

November 11, 2024

Mr. Michael F. King
Special Assistant for ADVANCE Act Implementation
Office of the Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: NEI Input on Advanced Methods of Manufacturing and Construction for Nuclear Energy Projects

Project Number: 689

Dear Mr. King:

The recently enacted bipartisan legislation known as the ADVANCE Act¹ will help nuclear energy play a key role in the Nation's effort to achieve its climate and energy security goals. The ADVANCE Act will bolster U.S. international competitiveness, accelerate the domestic deployment of innovative advanced nuclear technologies, promote greater efficiency and timeliness in the U.S. Nuclear Regulatory Commission's (NRC) processes and modernize the oversight and licensing of the operating fleet of reactors. The ability to implement advanced methods of manufacturing and construction for nuclear energy projects is essential to meeting these national objectives by enabling the deployment of new and advanced reactors and supporting the operating fleet in the coming decades.

To assist the NRC in obtaining feedback from the industry, the Nuclear Energy Institute (NEI)² has worked with our members to develop recommendations for the NRC's consideration with respect to implementing the provisions of the ADVANCE Act that address advanced methods of manufacturing and construction and build upon the White House National Science and Technology Council's Strategy for Leadership in Advanced Manufacturing. The ADVANCE Act and related 2023 amendments to the National Environmental Policy Act (NEPA) in Section 321 of the Fiscal Responsibility Act of 2023 (FRA), seek "[t]o advance the benefits of nuclear energy by enabling efficient, timely, and predictable licensing, regulation, and deployment of nuclear energy technologies." Section 401 of the ADVANCE Act (Advanced Methods of Manufacturing and Construction for Nuclear Energy Projects) directs the NRC to submit to Congress within 180 days after the date of enactment of the Act, a report describing

¹ The "Accelerating Deployment Of Versatile, Advanced Nuclear For Clean Energy Act Of 2024", (ADVANCE Act), full text available at https://www.epw.senate.gov/public/_cache/files/5/0/5053d4be-a56e-446d-8341-53ad78c3e82f/82728233c96dc75092f9436066fab212.bills-118s870eah.pdf

² The Nuclear Energy Institute (NEI) is responsible for establishing unified policy on behalf of its members relating to matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect and engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations involved in the nuclear energy industry.

the NRC's efforts to examine unique licensing issues or regulatory requirements for utilization of advanced manufacturing and construction methods, standard materials and components along with existing codes and standards, as well as the transportation of a fueled advanced reactor nuclear core to a licensee with a license to construct and operate the facility.

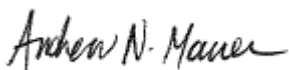
We appreciate that NRC has already taken steps that will help enable the implementation of advanced manufacturing and construction. There are considerable synergies between NRC's actions detailed in revision 1 of the "NRC Action Plan for Advanced Manufacturing Technologies (AMTs)"³ and additional actions that may be undertaken in response to section 401 of the ADVANCE Act. Thus, we discuss in the context of completed, ongoing and planned actions by the NRC, DOE, and industry, opportunities to conduct these actions in a coordinated manner.

Accordingly, the Attachment includes our recommendations which build on our 2019 Roadmap for Regulatory Acceptance of Advanced Manufacturing Methods in the Nuclear Industry⁴. Completion of the Roadmap and implementation of these recommendations will facilitate the agency's efforts to effectively and efficiently use advanced methods of manufacturing and construction for nuclear energy projects.

NEI appreciates the NRC's consideration of the industry's input, and the agency's efforts to allow the use of innovative manufacturing and construction methods and hope these comments will assist the NRC in meeting the requirements of section 401 of the ADVANCE Act. We are not seeking a specific response to this letter.

Please contact Mark Richter - Technical Advisor (mar@nei.org) with any questions regarding this submittal.

Sincerely,



Andrew Mauer

Sr. Director, Regulatory Affairs

Attachment: NEI Input on ADVANCE Act Section 401 Advanced Methods of Manufacturing and Construction for Nuclear Energy Projects

c: Andrea Veil – Director, Office of Nuclear Reactor Regulation
John Lubinski – Director, Office of Nuclear Material Safety and Safeguards

³ Revision 1 to the "United States Nuclear Regulatory Commission Action Plan for Advanced Manufacturing Technologies (AMTs), Revision 1" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19333B980).

⁴ Roadmap for Regulatory Acceptance of Advanced Manufacturing Methods in the Nuclear Energy Industry, Nuclear Energy Institute, May 13, 2019, (Agency Documents Access Management System (ADAMS) Accession Number, ML19134A090) 0

NEI Input on Advanced Methods of Manufacturing and Construction for Nuclear Energy Projects

Background

NRC has already taken several important steps toward enabling advanced manufacturing and construction. In SECY-18-0060, the NRC's Executive Director for Operations (EDO) indicated that to efficiently and effectively regulate new technologies, the NRC staff should engage early with ongoing industry research; develop codes and standards that support the use of new materials and manufacturing methods while ensuring the safety of these techniques; address updates to NRC guidance documents; and conduct other appropriate activities. Based on these interactions with stakeholders, the NRC recognized that the nuclear industry is likely to use Advanced Manufacturing Technologies (AMTs) in applications that require regulatory oversight.

In January 2019, NRC published a [draft action plan](#) for AMTs that identified objectives, regulatory paths, key considerations and near-term tasks to help NRC prepare for AMTs. The stated purpose of that action plan is to develop a strategy that will enable the NRC staff to effectively, efficiently, and transparently regulate components manufactured using advanced manufacturing methods.

NEI submitted to the NRC in May 2019, an industry proposal for a Roadmap for Regulatory Acceptance of Advanced Manufacturing Methods (AMM) in the [NEI Advanced Manufacturing Regulatory Roadmap - Final 2019-05-13.pdf](#)⁵. This roadmap identified the actions and priorities that would enable accelerated NRC acceptance and industry adoption of AMTs. It is now more important than ever that the Roadmap be completed, and we believe more work is needed to implement some of its proposals.

In June 2020, Revision 1 to the NRC AMT Action Plan was published, which updated and superseded the prior draft action plan. Many of the considerations and activities described in the NRC's action plan parallel actions in the NEI Roadmap for Regulatory Acceptance of AMM in the Nuclear Energy Industry. This latest action plan identified three primary tasks, each with specific subtasks:

- **Task 1: Technical Preparedness**
 - Subtask 1A: AMT Processes under Consideration
 - Subtask 1B: Inspection and Non-Destructive Examination (NDE)
 - Subtask 1C: Modeling and Simulation of Microstructure and Properties
- **Task 2: Regulatory Preparedness**
 - Subtask 2A: Implementation using the 10 CFR 50.59 Process
 - Subtask 2B: Assessment of Regulatory Guidance
 - Subtask 2C: AMT Guidance Document

⁵ Roadmap for Regulatory Acceptance of Advanced Manufacturing Methods in the Nuclear Energy Industry, Nuclear Energy Institute, May 13, 2019, (Agency Documents Access Management System (ADAMS) Accession Number ML19134A090)

- **Task 3: Communications and Knowledge Management**
 - Subtask 3A: Internal Interactions
 - Subtask 3B: External Interactions
 - Subtask 3C: Knowledge Management
 - Subtask 3D: Public Workshop
 - Subtask 3E: AMT Materials Information Course

The NEI Advanced Manufacturing Task Force along with other members and industry stakeholders have recently identified several risks to the successful, expedited deployment of advanced manufacturing materials within the nuclear industry which are noted below.

Risk #1 – The possibility that prioritized codes and standards might not be completed in time to be of use to early movers

Risk #2 – The potential for regulatory reviews to not benefit from prior NRC approval of technological advancements

Risk #3 – Opportunities for knowledge management and transfer could be missed

Risk #4 – The potential for disconnects between the NRC Action Plan and current research and actions related to advanced construction methods.

Risk #5 – The possible unavailability of new and extended materials property data required to support qualification and applications of materials and AMM

Risk #6 – Potential inadequacies in nondestructive evaluation methods needed qualify and monitor component integrity

Risk #7 – Achieving timely regulatory actions to address significant cross-cutting needs for regulatory acceptance and industry adoption of advanced methods of manufacturing and construction for nuclear energy projects.

Risks 1 through 4 can be mitigated by prioritizing the development and approval of new codes and standards, developing a change control process, allowing graded approaches to regulatory compliance, and addressing any lack of clarity in regulatory guidance.

Recommendation: The industry and consensus codes and standards development organizations (SDOs) have undertaken an effort to identify and prioritize needed codes and standards for advanced reactor deployment, many of which address manufacturing processes that utilize advanced materials. The standards development process is historically slow, with most work undertaken by volunteers and within a very formal and time-consuming process. The ongoing Advanced Reactor Codes and Standards Collaborative (ARCSC) prioritized needs assessment has captured many of these priorities. Ongoing engagement by the advanced reactor developers, advanced manufacturers, and SDOs is essential to optimize resources and expedite development and approval activities.

Since many AMTs are being used by other industries, the NRC should be able to accept these existing standards where they can be demonstrated to cover the area of applicability for the intended use in the nuclear industry, thus avoiding the need to unnecessarily duplicate work by developing nuclear-unique codes and standards. NRC acceptance could involve augmenting, where nuclear conditions are different (e.g., radiation effects, temperature zones, etc.). Expedited deployment will require resources to support codes and standards development. We request that the NRC identify and leverage the most efficient paths to adoption into the regulatory framework.

The pathways to efficiency described herein will benefit from the NRC's plans to develop performance-based graded options in its regulatory framework to increase flexibility through technology neutral-approaches, use of alternative codes and standards, and new materials and construction methods. In addition, the NRC's consideration of a change control process that would allow advanced reactor designers to make iterative design changes, and not require NRC approval of each change would be welcome. Application of approaches like 50.59 should be developed and permitted.

Finally, transportation of a fueled advanced reactor nuclear core to a licensee with a license to construct and operate the facility should be permitted. A well-established regulatory framework exists for the transportation of new and spent nuclear fuel. Clarity in the classification of the transported fuel will dictate the applicable regulatory framework as well as any design considerations for the transport cask. NEI recommends that NRC state clearly the classification of the fuel in the reactor in transit from the manufacturer. This will establish the applicable regulatory framework for its transportation.

Risks 5 and 6 can be addressed by specific applied research needed to support qualification and deployment.

Recommendation: Ongoing and future research should be focused on applications (component-specific techniques or process parameters for new or advanced materials) rather than fundamental research re-establishing the engineering basis for the manufacturing methods. NRC should assess current inspection capabilities to determine if gaps exist in the ability to inspect components designed through AMM and address whether "design for inspectability" principles are an integral consideration in the design process.

Parallel and informed processes for qualifying and codifying standards for new or advanced materials need to be completed and implemented. Work in these areas is ongoing but can be further expedited with a regulatory signal that such approaches are acceptable. Additionally, method demonstration projects should be informed by industry needs and produce needed data to support qualification work.

Risk 7 is overarching and identifies the need to comprehensively focus on significant cross-cutting needs for regulatory acceptance and industry adoption.

Recommendation: Success in advanced manufacturing deployment depends on several cross-cutting areas of work. NRC should engage and facilitate communication between Advanced Reactor Developers, Codes and Standards organizations, suppliers and DOE labs to ensure that end user needs align with research, testing and technology transfer and codification of needed codes and standards in the regulatory framework. A series of advanced reactor stakeholder workshops should be held where stakeholders can discuss actions that are needed to successfully utilize advanced manufacturing. These workshops will include participants such as NRC, DOE, National Laboratories, SDOs, nuclear designers and suppliers, and entities from other industries already using these methods. NEI is willing to help support and organize these workshops.