



NRC-INL Collaboration on Codes & Standards

September 2024

Changing the World's Energy Future

Jason Albert Christensen



INL is a U.S. Department of Energy National Laboratory operated by Battelle Energy Alliance, LLC

DISCLAIMER

This information was prepared as an account of work sponsored by an agency of the U.S. Government. Neither the U.S. Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness, of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S. Government or any agency thereof.

NRC-INL Collaboration on Codes & Standards

Jason Albert Christensen

September 2024

**Idaho National Laboratory
Idaho Falls, Idaho 83415**

<http://www.inl.gov>

**Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517**

September 25, 2024

Jason Christensen

Sr. Regulatory Engineer

NRC-INL Collaboration on Codes & Standards

NRC Standards Forum

Battelle Energy Alliance manages INL for the
U.S. Department of Energy's Office of Nuclear Energy



Idaho National Laboratory

Purpose of the Collaborative Effort

- Project was born from a discussion between Nuclear Regulatory Commission (NRC) Chair Hansen and Idaho National Laboratory (INL) Director John Wagner in an effort to enhance communications and technical exchanges between NRC and INL
- The purpose of this project between INL and NRC was to review and assess the effectiveness and timeliness of codes and standards activities associated with development and licensing of advanced nuclear reactors
 - Specifically, are there new and/or novel ways to endorse codes and standards more efficiently?
- The scope of this effort includes external communication with stakeholders and an evaluation of publicly available reports to identify the most critical codes and standards needed to successfully deploy advanced reactors

Public Meeting

- NRC Office of Nuclear Regulatory Research and INL Regulatory Support Group held a public meeting on April 4, 2024 at NRC headquarters in Rockville, MD
 - The attendees and participant organizations included the NRC, the Department of Energy (DOE) and other Federal Agencies, DOE National Laboratories, advanced reactor vendors, microreactor vendors, academic institutions, current reactor licensees, researchers, industry consultants, and international regulators
 - The meeting was hybrid, with approximately 45 in-person participants and over 300 virtual participants
 - The meeting consisted of presentations as well as facilitated two-way engagement via polls, questions, surveys as well as Q&A sessions

Public Meeting Introduction

- Introductions included remarks from:
 - Michele Sampson, NRC's Standards Executive and Director of the Division of Engineering in the Office of Nuclear Regulatory Research
 - Curtis Smith, Director of the Nuclear Safety and Regulatory Research Division at INL
- Opening Remarks were provided by:
 - The Honorable Christopher T. Hanson, Chair of the NRC
 - Dr. Jess Gehin, Associate Laboratory Director for the Nuclear Science and Technology Directorate at INL
- Highlights of the opening remarks included
 - Doubling nuclear capacity by 2050 and the challenges associated with that
 - Reduction of over-conservatisms in C&S by leveraging new technology and better risk characterizations
 - Expanding codes and standards activities to better include non-light water reactor (non-LWR) and the use of more risk-informed and performance-based thinking

Public Meeting Themes

- What Codes & Standards are Needed to Foster Efficiencies (and their Timeline)?
 - DOE Office of Nuclear Energy C&S activities
 - DOE National Laboratory studies on the needs of advanced reactors
 - Advanced Reactor Codes and Standards Committee (ARCSC)
- How can NRC's Codes and Standards Program be Enhanced?
 - NRC support to standards organizations and preparations for future reactors
 - Canadian Nuclear Safety Commission (CNSC) support to standards organizations and preparations for future reactors
 - National Reactor Innovation Center's (NRIC) role in preparing for future reactors
 - Standards Development Organizations (SDOs) activities to prepare for future reactors
 - Perspectives from reactor vendors

Common Themes to Polls and Questions

- Need to improve timeliness of the development, updating, and endorsement of codes and standards (C&S) to support new and advanced reactor designs. Challenges include the need for consensus, while relying on volunteers that may not be funded by their employer
- The NRC may need to consider a broad range of licensing and rulemaking tools to provide regulatory certainty, while not inhibiting innovation
- Current standards specific to light-water reactors (LWRs) may be overly prescriptive and are not applicable to many advanced reactor designs, and first-of-a-kind and Nth-of-a-kind applications may require different approaches
- There are significant gaps in C&S for certain technologies and material qualification. This is especially true in graphite and high-temperature materials

Common Themes to Polls and Questions (continued)

- There is also a need for risk informed and performance-based standards which cover, among other things, passive designs
- Existing material standards do not cover the higher temperature ranges and the new materials needed for several advanced reactor designs. In addition, existing graphite qualification standards are overly restrictive and grade-specific which make it harder for new vendors to enter the industry
- Consider clarification of roles between vendors, DOE, and SDOs to avoid duplication of effort and ensure that we address all existing gaps
- International code and standard inclusion is essential to utilizing foreign vendors as current efforts are focused heavily on North America
- Current codes and standards tend to be overly prescriptive, which can hinder risk-informed and performance-based development and licensing



INL Capabilities

- Through this collaboration, INL brings a plethora of resources to NRC's R&D and endorsement of codes and standards
 - This also allows access to the national laboratory complex as a whole

Path Forward

- NRC and INL prepared and issued the final meeting summary
- NRC developed an action plan for the path forward in the area of codes and standards efficiencies
- INL is currently reviewing the NRC Action Plan to determine next steps
 - This path forward will continue collaborative efforts with the NRC and will likely include coordination with industry and other organizations
 - Collaboration will open access to INL resources as well as access to the national laboratory complex as a whole
- DOE-NE Regulatory Development Program will be continuing work in FY25 to revise and support NRC endorsement of the sodium fire consensus standard ANS 54.8, which was previously endorsed in 1988 and withdrawn in 2000.
 - This could be used as a test case for the NRC-INL Collaboration
- For input or observations, please contact:
 - Jason Christensen, INL Sr. Regulatory Engineer,
Jason.Christensen@inl.gov

IDAHO NATIONAL
LABORATORY



TH
ANNIVERSARY

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.



Idaho National Laboratory

www.inl.gov



Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.

WWW.INL.GOV