



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

June 18, 2024

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

**SUBJECT: SUMMARY REPORT – 715<sup>th</sup> MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, APRIL 30 - MAY 2, 2024**

Dear Chair Hanson:

During its 715<sup>th</sup> meeting, April 30 through May 2, 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**

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

- Report on the Safety Aspects of the License Renewal Application Review of Comanche Peak Nuclear Power Plant, Units 1 and 2, dated May 14, 2024, Agencywide Documents Access and Management System (ADAMS) Accession No. [ML24128A269](#), and
- Report on the Safety Aspects of the Subsequent License Renewal Application Review of Monticello Nuclear Generating Plant, Unit 1, dated May 16, 2024, ADAMS Accession No. [ML24128A258](#).

**LETTERS**

Letter to Raymond V. Furstenau, Acting Executive Director for Operations (EDO), U.S. Nuclear Regulatory Commission (NRC) from Walter L. Kirchner, Chair, ACRS:

- Review of Computer Code Development and Validation for Non-Light Water Reactors, dated May 24, 2024, ADAMS Accession No. [ML24129A189](#), and
- Incremental Extension of Burnup Limit for Westinghouse and Combustion Engineering Fuel Designs, dated May 24, 2024, ADAMS Accession No. [ML24132A009](#).

MEMORANDA

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 May 2024, dated May 7, 2024, ADAMS Accession No. [ML24128A148](#), and
- Regulatory Guides dated May 8, 2024, ADAMS Accession No. [ML24128A146](#).

HIGHLIGHTS OF KEY ISSUES

a. Report on the Safety Aspects of the License Renewal (LR) Application Review of Comanche Peak Nuclear Power Plant, Units 1 and 2 (CPNPP)

The Committee heard from licensee representatives and NRC staff, and it issued a May 14, 2024, letter, with the following conclusion and recommendation:

1. The existing and new programs, combined with the commitments made by the licensee for managing age-related degradation, provide confidence that CPNPP can be operated in accordance with its current licensing basis for the Period of Extended Operation (PEO) with no adverse effect on the risk to the health and safety of the public.
2. The licensee's application for the LR of the operating licenses for CPNPP should be approved.

Member Sunseri did not deliberate in the review of this application.

b. Report on the Safety Aspects of the Subsequent License Renewal (SLR) Application Review of Monticello Nuclear Generating Plant, Unit 1 (MNGP)

The Committee heard from licensee representatives and NRC staff, and it issued a May 16, 2024, letter, with the following conclusion and recommendation:

1. The established programs and the commitments made by the licensee to manage age-related degradation provide confidence that MNGP can be operated in accordance with its current licensing basis for the subsequent period of extended operation (SPEO) without undue risk to the health and safety of the public.
2. The licensee's application for the SLR of the operating license for MNGP should be approved.

c. Review of Computer Code Development and Validation for Non-Light Water Reactors (non-LWRs)

The Committee heard from the NRC's Office of Regulatory Research staff and issued its letter dated May 24, 2024, with the following conclusions and recommendations:

1. The staff has optimally leveraged internal resources and the Department of Energy's (DOE) Nuclear Energy Advanced Modeling and Simulation (NEAMS) program. This relationship provides mutual benefit: DOE NEAMS gains from having end user feedback and NRC gains best-in-class capability. This should be continued to provide effective and efficient safety reviews of non-LWR designs.
  2. Staff training on the new reactor designs and associated phenomena during code development, application, and validation supports the agency's knowledge management objectives and should be continued.
  3. While end user needs for the deterministic application of BlueCRAB computer codes have been largely met, applying these computer codes in probabilistic risk assessments may impose additional requirements. These include capability to incorporate uncertainties, and to couple deterministic and probabilistic codes. The explicit characterization of uncertainties facilitates modern evaluation models that are frequently used in risk-informed analyses.
  4. The Agency should pursue a structured and deliberate process for the preservation and maintenance of datasets used to demonstrate the quality of non-LWR computer codes.
- d. Incremental Extension of Burnup Limit for Westinghouse (WEC) and Combustion Engineering (CE) Fuel Designs

The Committee heard from Westinghouse representatives and the NRC staff on this issue which is detailed in a topical report (TR) and associated safety evaluation (SE) report. In addition, some staff provided a presentation and discussion on a related non-concurrence on this topic. The Committee issued its letter dated May 24, 2024, with the following conclusions and recommendations:

1. The TR presents a methodology and evaluation of an increased burnup limit in WEC and CE fuel designs. The methodology mitigates the safety implications of Fuel Fragmentation, Relocation and Dispersal (FFRD) by limiting higher burnup assemblies to lower power peripheral positions in the core and imposing a no-burst criterion during a loss-of-coolant accident (LOCA) on rods in the extended burnup range.
2. The SE report provides a thorough evaluation supporting the staff's approval of the requested extended burnup limit by addressing fuel assembly mechanical design, core and fuel rod performance, non-LOCA and LOCA safety analyses, and radiological consequences.
3. The non-concurrence presents a thorough discussion of the importance of considering FFRD as a fuel performance issue. The SE report should be issued because the WEC methodology, with the imposed limitations and conditions, minimizes the potential for fuel dispersal when using higher burnup fuel assemblies in non-limiting peripheral core locations.

e. Discussions at the Planning and Procedures Session

1. The Committee discussed the Full Committee and Subcommittee schedules through October 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 Full Committee meeting in April 2024. The Executive Director documented this activity in a memorandum dated May 7, 2024, ADAMS Accession No. [ML24128A148](#).
3. The Executive Director led a discussion about potential review recommendation on 3 regulatory guides (RG)/draft regulatory guides (DRGs). The Committee documented its decisions on these RGs in the memorandum dated May 8, 2024, ADAMS Accession No. [ML24128A146](#).

Although it was decided that no review of DRG-1290 or DRG-1417 was needed, the Committee did decide to request a briefing on the status of the probabilistic flood hazard assessment methodology presently being worked on and the scheduling of a briefing in the future when it has progressed into a draft guidance document.

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 Technical Training Center, and Region II offices including a Plant Operations Subcommittee meeting while at Region II. Additional logistical information will be provided to members in the future.
5. Member-at-Large Petti led a discussion of the planned subcommittee and full committee meetings to support the ACRS review of the Kairos Hermes 2 construction permit application. Currently, multiple chapters are planned to be discussed in subcommittee meetings on May 16<sup>th</sup> and June 4<sup>th</sup>. A third subcommittee meeting is scheduled for June 25, 2024, to support preparations in drafting the Committee's letter on its review. The final Committee letter on this application is planned for deliberation during the July 2024 full committee meeting.
6. Member Ballinger led a discussion about the details concerning the site visit by several members to the General Electric-Hitachi fuel fabrication facility scheduled for September 17, 2024.
7. Member Martin led a discussion on recommendations for review of the X-energy TR on Atmospheric Dispersion and Dose Calculation Methodology.

X-energy has developed a suite of codes, referred to as XSTERM, to mechanistically model the transport of radionuclides that comprise the source term, from their origin in the fuel to their potential release and transport to the environment. The code is used in combination with other thermal hydraulic software tools in the analysis of licensing basis events (LBEs). The mechanistic source term part of those methods and calculations will be documented under a separate topical report. This TR documents the methodology associated with the calculation of atmospheric dispersion factors and doses from Xe-100 LBEs. An XSTERM code module, XDIS, can be used to calculate post-release doses at the plant Exclusion Area Boundary/Low Population Zone (EAB/LPZ) and Control Room (CR) location.

To support input to the XDIS module, X-energy is developing a two-phase approach to post-accident atmospheric dispersion. Given the source terms are expected to be minor, a generic methodology is first developed assuming conservative meteorological conditions and comparisons to industry field data. These generic site atmospheric dispersion factors are documented in this report and will be either validated or replaced using site-specific atmospheric dispersion factors once Xe-100 sites are selected for specific projects and site-specific meteorology is obtained and/or collected. It is expected that site-specific EAB/LPZ atmospheric dispersion factor calculations will use the latest regulatory guidance, including RG 1.249 for use of the ARCON code.

After much discussion by the Committee, it was decided that the Committee would not review this TR on its own but would work with the staff and find another topic to discuss with this topic. For example, this could be paired with the topic of mechanistic source term evaluation for the X-energy design. It was recognized that the staff is moving ahead with issuing the SE report on its schedule.

8. Member Ballinger led a discussion about the Pressurized Water Reactor Owners Group (PWROG) TR on the use of direct fracture toughness for evaluation of reactor pressure vessel (RPV) integrity.

The PWROG-18068-NP TR proposes a methodology that justifies the use of direct fracture toughness data to evaluate reactor pressure vessel (RPV) integrity as an alternative to the requirements of pressurized thermal shock (PTS) (10 CFR 50.61) and pressure-temperature (P-T) limit curves (10 CFR 50, Appendix G). Specifically, the TR presents a methodology to generate a ductile-brittle transition reference temperature ( $T_0$ ), adjust the data for differences between the tested material and the RPV component of interest (Master Curve approach), account for test result uncertainty and material variability in the respective RPV component, and to apply the data using the ASME Section XI Code.

The approach represents a departure from the approach used in the current method(s) required in the PTS rule and the development of the P-T limit curve. The current approaches make use of empirical embrittlement correlations (RG 1.99) that are based on Charpy data correlated with material toughness. From the PWROG-18068-NP TR:

“Transitioning from the current unirradiated reference temperature for nil ductility transition ( $RT_{NDT}$ ), and the predicted embrittlement shift approach for RPV integrity evaluations to a direct fracture toughness (master curve) approach is expected to benefit RPV operation for license renewal and subsequent license renewal by reducing uncertainties. The available irradiated master curve data show in many cases that substantial conservatism exists due to uncertainties in the current approach. Thus, application of irradiated master curve data, as an alternative to 10 CFR 50.61 and 10 CFR Part 50, Appendix G RPV evaluations, is expected to show margin in these analyses. Establishing a robust fracture toughness basis will ensure public health and safety by reducing uncertainty and enabling a statistical understanding of the actual irradiated RPV fracture toughness.”

The approach taken in the proposed methodology uses NRC approved methodologies in American Society of Mechanical Engineers (ASME) Section XI, Appendix G, subsection

G-2110 (RT<sub>T0</sub>) and the NRC endorsed Code Case N-830-1, “Direct Use of Fracture Toughness for Flaw Evaluations of Pressure Boundary Materials in Class 1 Ferritic Steel Components.” The methodology uses the industry consensus ASTM International E1921-20 Standard Test Method and the ASTM International E900-15 Standard Guide for predicting embrittlement and ensures uncertainties are properly addressed and appropriately bounding.

The proposed approach in the PWROG-18068-NP TR represents a significant improvement in the estimation of the extent of embrittlement since it makes use of actual toughness data as opposed to empirical correlations. This will allow for a better determination of uncertainties and will likely result in bases for extending inspection intervals (Section XI). Considering this likelihood, Member Ballinger recommended that the committee review this method. A SC meeting has been scheduled for August 22, 2024.

The Committee agreed with this recommendation.

9. Member-at-Large Petti led a discussion on the Triennial Review of NRC’s Safety Research Program including subject leads as follows:

Research Topics and Leads for Members for 2024 RES Review

<b>Topic</b>	<b>Subcommittee (SC)/Full Committee (FC) Meeting 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
RIL on FFRD	FC: December 1, 2021	Ballinger
Advanced Manufacturing	FC: July 6, 2022	Sunseri
How machine learning is influencing NDE and ISI	FC: March 6, 2024	Ballinger
Non-LWR code development update	FC: April 3, 2024	Martin
High Energy Arc Faults	FC: March 7, 2024	Roberts/Brown
Risk assessment and human factors for non-LWRs	FC: Tentatively July 2024	Dimitrijevic/Bier

Note: letter slated for November 2024 FC (Member Petti will not be present for December 2024 FC). Backup would be February 2025 to meet the March 2025 deadline.

10. Chair Kirchner led a discussion of 2 memoranda on the NuScale US460 standard design approval application review. The Committee reviewed the memoranda for Chapters 2 and 13 which were authored by Vice-Chair Halnon on the subjects of site characteristics and conduct of operations, respectively.
11. The Chair led a run-through of the intended presentation to the Commission, which is scheduled for June 7, 2024, at 10 a.m. Presenters ran-through slides and presentations for time and content. As a reminder the presenters and topics on the agenda include:
  - Kirchner – Overview
  - Greg Halnon - ACRS Improvements to Effectiveness and Efficiency
  - Dave Petti - Practical Applications of Committee Improvements in Recent Reviews
  - Matt Sunseri – Reports on the Safety Aspects of Recent License Renewal and Subsequent License Renewal Application Reviews of St. Lucie Plant, Units 1 and 2; Commanche Peak Nuclear Power Plant, Units 1 and 2; and Monticello Nuclear Generating Plant, Unit 1
  - Ron Ballinger - Low Level Radioactive Waste Disposal Proposed Rule (Part 61)

Rob Krsek will collate all presentations and route for review and comment by the Committee members and presenters.

f. Scheduled Topic from the 716<sup>th</sup> ACRS Meeting

The following topic was on the agenda of the 716<sup>th</sup> ACRS meeting scheduled for June 5 through 7, 2024:

- Terrapower Sodium TRs on principal design criteria and fuel and control assembly qualification plan.

Sincerely,



Signed by Kirchner, Walter  
on 06/18/24

Walter L. Kirchner  
Chair

June 18, 2024

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