risk requires more design maturity of the plant design.

The SC concluded that the TerraPower submittal and the staff's SE were thorough and complete relative to the volcanic hazards. The subcommittee also expressed interest in follow-up discussions on the next revision to RG 4.26 at the appropriate time in the revision process.

The TerraPower Natrium™ SC members recommends that it is not necessary to refer this topic to the FC for a report. The SC did not identify any open issues or unresolved questions, noted that the SE report limitations and conditions would require further assessment of plant risk and potential mitigations in subsequent safety analysis reports that will be reviewed by the ACRS, and therefore recommends that additional review by the full committee of the ACRS is not necessary at this time. The Committee agreed with this recommendation.

13. A BWRX-300 design center SC meeting was held on July 9, 2024, to discuss the TR on Steel-Plate Composite Containment Vessel (SCCV) and Reactor Building (RB) Structural Method.

General Electric Hitachi Nuclear Energy (GEH) submitted this licensing TR for NRC review and evaluation to seek approval of their proposed structural design approach and methodology to utilize steel-plate concrete composite structures with diaphragm plates (DP-SC) for the containment and reactor building of the BWRX-300 small modular reactor. Current design codes do not address the use of steel-plate concrete (SC) structural systems for the containment pressure boundary or DP-SC for any reactor structures. The applicant has proposed design rules for a steel-plate concrete composite containment vessel (SCCV) by adapting the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PVC) Section III, Division 2, Code for Concrete Containments (Subsection CC-1000 through 6000) for materials, design, fabrication, construction, construction testing and examination. GEH also proposed further supplementing and augmenting/modifying criteria from the American Institute of Steel Construction Code (AISC) N690-18 for use of DP-SC modules for the reactor building and structures that are not part of the containment pressure boundary, and where their application is beyond the scope of existing codes and standards. The TR also describes a supplemental test program conducted through the National Reactor Innovation Center to validate proposed design rules and safety margins with prototypic test specimens of DP-SC modules.

The staff's evaluation of the TR was comprehensive and covered among other areas: materials; concrete in-fill; design loads, forces, and service conditions; missile and aircraft impact; floors, openings, penetrations, and connection of modules; corrosion; Seismic Category I structure application; and inspection and in-service testing (with reference to the GALL-SLR report aging management programs for structures monitoring). The staff concluded that the TR design approach and methodology for DP-SC provides a reasonable and adequate expectation of meeting applicable regulatory requirements when an actual application is submitted.

The BWRX-300 design center SC recommends that it is not necessary to refer this topic to the FC for a report at this time, rather withhold further review until the DP-SC technology is included in a BWRX-300 license application. That will also provide an opportunity to examine the DP-SC containment and reactor building performance under postulated accident conditions and seismic loadings. The Committee agreed with this recommendation.

14. Member-at-Large Petti led a discussion of the plans to produce the report on the triennial review of NRC's safety research program including lead member assignments as follows:

#### **Research Topics and Leads for Members for 2024 RES Review**

Note: letter slated for Feb 2025 to meet March 2025 deadline.

<b>Topic</b>	<b>SC/FC mtg date</b>	<b>ACRS Member Lead</b>
Integration of Source Term Activities in Support of Advanced Reactor Initiatives	SC: February 17, 2022 FC: March 2-4, 2022 ACRS Letter: April 4, 2022	Petti
Digital Twins Information Briefing	FC: May 4, 2022	Bier
Update on NRC Materials Harvesting Activities	FC: October 6, 2022	Sunseri
Level 3 Probabilistic Risk Assessment	SC: June 22, 2022, and October 19, 2023 FC: November 1, 2023	Dimitrijevic
Implementing the NRC's Artificial Intelligence (AI) Strategic Plan Fiscal Years 2023-2027	SC: November 15, 2023	Bier
High Burnup Fuel Source Term Accident Analysis	SC: November 16, 2023	Petti
Research Information Letter on Fuel Fragmentation, Relocation and Dispersal at High Burnup	FC: December 1, 2021	Ballinger
Advanced Manufacturing	FC: July 6, 2022	Sunseri
How machine learning is influencing Non-Destructive Examination and Inservice Inspection	FC: March 6, 2024	Ballinger
Non-Light Water Reactor code development update	FC: April 3, 2024	Martin



High Energy Arc Faults	FC: March 7, 2024	Roberts
Risk assessment and human factors for non-light water reactors	FC: July 10, 2024	Dimitrijevic and Bier

15. There was a closed portion of the meeting held to discuss personnel and administrative issues.
16. The following topics are on the agenda of the 718<sup>th</sup> ACRS FC meeting which will be held on September 4-6, 2024:
- X-energy principal design criteria topical report, and
  - Seabrook Alkali-silica reaction topic.

Sincerely,



Signed by Kirchner, Walter  
on 08/12/24

Walter L. Kirchner  
Chair

August 12, 2024

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