Action Plan for Enhancing U.S. Nuclear Regulatory Commission's Codes and Standards Program for Future Reactors

BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC) uses voluntary consensus standards as an integral part of the NRC's regulatory framework. Consensus standards contain technical requirements, safety requirements, guidelines, characteristics, and recommended practices for performance. The NRC incorporates some standards directly into regulations, traditionally into Title 10 of the *Code of Federal Regulations* Part 50, "Domestic licensing of production and utilization facilities," and endorses other standards in its guidance on acceptable methods for complying with NRC regulations such as Regulatory Guides.

The NRC's codes and standards program involves staff across the agency who participate in working groups and committees to support the development of various consensus standards. The program is aligned with the National Technology Transfer and Advancement Act of 1995 as detailed in Office of Management and Budget Circular A-119, "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities."

COORDINATION WITH IDAHO NATIONAL LABORATORY

In February 2024, staff from the NRC and the Idaho National Laboratory (INL) issued a Coordination Plan with the objective of sharing technical expertise and knowledge to 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. The Coordination Plan is publicly available in the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML24060A164.

The scope of this agreement included stakeholder engagement through a public workshop and sharing of information and documents to identify consensus standards with a strong nexus to new and advanced reactor designs. This included:

- INL's report INL/RPT-23-74258, Revision 0, "A Regulatory Approach to Accelerated Deployment for New Material or Applications in Advanced Reactors," April 2023.
- Argonne National Lab's (ANL) report ANL/NSE-23/36 "Assessment of Sodium Fast Reactor Specific Consensus Standards and Recommendations for Future Regulatory Development for Standards Activities," June 2023.
- Oak Ridge National Lab's (ORNL) report ORNL/TM-2020/1478 "Proposed Guidance for Preparing and Reviewing a Molten Salt Non-Power Reactor Application," June 2023.
- Nuclear Energy Institute (NEI) report NEI 19.03, Revision 1, "Advanced Reactor Codes and Standards Needs Assessment," March 2020.

On April 4, 2024, the NRC and the INL cohosted a public workshop to gain insights on the most critical consensus standards needed to successfully deploy new and advanced reactors and the effectiveness of the NRC's codes and standards program to provide a timely review and endorsement of new or revised standards.

The workshop summary (ML24123A021) documents the extensive feedback collected during the all-day event. In addition to the presentations from invited speakers, feedback was obtained through the use of live polling questions, and dialogue with the workshop participants. Feedback received during the workshop directly influenced the scope of this action plan to enhance the NRC's codes and standards program.

WORKSHOP INPUT SYNTHESIS

Due to the extensive feedback collected during the workshop, distillation and synthesis into action items took longer than initially expected. As part of the synthesis process, staff developed summary observations which contributed to the subsequent action items and are discussed below.

The existing consensus standards development process remains effective. The process creates a robust, reliable framework that nuclear plant designers, builders, vendors, and operators can rely on. This process provides a thorough vetting of consensus standards before they are issued. and considered for endorsement by the NRC.

The NRC endorsement process remains an effective tool for providing regulatory assurance. The use of rulemaking to incorporate by reference certain consensus standards ensures regulatory stability for operating large light-water reactors.

Existing standards developed for the large light-water reactors may, in some cases, add time and cost without a commensurate safety benefit for new and advanced reactors. In many cases, these future reactor designs propose use of new materials and under conditions that differ from the current large light-water reactors. Some new standards have been developed and others are under development. The NRC should remain an active participant in these development activities.

To support timely endorsement for newly revised and developing standards, the NRC should identify process enhancements to streamline the agency's endorsement process for consensus standards that are a high priority need to the advanced reactor community. Early public engagement by the NRC during the standards development and/or revision process may provide additional efficiencies to improve the timeliness of endorsement.

As an alternative to the traditional nuclear-specific standards, new and advanced reactor designers and vendors identified some commercial standards for potential use based on the relative risk of the structures, systems and components in the design and the limited impact to the safety of plant staff and to the public (e.g. non-nuclear components).

NRC Action Plan

Nuclear plant design today is working at a scope and pace not seen in decades, and with broad industry and bipartisan political support. Reactor developers are revisiting old technologies and pioneering new ones. The NRC is currently reviewing new and advanced reactor applications, and efforts to develop new and revised consensus standards are occurring in tandem with these first-of-a-kind designs. These future consensus standards can bridge the intersection of new

and advanced reactor design, licensing and construction. Timely review and endorsement of new or revised standards may provide for efficiency, in both licensing and construction, supporting serial deployment, so-called N^{th}-of-a-kind reactors, accounting for the enhanced safety of many reactor designs.

The action plan for enhancing the NRC's Codes and Standards Program is divided into three different sections: (1) consensus standards development process improvements, (2) NRC's endorsement enhancements, and (3) leveraging commercial/non-nuclear consensus standards and other efforts. Swift Actions will take about 1-year to implement, Intermediate Activities will take about 2- to 4-years to implement, and Program Enhancements are those items that may take longer than 5-years or that are ongoing/programmatic in nature.

Table 1: ACTION PLAN: Consensus Standards Development Process Improvements

Swift Actions	Intermediate Activities	Program Enhancements
1.1 Publish a list of prioritized consensus standards, committees, and working groups for enhanced NRC staff engagement.	1.3 Identify opportunities to promote the inclusion of risk- and performance-based insights within existing or new consensus standards.	1.4 Periodically conduct public meetings to solicit information on approaches for deployment of new, non-code, materials or use of materials outside existing parameter ranges (e.g., temperature, pressure, etc.).
1.2 Identify NRC staff experts to support attendance at prioritized committee and working group meetings.		1.5 Conduct public meetings in-between consensus standards working group meetings to allow NRC staff opportunities to provide prompt, independent, regulatory feedback when significant technical issues of concern to the NRC have been identified.

Table 2: ACTION PLAN: NRC's Endorsement Enhancements

Swift Actions	Intermediate Activities	Program Enhancements
2.1 Expedite staff's endorsement review of the 2023 edition of ASME Section III, Rules for Construction of Nuclear Facility Components, Division 5, High-Temperature Reactors.	2.3 Update Management Directive (MD) 6.5, "*NRC Participation in the Development and Use of Consensus Standards,*" to incorporate identified enhancements for early deployment and flexibility.	2.5 Evaluate potential use of artificial intelligence, such as Large Language Models, for updating NRC's RG 1.84, "*Design, Fabrication, and Materials Code Case Acceptability, ASME Section III*," RG 1.147, "*Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*," RG 1.192, "*Operation and Maintenance Code Case Acceptability, ASME OM Code,*" and RG 1.193, "*ASME Code Case Not Approved for Use,*" with the latest ASME code cases, more efficiently. The goal would be to update more frequently and with significantly less staff resources than the current process.
2.2 Develop potential efficiencies for the endorsement process, such as the augmented use of Interim Staff Guidance, Trial Use Regulatory Guides, Standard Review Plans, White Papers, and expanded opportunities for public engagement.	2.4 Identify a test case to pilot one or more of the identified enhancements to facilitate endorsement of a consensus standard for use by new and advanced reactors.	

Table 3: ACTION PLAN: Leveraging Commercial/Non-Nuclear Consensus Standards and Other Efforts

Swift Actions	Intermediate Activities	Program Enhancements
3.1 Solicit public input and identify potential commercial standards for NRC staff consideration and review, including a public meeting, to solicit input on the use by Advanced Reactor vendors and applicants of existing: (1) commercial standards, (2) guidance from research organizations, and (3) guidance from nuclear-focused non-standards organizations.	3.3 Maintain support of ongoing efforts by industry and other organizations to develop approaches for advanced deployment of new, non-code, materials or materials outside existing parameters for advanced reactors.	3.5 For commercial standards that are identified as appropriate for potential nuclear facility use, develop a regulatory guide specific to these standards for endorsement.
3.2 Identify NRC staff to observe and/or participate in select commercial standards revisions and/or development.	3.4 Pilot a test case consensus standard not developed for use by nuclear power reactors for review and potential endorsement for a nuclear reactor application.	3.6 Support efforts by consensus standard organizations to create risk-informed and performance-based standards. Recognizing that risk-informed and performance-based standards may be inherently less detailed than more deterministic, prescriptive standards, identify approaches for NRC endorsement that provide an appropriate level of regulatory efficiency, certainty, and stability.
		3.7 Participate as an observer in the Advanced Reactor Codes and Standards Collaboration working group to maintain awareness of industry efforts.