SIGNIFICANT ADVANCED REACTOR ACCOMPLISHMENTS FOR CALENDAR YEAR 2024

Enclosure

Introduction

This enclosure summarizes significant accomplishments by the U.S. Nuclear Regulatory Commission (NRC) staff (the staff) to make the safe use of advanced nuclear technology possible. This enclosure covers noteworthy activities completed during calendar year (CY) 2024 in the following areas:

- Regulatory Framework Advancement
- Licensing
- Advanced Reactor Research Activities
- Oversight
- International Collaboration
- External Coordination and Communication

Regulatory Framework Advancement

- On January 24, 2024, the staff submitted to the Commission for its consideration SECY-24-0008, "Micro-Reactor Licensing and Deployment Considerations: Fuel Loading and Operational Testing at a Factory" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23207A250), with options for addressing certain aspects of fuel loading and operational testing of commercial-factory-fabricated microreactors. This paper also seeks Commission direction on whether a factory-fabricated microreactor that includes "features to preclude criticality" would require a facility operating license or a combined license (COL) when loaded with fuel. The NRC staff is currently focusing on developing strategies to streamline the licensing timelines for "nth-of-a-kind" microreactor deployment, some of which were identified as future actions in the enclosure to SECY-24-0008.

- On February 29, 2024, the staff issued Regulatory Guide (RG) 4.7, Revision 4, "General Site Suitability Criteria for Nuclear Power Stations" (ML23348A082), which included alternative approaches to the population-density criterion and expanded the regulatory guidance developed for large light-water reactor technology with appropriate modifications for advanced reactor designs. This guidance will facilitate assessment of population-related issues when siting advanced reactors, including consideration of design features, attributes, and associated event analysis, and address, in part, requirements in section 208(a)(1) of the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act to establish strategies and guidance for the siting of microreactors.

- On March 24, 2024, the staff issued nine interim staff guidance documents from the NRC-led Advanced Reactor Content of Application Project (ARCAP),[1] in order to facilitate the preparation of non-light-water-reactor (non-LWR) applications for construction permits or operating licenses and provide guidance to NRC staff on how to review such applications.

- On March 24, 2024, the staff issued RG 1.253, "Guidance for a Technology-Inclusive Content-of-Application Methodology to Inform the Licensing Basis and Content of

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[1] https://www.nrc.gov/reactors/new-reactors/advanced/modernizing/guidance/advanced-reactor-content-of-application-project.html

Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors" (ML23269A222), which revised the guidance for a technology-inclusive content of application methodology and included proposed appendix B, providing guidance on the acceptability of a probabilistic risk assessment (PRA) that supports a non-LWR CP application based on the Licensing Modernization Project methodology.

- On July 22, 2024, the staff delivered SECY-24-0062, "Risk-Informed Methodology for a Future Transportable TRISO-Based Micro-Reactor Package Application" (ML23320A124), to the Commission. This paper discusses a risk-informed methodology that the staff considers acceptable for use in future U.S. Department of Defense transportable microreactors based on tri-structural isotropic fuel particles (TRISO).

- On July 31, 2024, the staff issued Draft Guide 1290, Revision 1, "Design-Basis Floods for Nuclear Power Plants" (ML23320A025), for public comment. When issued as final, this document will describe methods acceptable for use in the determination of design-basis floods for nuclear power plants, including an appendix that provides specific guidance for advanced reactors.

- On July 31, 2024, the staff issued NUREG-2266, "Environmental Evaluation of Accident Tolerant Fuels with Increased Enrichment and Higher Burnup Levels" (ML24207A210), to support efficient and effective licensing reviews of new accident tolerant fuels.

- On August 9, 2024, the staff published the proposed rule, "Alternative Physical Security Requirements for Advanced Reactors" (89 FR 65226), for public comment through October 23, 2024. When finalized, the limited-scope rule will establish voluntary alternatives to some physical security requirements and will provide certain opportunities to better credit security by design under the existing regulatory framework in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The staff plans to evaluate public comments and submit a final rulemaking package to the Commission in late CY 2025. More information on this rulemaking and the associated policy issue appears on the NRC's advanced reactors rulemaking and guidance webpage.[2]

- On September 27, 2024, the staff released a preliminary white paper "Nth-of-a-Kind Micro-Reactor Licensing and Deployment Considerations" to support interactions with external stakeholders and the Advisory Committee on Reactor Safeguards (ACRS) on the staff's strategy to efficiently license nth-of-a-kind microreactors for standardized operational programs and designs. An additional enclosure to the paper focusing on environment reviews, was released on October 29, 2024 (ML24302A292).

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[2] https://www.nrc.gov/reactors/new-reactors/advanced/modernizing/rulemaking/physical-security.html

- On October 31, 2024, the NRC published the proposed 10 CFR Part 53, "Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors," rulemaking package in the *Federal Register* (89 FR 86918), including applicable guidance documents, for public comment. The comment period closed on February 28, 2025.

- On December 11, 2024, the staff delivered SECY-24-0085, "Proposed Rule: Regulatory Framework for Fusion Machines" (ML24019A064), to the Commission. The proposed rule implements the Commission's direction (ML23103A449) to develop a limited-scope rulemaking to establish a regulatory framework for fusion machines that augments the NRC's byproduct material framework in 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material." The proposed rule incorporates the new definition for fusion machine and amended definition for byproduct material from the ADVANCE Act. Additionally, in CY 2024 the staff held three[3] public meetings on this topic.

Licensing

Non-Light-Water Reactors

Construction Permits Issued[4]

Abilene Christian University Research Reactor

- On January 22, 2024, the staff issued "Summary Report on the Environmental Audit of Abilene Christian University Molten Salt Research Reactor Construction Permit Application" (ML24023A001), and on September 6, 2024, the staff issued "Issuance of Audit Reports for Abilene Christian University's Construction Permit Application Review" (ML24250A134).

- On February 27, 2024, the staff issued "NRC Documentation of its Section 106 Environmental Assessment Review Findings" (ML24018A115).

- On March 14, 2024, the staff published the "Environmental Assessment for the Construction Permit Application for the Abilene Christian University Molten Salt Research Reactor" (ML23300A053), in the *Federal Register* (89 FR 18678).

- On June 12, 2024, the staff issued "Abilene Christian University—Molten Salt Research Reactor Construction Permit Application Revised Review Schedule (EPID: L-2022-NFW-0002)" (ML24162A093).

- On September 16, 2024, the staff issued the "Safety Evaluation: Related to the Abilene Christian University Construction Permit Application for the Molten Salt Research Reactor" (ML24243A042), and the "Abilene Christian University Molten Salt Research Reactor Construction Permit, Construction Permit No. CPRR-124" (ML24243A040).

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3 https://www.nrc.gov/materials/fusion-machine.html#rule (August 14, 2024; March 18, 2024; January 17, 2024).

4 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with.html

Kairos Hermes 2

- On January 5, 2024, the staff issued “Environmental Report Audit Plan” (ML23353A069).

- In April 2024, the staff issued “Environmental Assessment and Finding of No Significant Impact for the Construction Permits for the Kairos Hermes 2 Test Reactors: Draft Report for Comment” (ML24103A002).

- On July 11, 2024, the staff issued “Summary Report for the Regulatory Audit of Kairos Power LLC Hermes 2 Construction Permit Preliminary Safety Analysis Report General Audit” (ML24193A214).

- On July 19, 2024, the staff issued “Safety Evaluation: Related to the Kairos Power LLC Construction Permit Application for the Hermes 2 Test Reactor Facility” (ML24200A114).

- On August 30, 2024, the staff issued “Environmental Assessment and Finding of No Significant Impact for the Construction Permits and Environmental Review Exemptions for the Kairos Hermes 2 Test Reactors” (ML24240A034).

- On September 5, 2024, the staff issued SECY-24-0075, “Staff’s Statement in Support of the Uncontested Hearing for Issuance of Construction Permits for the Kairos Hermes 2 Test Reactor Facility” (ML24152A258).[5]

- On November 21, 2024, the staff issued “Hermes 2 Test Reactor Facility Unit 1, Construction Permit, Construction Permit No. CPTR-7” (ML24324A021), and “Hermes 2 Test Reactor Facility Unit 2, Construction Permit, Construction Permit No. CPTR-8” (ML24324A022).

Construction Permit Applications Under Review

TerraPower, LLC

- On March 19, 2024, the staff issued the readiness assessment report for the Kemmerer Power Station Unit 1 construction permit draft application (ML24060A227).

- On May 21, 2024, the staff issued “Acceptance for Docketing of Kemmerer Power Station Unit 1 Construction Permit Application by US SFR Owner, LLC” (ML24135A109).

- On June 6, 2024, the staff published the “Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement” (ML24109A021), in the *Federal Register* (89 FR 49917).

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[5] The staff used the simplified hearing procedures approved by the Commission on July 18, 2024, “Staff Requirements—SECY-24-0032—Revisiting the Mandatory Hearing Process at the U.S. Nuclear Regulatory Commission” (ML24200A044).

- On June 12, 2024, the staff issued "US SFR OWNER, LLC—Kemmerer Power Station Unit 1 Construction Permit Application Review Schedule and Resource Estimate (EPIDS: L-2024-CPS-0000 and L-2024-LNE-0002)" (ML24162A063).

- On July 15, 2024, the staff issued "US SFR Owner, LLC—Plan for a General Audit of the Kemmerer Unit 1 Construction Permit Application (EPID No. L-2024-CPS-0000)" (ML24187A117).

- On July 16, 2024, the staff conducted the environmental scoping meeting, "Scoping Meeting Related to the proposed Kemmerer Unit One Power Plant" (ML24197A073).

- On August 13, 2024, the staff issued "Summary of Public Scoping Meeting Related to the Environmental Scoping Process for the US SFR Owner, LLC Construction Permit for Kemmerer Unit 1" (ML24222A592).

Preapplication Engagements[6]

Aalo Atomics, Aalo-1 Microreactor

- On July 1, 2024, Aalo Atomics submitted "Regulatory Engagement Plan for Idaho Nuclear Project" (ML24193A003).

Abilene Christian University Molten Salt Research Reactor

- On October 31, 2024, Abilene Christian University submitted Revision 2 of its Regulatory Engagement Plan (ML24305A288) related to their planned application for an operating license.

ARC Clean Technology, ARC-100 Sodium Fast Reactor

- On January 12, 2024, the staff issued "U.S. Nuclear Regulatory Commission Staff Feedback and Observations Regarding Arc Clean Technology White Paper 'Spent Fuel Storage Inside the Reactor Vessel,' Revision 0.0 (EPID No. L-2023-LRO-0054)" (ML24012A214).

- On August 19, 2024, the staff issued "U.S. Nuclear Regulatory Commission Staff Feedback Regarding ARC Clean Technology Inc., 'White Paper on Fuel Qualification,' Revision 0.0 (EPID L-2023-LRO-0071)" (ML24219A399).

General Atomics Electromagnetic Systems, Fast Modular Reactor

- On January 11, 2024, General Atomics submitted 30599200R0039, Revision 1, "Nuclear Technologies and Materials Advanced Reactor Concepts-20, Fast Modular Reactor Selection of Licensing Basis Events" (ML24011A221).

- On October 14, 2024, the staff issued "U.S. Nuclear Regulatory Commission Staff Feedback Regarding General Atomics Electromagnetic Systems White Paper: 'Fast Modular Reactor Safety Classification of Structures, Systems, and Components'" (ML24262A233).

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6 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/pre-application-activities.html

- On October 24, 2024, the staff issued “U.S. Nuclear Regulatory Commission Staff Feedback Regarding General Atomics Electromagnetic Systems White Paper: ‘Fast Modular Reactor Source Term Methodology’ (EPID L-2023-LRO-0086)” (ML24277A278).

Energy Northwest Small Modular Reactor Project

- On August 26, 2024, Energy Northwest submitted its Regulatory Engagement Plan (ML24239A815).

Long Mott Energy, LLC

- On May 9, 2024, Long Mott Energy, LLC submitted a regulatory engagement plan that provides planned activities and engagements to support its planned construction permit application (ML24130A253).

Natura Resources, LLC, Liquid Fueled Molten Salt Reactor

- On January 29, 2024, Natura Resources submitted a “Plan for Regulatory Engagement with the U.S. Nuclear Regulatory Commission, Revision 0” (ML24030A014).

Oklo Inc.

- On February 29, 2024, the staff issued “Oklo Inc. - U.S. Nuclear Regulatory Commission Staff Feedback and Observations Regarding White Paper ‘Approach to Seismic Design Categorization and Site Characterization’ (EPID No. L-2022-LRO-0048” (ML24036A305).

- On March 22, 2024, the staff issued “Oklo Inc. - U.S. Nuclear Regulatory Commission Staff Feedback and Observations Regarding White Paper, ‘Emergency Plan’ (EPID No. L-2023-LRO-0079” (ML24072A287).

- On May 24, 2024, the staff issued “Oklo Inc. - U.S. Nuclear Regulatory Commission Staff Feedback and Observations on the Oklo White Paper for Pre-Application Engagement, ‘Development of Regulatory Controls: Shutdown Case Study’” (ML24033A068).

- On May 28, 2024, the staff issued “Oklo Inc. - U.S. Nuclear Regulatory Commission Staff Feedback and Observations on the Oklo White Paper for Pre-Application Engagement, ‘Considerations for Including Principal Design Criteria in the Licensing Basis in 10 CFR Part 52’” (ML24071A064).

Radiant Industries, Inc., Kaleidos Microreactor

- On October 4, 2024, the staff issued “Radiant Industries, Inc.—U.S. Nuclear Regulatory Commission’s Feedback Regarding Title 10 of the Code of Federal Regulations Part 70, ‘Domestic Licensing of Special Nuclear Material’ Gap Analysis White Paper (EPID No. L-2024-LRO0026/CAC 000431)” (ML24262A066).

Terrestrial Energy USA, Inc.

- On September 11, 2024, the staff issued the "U.S. Nuclear Regulatory Commission Staff's Feedback Regarding the Terrestrial Energy USA, Inc. White Paper Titled: 'Modeling and Simulation Activities Related to Source Term for IMSR Design Basis Accidents' (EPID: L-2024-LRO-0014)" (ML24226A375).

University of Illinois at Urbana-Champaign, Research and Test Reactor

- On March 7, 2024, the staff issued "University of Illinois at Urbana-Champaign—Safety Evaluation for Topical Report Related to Event Sequence Identification and Safety Classification Methodology" (ML24039A164).

- On July 25, 2024, the staff issued "University of Illinois at Urbana-Champaign—Safety Evaluation for Topical Report Related to Principal Design Criteria" (ML24155A168).

- On July 25, 2024, the staff issued "University of Illinois at Urbana-Champaign—Safety Evaluation for Topical Report Titled 'High-Temperature Gas-Cooled Research Reactor: Applicability of Nuclear Regulatory Commission Regulations,' Release 4" (ML24165A000).

Westinghouse Electric Company, LLC, eVinci Microreactor

- On September 30, 2024, the staff issued "Westinghouse Electric Company, LLC - Final Safety Evaluation for Topical Reports: 'Advanced Logic System® [ALS] V2 Platform' and 'Advanced Logic System® Development Process' (EPID Nos. L-2022 TOP-0059 and L-2022-TOP-0060)" (ML24236A061).

- On October 16, 2024, the staff issued "Westinghouse Electric Company, LLC — Final Safety Evaluation for Topical Report EVR-LIC-001-P/NP, Westinghouse Principal Design Criteria Topical Report for the eVinciTM Microreactor (EPID: L-2023-TOP-0040)" (ML24283A133).

X-energy, LLC, Xe-100 High-Temperature Gas-Cooled Reactor

- On February 7, 2024, the staff issued a preapplication readiness assessment report on portions of the draft preliminary safety analysis report (ML24010A222).

- On September 12, 2024, the staff issued "U.S. Nuclear Regulatory Commission Final Safety Evaluation of the X Energy, LLC., XE-100 Atmospheric Dispersion and Dose Calculation Methodology Topical Report, Revision 2 (EPID L-2023-TOP-0032)" (ML24242A251).

- On October 24, 2024, the staff issued "U.S. Nuclear Regulatory Commission Final Safety Evaluation for X Energy, LLC., X-100 Principal Design Criteria Topical Report, Revision 3 (EPID L-2022-TOP-0010)" (ML24284A012).

- On December 19, 2024, the staff issued a second readiness assessment report on portions of the draft preliminary safety analysis report (ML24344A100).

X-energy, XENITH Microreactor

- On November 7, 2024, the staff issued feedback regarding the white paper on Xenith's concept of operations (ML24305A218).

Small Modular Reactor Licensing

NuScale Power, LLC[7]

- On February 27, 2024, the staff issued its safety evaluation report on topical report TR-108601, Revision 4, "Statistical Subchannel Analysis Methodology, Supplement 1 to TR-0915-17564-P-A, Revision 2, Subchannel Analysis Methodology" (ML24058A019).

- In 2024, the staff issued advanced safety evaluations[8] associated with its review of the NuScale US460 standard design approval application on the following chapters:

  - Chapter 2, "Site Characteristics and Site Parameters," February 9, 2024 (ML24040A063)

  - Chapter 10, "Steam and Power Conversion System," dated March 11, 2024 (ML24011A133)

  - Chapter 11, "Radioactive Waste Management," dated February 24, 2024 (ML24016A033)

  - Chapter 13, "Conduct of Operations," dated March 11, 2024 (ML23355A271)

  - Chapter 17, "Quality Assurance and Reliability Assurance," dated February 13, 2024 (ML23346A042).

- On July 29, 2024, the staff issued "Updated—Audit Plan for the Staff Review of the NuScale Power, LLC Standard Design Approval Application—NuScale US460 Design" (ML24211A089).

SMR, LLC SMR-300, a subsidiary of Holtec International[9]

- On August 6, 2024, the staff issued its audit plan for topical report HI-2230875, Revision 0, "Audit Plan for the Regulatory Audit of SMR, LLC Submittal of Holtec PSA Risk Significance Determination Methodology Licensing Topical Report (Project No. 99902049)" (ML24211A226).

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7 https://www.nrc.gov/reactors/new-reactors/smr/licensing-activities/current-licensing-reviews/nuscale-us460.html

8 Additional information and copies of the evaluations appear at the following web page: https://www.nrc.gov/reactors/new-reactors/smr/licensing-activities/current-licensing-reviews/nuscale-us460/safety-evaluations.html

9 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/pre-application-activities/holtec/smr300.html

- On August 26, 2024, the staff issued its safety evaluation report on topical report HI-2230815, Revision 0, "Final Safety Evaluation for the 'Topical Report on the Quality Assurance Program for Holtec International's Small Modular Reactor (SMR) Design and Construction' (EPID No. L-2023-TOP-0049)" (ML24228A060).

- Throughout 2024, the staff reviewed and provided feedback on two white papers and held 19 public meetings with SMR, LLC (Holtec), to discuss various topics associated with the SMR-300 design.

Westinghouse Electric Company, LLC AP300[10]

- Throughout 2024, the staff held nine public meetings with Westinghouse to discuss topics associated with the AP300 design.

- In 2024, the staff provided feedback on eight white papers submitted by Westinghouse associated with a future design certification application.

GE-Hitachi BWRX-300[11]

- On July 16, 2024, the staff issued "Plan for the Regulatory Audit of GE Hitachi Topical Report NEDC-33934P/NEDO-33934, Revision 1, 'BWRX-300 Safety Strategy'" (ML24144A192).

- On August 16, 2024, the staff issued "Final Safety Evaluation for GE-Hitachi Licensing Topical Report NEDO-33926/NEDC-33926P, Revision 2, 'BWRX-300 Steel-Plate Composite Containment Vessel and Reactor Building Structural Design'" (ML24220A016).

Duke Energy Belews Creek[12]

- In 2024, the staff held one public meeting with Duke Energy and on August 5, 2024, the staff issued a letter summarizing its audit of the subsurface investigation work performed for the Belews Creek, North Carolina, project site from June 25–26, 2024 (ML24214A206).

Fuel Cycle Licensing

Global Laser Enrichment, LLC

- On August 19, 2024, the NRC approved an exemption that supports bifurcation of the planned license application for the applicant's Paducah Laser Enrichment Facility to submit the environmental report up to one year in advance of a safety and safeguards analysis report (ML24184B971).

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10 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/pre-application-activities/westinghouse.html

11 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/pre-application-activities/bwrx-300.html

12 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/pre-application-activities/duke-energy-belews-creek.html

Louisiana Energy Services (LES) LLC (Urenco USA)

- On December 11, 2024, the staff approved a license amendment request to increase the enrichment limit at LES from 5.5 weight percent uranium-235 to less than 10.0 weight percent uranium-235 (ML24318C241). This amendment allows LES to produce enriched uranium for use in accident tolerant fuel with increased enrichment and advanced reactor fuels.

American Centrifuge Operating (ACO) LLC (Centrus)

- On September 20, 2024, the NRC issued an amendment to ACO to increase the possession limits for high assay low enriched uranium (HALEU) at the Centrus/ACO American Centrifuge Plant for Phase II of the Department of Energy (DOE) HALEU Demonstration. This amendment would allow ACO to produce approximately 1,400 kilograms of HALEU in the form of uranium hexafluoride (ML24228A129).

- On December 31, 2024, the NRC issued an amendment to ACO extending the licensing authorization for continued HALEU operations to June 30, 2025 (ML24345A251).

Oversight

- The NRC staff held four Advanced Reactor Construction Oversight Program (ARCOP) public workshops in 2024. During these workshops, external stakeholders and the staff discussed several topics through tabletop exercises. Several options for ARCOP inspection scoping, issue dispositioning, and performance assessment were included in these discussions. In CY 2025, the results of these workshops will be reflected in an information paper to the Commission describing several details of the ARCOP. Development of ARCOP staff guidance in inspection manual chapters and inspection procedures is scheduled to be complete in CY 2025.

Research Activities[13]

Computer Codes

- On April 3, 2024, the staff briefed the ACRS on the status of computer code development activities regarding fuel performance, system analysis, accident progression and source term, consequence analysis, and radiation protection. The Committee recognized the significant effort by the staff to develop, verify, and validate non-LWR code analysis capability. This will substantially improve the agency's technical and regulatory readiness for reviewing non-LWR licensing applications (ML24129A189).

- On April 4, 2024, the staff hosted an event to share technical expertise and knowledge and identify opportunities to enhance aspects of the NRC's codes and standards program that could increase the efficiency of NRC's licensing and oversight of new and

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13 Additional information regarding research activities, including for advanced reactors, appears at https://www.nrc.gov/about-nrc/regulatory/research.html.

advanced reactors. Information on the event is available on the New & Advanced Reactors Codes & Standards symposium webpage.[14]

- On June 4, 2024, the staff supported the ACRS Kairos Power licensing subcommittee meeting for the Hermes 2 nonpower reactor preliminary safety analysis. The scoping calculations using SCALE/MELCOR provided insights into the nature of accident progression, and the ACRS agreed with the staff that there is confidence the facility can be constructed in accordance with relevant regulations and the design bases outlined in the preliminary safety analysis report (ML24197A152).

- On July 11, 2024, the staff conducted a public workshop on the SCALE/MELCOR non-LWR fuel cycle demonstration project for a molten salt reactor (more information appears on the NRC's public website).[15] The workshop was part of the agency's efforts to prepare for safety reviews of non-LWR license applications. The staff, Sandia National Laboratories, and Oak Ridge National Laboratory presented SCALE and MELCOR modeling methods and results for simulating fission product inventory, decay heat, fuel heatup, and fission product release during different accident scenarios.

- In September 2024, the staff issued the report "Assessment of Current MACCS Capabilities for Modeling Atmospheric Physical and Chemical Transformations" (ML24261B964). The staff concluded that the inclusion of physical and chemical transformations is very limited in current state-of-practice codes for atmospheric dispersion of radionuclides, and therefore no updates to the MELCOR Accident Consequence Code System (MACCS) code are needed to bring it up to the state of practice.

Codes and Standards

- On April 4, 2024, the NRC hosted a public workshop to share technical expertise and knowledge and identify opportunities to enhance aspects of the NRC's codes and standards program that could increase the efficiency of NRC's licensing and oversight of new and advanced reactors. Information on the workshop is available on the New & Advanced Reactors Codes & Standards symposium webpage.[16] On August 22, 2024, the NRC issued the "Action Plan for Enhancing U.S. Nuclear Regulatory Commission's Codes and Standards Program for Advanced Reactors" (ML24234A011), documenting staff-developed enhancements to the codes and standards program following the workshop.

Risk Insights

- On January 31–February 1, 2024, the staff hosted a public workshop on human factors considerations for remote operations (ML24061A181). The workshop provided an opportunity for the staff to hear from industry representatives about their interest in and plans for remote operation of advanced reactors. Insights will be considered in the development of human factors review guidance.

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14 https://www.nrc.gov/public-involve/conference-symposia/new-adv-codes-standards.html

15 https://www.nrc.gov/reactors/new-reactors/advanced/references/nuclear-power-reactor-source-term.html#history

16 https://www.nrc.gov/public-involve/conference-symposia/new-adv-codes-standards.html

- On July 18, 2024, the staff held a public workshop to discuss the development of risk metrics and tools to support risk estimation for non-LWRs (ML24220A189). Insights will be considered in the development of staff guidance on the review of applicant-proposed risk metrics under the proposed 10 CFR Part 53 rule.

- In September 2024, the staff completed a public website on PRA standards for non-LWRs, available at https://prastandards.sandia.gov/. The website supports features for searching, filtering, sorting, and exporting information to support clarity and consistency in communicating staff positions on the large number of PRA requirements that are documented across different PRA standards.

Other

- In April 2024, the staff issued technical letter report TLR-RES/DE/REB-2024-02, "Preliminary Assessment of Models for Generating Predictions of Long-Term Corrosion in Molten Salts" (ML24095A304). This assessment helps staff better understand the methodology and experimental parameters used to assess the molten salt compatibility of structural materials in static halide salts and provides recommendations for how to interpret corrosion data that could be part of a license submittal for a molten salt reactor.

- In July 2024, the staff issued TLR-RES/DE/REB-2024-09, "Effect of Fission Products on Degradation of Structural Materials in Molten Salt Reactors" (ML24178A348). The purpose of this assessment is to provide NRC with qualitative insights into which fission products have the most significant effect on corrosion, so that they can be considered when license applications are submitted.

- In August 2024, the staff issued TLR-RES/DE/REB-2024-14, "Examining Graphite Degradation in Molten Salt Environments: A Chemical, Physical, and Material Analysis" (ML24236A722). The report identifies the degradation mechanisms that may affect graphite in a molten salt environment.

- On August 7, 2024, the staff issued TLR-RES/DE/REB-2024-12, "Technical Information Needs and Regulatory Considerations for Front-End Transportation Activities of HALEU Fuel Feed Material" (ML24220A147). The report documents the safety and regulatory considerations for the transportation of the feed material that will be used to make HALEU fuel.

- In September 2024, the staff issued TLR-RES/DE/REB-2024-15, "Storage and Transportation of Molten Salt Reactor Wastes: Identification of Technical Information Needs and Safety Implications for Safety Review Guidance" (ML24256A003). This report identifies plausible scenarios for storing and transporting such waste and identifies potential additional technical considerations and associated information needs for storage and transportation safety evaluations.

- In September 2024, the staff issued TLR-RES/DE/REB-2024-17, "Assessment of Technical Information Needs and Considerations for Front-End Activities for Molten Salt Fuel Types" (ML24267A025). This report details an assessment of the safety impacts related to front-end operations of molten salt reactors and an assessment of existing regulations and safety guidance. Primary areas of evaluation include fuel cycle facilities, transportation, and reactor fuel mixing operations up to reactor startup.

- In November 2024, the staff issued TLR-RES/DE/REB-2024-19, "Assessment of Stress Relaxation Cracking of Austenitic Components in Regard to the ASME Section III, Division 5 Rules" (ML24323A060). Several of the metals anticipated for use in advanced reactors are susceptible to stress relaxation cracking (SRC), and it was identified in RG 1.87, Revision 2, "Acceptability of ASME Code, Section III, Division 5, 'High Temperature Reactors'," issued January 2023 (ML22101A263), that when using some parts of Section III, Division 5 of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, an applicant will need to develop its own methods for addressing SRC. This report provides a technical basis for SRC and discusses screening, modeling, and processing strategies that may help to mitigate SRC.

- On December 3–5, 2024, the staff hosted a virtual public workshop, "2024 Workshop on Storage and Transportation of TRISO and Metal Spent Nuclear Fuels." The workshop was held in coordination with the DOE's Office of Nuclear Energy and the Electric Power Research Institute, with assistance from the Center for Nuclear Waste Regulatory Analyses. The workshop was focused on technical and regulatory considerations for spent fuel management pertaining to advanced nuclear fuels, to prepare for potential future licensing and certification reviews. The workshop also facilitated discussions to inform the NRC's regulatory readiness and identify opportunities for regulatory guidance.

International Collaboration[17]

Memorandum of Cooperation Between NRC, Canadian Nuclear Safety Commission, and United Kingdom's Office for Nuclear Regulation

On March 12, 2024, the Canadian Nuclear Safety Commission, the United Kingdom's Office for Nuclear Regulation, and the NRC signed a memorandum of cooperation to increase collaboration on the technical reviews of advanced reactor and small modular reactor technologies (ML24066A026).

International Atomic Energy Agency (IAEA)

In 2024, the staff continued to support the IAEA on topics of mutual interest, such as the SMR regulators' forum and development of three technical documents for the Regulatory Track of the Nuclear Harmonization and Standardization Initiative.[18]

Nuclear Energy Agency

The staff chairs the Working Group on Policy and Licensing under the Committee on Nuclear Regulatory Activities (CNRA) at the Nuclear Energy Agency.[19] The staff also participates in the CNRA Working Group on New Technologies.[20] Relevant tasks for the working groups include pre-application engagement, safety classification of pressure boundary components, and regulatory practices to ensure appropriate qualification and through-life performance of

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17 https://www.nrc.gov/reactors/new-reactors/advanced/who-were-working-with/international-cooperation.html
18 https://nucleus.iaea.org/sites/smr/SitePages/NHSI-Regulatory-Track.aspx?web=1
19 https://www.oecd-nea.org/tools/mandates/
20 https://www.oecd-nea.org/tools/mandates/index/id/11595/lang/en_gb

materials in advanced reactors.

External Coordination and Communication[21]

- In CY 2024, the staff held over 100 public meetings on advanced reactor topics such as preapplication and licensing documents, staff-developed guidance, and industry-led guidance initiatives.

- The staff updated the format of the NRC's Advanced Reactors public webpage[22] to make it more user friendly and better enable external stakeholders in locating information of interest.

- The staff briefed the ACRS subcommittees and the ACRS Full Committee on various topics supporting numerous pre-application and licensing or framework development. Examples include the staff safety evaluation for the Kairos Power LLC, Hermes 1 test reactor construction permit application and two Kairos topical report safety evaluations; proposed guidance on the content of applications; the draft white paper on microreactor licensing and deployment considerations; and other topics related to advanced reactors.

- During CY 2024, the staff briefed the Commission on multiple topics, including: advanced reactor licensing under 10 CFR Part 50 and 10 CFR Part 52, an update on 10 CFR Part 53 licensing and regulation of advanced reactors, the interface of research and test reactors with advanced reactors, international initiatives, transportable microreactors, and new fuels licensing. The staff also provided the Commission with a strategic programmatic overview of the New Reactor Business Line.

Department of Energy

The staff continued routine interactions with the Office of Clean Energy Demonstration and the Office of Nuclear Energy in the DOE. These engagements support the Federal government's comprehensive understanding of the landscape for nuclear developers and potential applicants and ensures resources and information are positioned to enable deployment of advanced reactor technologies.

Department of Defense

On October 7, 2024, the staff endorsed a risk assessment methodology (ML24271A054) for prospective licensees to use in applying for transport package approval of a Department of Defense transportable microreactor.

The staff continued interaction with the U.S. Department of the Air Force (DAF) in support of its Eielson Air Force Base microreactor pilot program.[23] In August 2024, the staff signed a memorandum of understanding with the DAF for cooperation on the anticipated environmental review (ML24235A211) and continued to support several DAF-led community engagement meetings for this project.

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21 https://www.nrc.gov/reactors/new-reactors/advanced/get-involved.html

22 https://www.nrc.gov/reactors/new-reactors/advanced.html

23 https://www.eielson.af.mil/microreactor/