



POLICY ISSUE **(Information)**

January 30, 2020

SECY-20-0010

FOR: The Commissioners

FROM: Ho K. Nieh, Director
Office of Nuclear Reactor Regulation

SUBJECT: ADVANCED REACTOR PROGRAM STATUS

PURPOSE:

The purpose of this paper is to provide the Commission an update of the U.S. Nuclear Regulatory Commission (NRC) staff's activities underway to make the safe use of advanced nuclear technology possible. This paper informs the Commission about the progress and path forward on activities such as the resolution of key technology-inclusive policy issues, development of risk-informed and performance-based licensing approaches, and interactions with prospective applicants and other stakeholders. This paper does not address any new commitments or resource implications.

BACKGROUND:

To prepare to review and regulate a new generation of non-light-water reactors (non-LWRs), the NRC developed a vision and strategy to ensure the agency's readiness to effectively and efficiently conduct its mission for these technologies. The agency describes this vision and strategy in "NRC Vision and Strategy: Safely Achieving Effective and Efficient non-Light Water Reactor Mission Readiness," issued December 2016.¹ To achieve the goals and objectives stated in this vision and strategy report, the staff developed an implementation action plan (the plan), dated July 12, 2017.² The plan identified specific activities the staff expected to conduct in the near-term (0–5 years), mid-term (5–10 years), and long-term (beyond 10 years) time frames to achieve non-LWR readiness.

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¹ See "NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Headiness," dated December 21, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16356A670)

² See "NRC Non-Light Water Reactor Near-Term Implementation Action Plans," dated July 12, 2017 (ADAMS Accession No. ML17165A069), and "NRC Non-Light Water Reactor Mid-Term and Long-Term Implementation Action Plans," dated July 12, 2017 (ADAMS Accession No. ML17164A173)

The staff has made significant progress over the past year on its ongoing activities to support licensing non-LWRs. Many of these activities support those required by Section 103 of the Nuclear Energy Innovation and Modernization Act (NEIMA), which was signed into law on January 14, 2019.³ As required by Sections 103(b) and 103(c) of NEIMA, the NRC prepared two reports on (1) expediting and establishing stages in the licensing process for commercial advanced nuclear reactors, and (2) increasing, where appropriate, the use of risk-informed and performance-based evaluation techniques and regulatory guidance in licensing commercial advanced nuclear reactors within the existing regulatory framework. The NRC sent these reports to Congress on July 12, 2019.⁴ The staff has enhanced its advanced reactor technical readiness in accordance with Section 103(a)(5) of NEIMA, which requires the NRC to provide for staff training or hiring of experts to support activities required under Section 103(a)(1)–(4) of NEIMA and support preparations for preapplication interactions and reviews of commercial advanced reactor license applications. Finally, consistent with Section 103 of NEIMA, the staff has begun efforts to establish a “technology-inclusive regulatory framework” for optional use by applicants for new commercial advanced nuclear reactor licenses. While the staff has made considerable progress, there remains significant work to be accomplished and the agency is actively pursuing it.

DISCUSSION:

As described in the plan, the staff has organized its non-LWR readiness efforts into six strategic areas: (1) staff development and knowledge management, (2) analytical tools, (3) regulatory framework, (4) consensus codes and standards, (5) resolution of policy issues, and (6) communications. Since issuance of the plan, the staff has made significant progress in activities related to all of these areas. The staff is continuing its non-LWR readiness activities in fiscal year (FY) 2020, with a priority on advancing risk-informed and performance-based licensing approaches and addressing key policy issues and will continue to engage in preapplication interactions with the prospective applicants. In its efforts, the staff has continued to work closely with its counterparts at the U.S. Department of Energy and U.S. Department of Defense and has engaged extensively with external stakeholders.

This paper covers progress made through December 31, 2019, in each of the six strategic areas. The enclosure discusses the staff’s accomplishments in more detail, including the following:

- Issued SECY-19-0117 “Technology-Inclusive, Risk-Informed, and Performance Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors,” on December 2, 2019.⁵
- Issued draft SECY paper “Population-Related Siting Consideration for Advanced Reactors” dated July 19, 2019.⁶

³ NEIMA; <https://www.congress.gov/bill/115th-congress/senate-bill/512>.

⁴ See letter to Senators Barrasso and Pallone from Chairman Svinicki, dated July 12, 2019 (ADAMS Accession No. ML19128A289)

⁵ See SECY-19-0117 “Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses. Certifications, and Approvals for Non-Light Water Reactors,” dated December 2, 2019 (ADAMS Accession No. ML18311A264)

⁶ See draft SECY paper, “Population-Related Siting Considerations for Advanced Reactors,” dated July 19, 2019 (ADAMS Accession No. ML19203A219)

- Published the regulatory basis for the “Rulemaking for Physical Security for Advanced Reactors,” dated July 16, 2019.⁷
- Published draft regulatory guide (DG) 1353, “Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light Water Reactors,” dated April 30, 2019, for public comment.⁸
- Developed training courses for fast reactors and high-temperature gas-cooled reactors and conducted training for staff.
- Developed draft Strategy 2 Code Assessment Plans (Volumes 1, 2, and 3).⁹
- Participated actively in the development of consensus codes and standards, including American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, Division 5, for high-temperature materials and the joint ASME/American Nuclear Society probabilistic risk assessment standard for advanced non-LWR plants and developed plans for NRC endorsement.
- Conducted eight public meetings to obtain stakeholder feedback on a variety of advanced reactor topics.
- Conducted four briefings of the Advisory Committee on Reactor Safeguards (ACRS) Future Plant Subcommittee and three briefings of the ACRS Full Committee.
- Chaired the Nuclear Energy Agency working group on the safety of advanced reactors.
- Entered into a memorandum of cooperation with the Canadian Nuclear Safety Commission to increase collaborative work on the technical reviews of advanced reactor and small modular reactor technologies.¹⁰
- Entered into two memoranda of understanding with Department of Energy.¹¹

The staff described previous accomplishments and provided background information in both previous annual updates: SECY-18-0011 and SECY-19-0009, “Advanced Reactor Program Status,” dated January 25, 2018,¹² and January 17, 2019¹³, respectively.

With the anticipated increase in preapplication interactions and the planned submittal of one combined license application in early 2020, the staff worked to strategically build capacity and capability to conduct non-LWR reviews. In April 2019, the Office of New Reactors (NRO) was restructured, in part to form a new division, the Division of Advanced Reactors. In October 2019, when NRO merged with the Office of Nuclear Reactor Regulation (NRR), the new division became the Division of Advanced Reactors and Non-Power Production and Utilization Facilities.

⁷ See “Rulemaking for Physical Security for Advanced Reactors,” dated July 16, 2019 (ADAMS Accession No. ML19099A017)

⁸ See draft regulatory guide DG-1353 “Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light Water Reactors,” dated April 30, 2019 (ADAMS Accession No. ML18312A242)

⁹ See draft “Non-Light Water Reactors Code Plans,” dated April 3, 2019 (ADAMS Accession No. ML19093B424)

¹⁰ See “Memorandum of Cooperation on Advanced Reactors and Small Modular Reactor Technologies between the United States Nuclear Regulatory Commission and the Canadian Nuclear Safety Commission” dated August 15, 2019 (ADAMS Accession No. ML19275D578)

¹¹ See “Memorandum of Understanding between U.S. Department of Energy and U.S. Nuclear Regulatory Commission on Nuclear Energy Innovation”, dated October 7, 2019 (ADAMS Accession No. ML19263C976) and “Memorandum of Understanding between U.S. Nuclear Regulatory Commission and U.S. Department of Energy on Versatile Test Reactor Engagement,” dated September 19, 2019 (ADAMS Accession No. ML19266A003)

¹² See SECY-18-0011, “Advanced Reactor Program Status,” dated on January 25, 2018 (ADAMS Accession No. ML17334B184)

¹³ See SECY-19-0009, “Advanced Reactor Program Status,” dated on January 17, 2019 (ADAMS Accession No. ML18346A075)

The staff created the new division with the intention of providing increased focus on advanced reactors readiness activities and increasing staff capacity to support advanced reactor licensing. The new division has three branches that focus on advanced reactors: the Advanced Reactor Policy Branch, the Advanced Reactor Licensing Branch, and the Advanced Reactor Technical Branch. Subject matter experts from critical disciplines were reassigned to this new division to prepare for potential early mover advanced reactor applications. Creation of this division also ensured that the staff had enough resources to conduct preapplication reviews and to continue to develop regulatory infrastructure for non-LWRs. The staff continues to use the non-LWR core review team approach to conduct effective and efficient non-LWR preapplication reviews and plans to fill remaining vacancies in the new division in FY 2020. Given the expected enhancements in safety and decreased risk profile of advanced reactor designs, the staff will be approaching the technical and safety review in a different manner than recent light-water-reactor reviews. The staff is using a multi-tiered project team approach for the review, which will be led by a core team conducting a holistic integrated review of the applications.

Six non-LWR developers have formally notified the staff of their intent to begin regulatory interactions by providing a response to a Regulatory Issue Summary.¹⁴ The developers are in different stages of design development. The staff started formal preapplication interactions, including participation in meetings and reviews of topical reports, with Oklo, Inc. (Oklo), in November 2016 on its micro fast-reactor design; X-Energy, LLC (X-Energy), in September 2018 on its pebble bed high-temperature gas-cooled reactor (HTGR); and Kairos Power (Kairos) in October 2018 on its pebble-fueled, molten-salt-cooled reactor. The staff is also engaged with X-Energy on preapplication interactions for a fuel fabrication facility to produce tristructural isotropic fuel. The staff anticipates starting additional preapplication interactions and beginning the review of the OKLO Aurora combined license application in early 2020. Figure 1 summarizes some of the diverse designs currently in development.¹⁵

The Fiscal Year 2020 Budget for the DOE Office of Nuclear Energy included appropriations for various projects supportive of pursuing advanced reactors. For example, there is direction and funding to pursue an Advanced Reactor Demonstration Program for multiple advanced reactor designs, including proposals to build two reactors. The demonstration reactors can be an advanced reactor operated as part of the power generation facilities of an electric utility system or in any other manner for the purpose of demonstrating the suitability for commercial application of the advanced nuclear reactor. Additionally, there is direction and funding to DOE to pursue Regulatory Development through the national laboratories and work with the NRC. The NRC continues to interact frequently with DOE on these projects and in modernizing our regulatory framework in support the potential future licensing of advanced reactors.

¹⁴ See "NRC Regulatory Issue Summary 2017-08 Process for Scheduling and Allocating Resources for Fiscal Years 2020 through 2022 for the Review of New Licensing Applications for Light-Water Reactors," dated December 21, 2017 (ADAMS Accession No. ML17262B022)

¹⁵ The figure does not include technologies such as fusion energy or accelerator-driven systems and may not include all companies actively developing designs even within the listed categories of micro reactors, liquid-metal-cooled fast reactors (LMFRs), HTGRs, and molten salt reactors (MSRs)

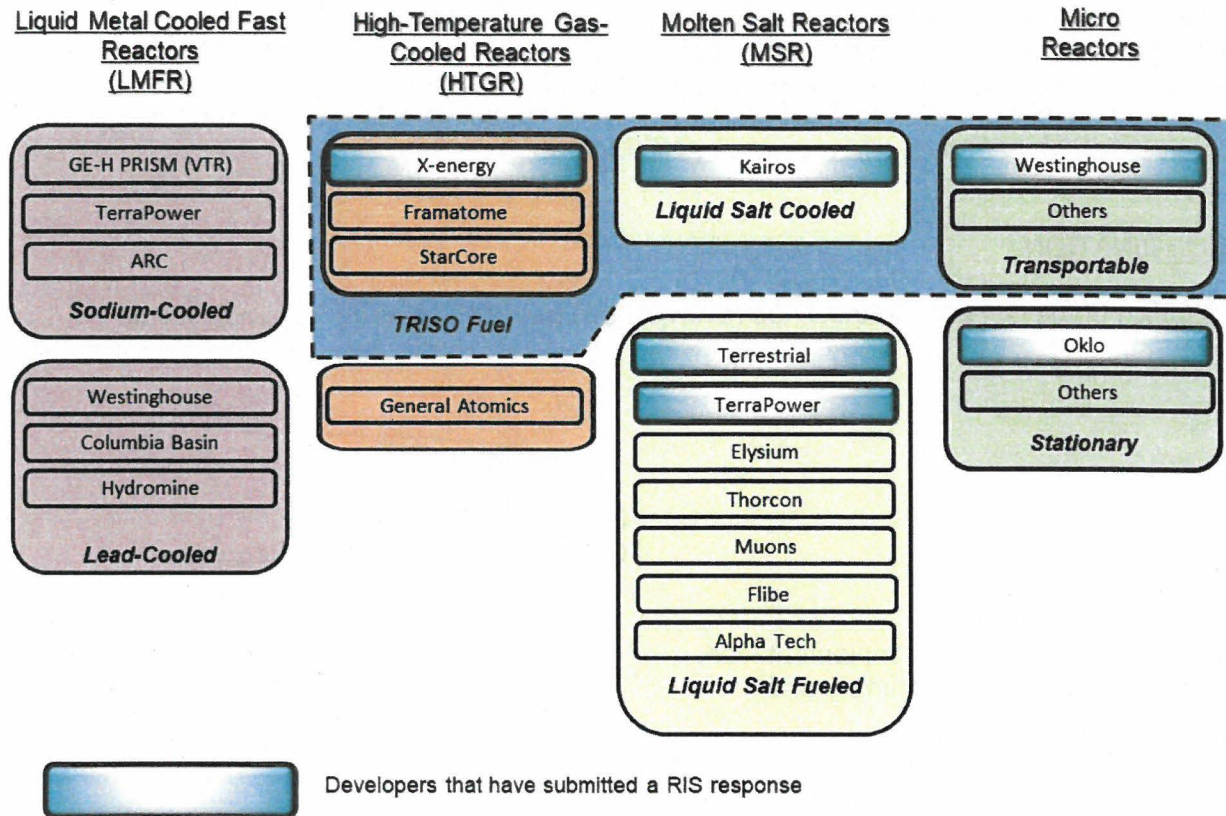


Figure 1: Companies developing non-LWR designs

The staff continues to implement flexible and staged non-LWR regulatory review processes to engage with developers and to align the NRC's activities with the developers' needs, as described in the guidance document, "A Regulatory Review Roadmap for Non-Light Water Reactors" issued December 2017.¹⁶

The public can access the status of the NRC's non-LWR readiness activities through the NRC's public Web site (<https://www.nrc.gov/reactors/new-reactors/advanced.html>). To ensure that the Web site is current, NRR project managers routinely review and update this information.

CONCLUSION:

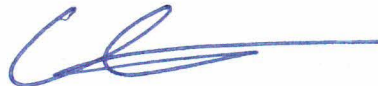
The staff has made progress in preparing for effective and efficient non-LWR application reviews consistent with available resources. The staff is continuing its non-LWR readiness activities in fiscal year (FY) 2020, with a priority on advancing risk-informed and performance-based licensing approaches, addressing key policy issues, and continuing to engage in preapplication interactions with prospective applicants. The staff will continue to keep the Commission informed of the status of its non-LWR readiness activities and plans for potential licensing applications.

¹⁶ See "A Regulatory Review Roadmap for Non-Light Water Reactors" issued December 2017 (ADAMS Accession No. ML173212B567)

The staff also plans to inform the Commission, and seek Commission decisions where appropriate, on advanced reactor policy topics, such as siting in densely populated areas, and potential policy and regulatory issues related to micro reactors. Finally, the staff is also preparing a rulemaking plan that will be transmitted to the commission for the "technology-inclusive regulatory framework" required by NEIMA.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objections.



Ho K. Nieh, Director
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Enclosure:

Non-Light Water Reactor Implementation
Action Plan— Progress Summary and
Future Plans

SUBJECT: ADVANCED REACTOR PROGRAM STATUS DATED: January 30, 2020

[SRM-M170511-4](#)

ADAMS Accession Nos.: ML19331A034 Package

***via e-mail**

SECY-012

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