



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 12, 2021

MEMORANDUM TO: Louise Lund, Director
Division of Engineering
Office of Nuclear Regulatory Research

FROM: Meraj Rahimi, Branch Chief **/RA/**
Regulatory Guide and Programs Management Branch
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: SUMMARY OF THE 2021 NRC STANDARDS FORUM

On September 15, 2021, staff from the Office of Nuclear Regulatory Research (RES) and Office of Nuclear Reactor Regulation (NRR) held the fifth annual U.S. Nuclear Regulatory Commission (NRC) Standards Forum.¹ The purpose of the Standards Forum is to facilitate discussions on codes and standards needs within the nuclear industry and explore how to collaborate in accelerating the development of codes and standards and the NRC's endorsement of these codes and standards in its regulations and regulatory guides.

Enclosure 1 contains the Agenda for the Forum. Approximately 190 attendees joined the event, including participation from NRC staff, representatives from Standards Development Organizations (SDOs) such as American Nuclear Society (ANS), American Society of Mechanical Engineers (ASME), American Concrete Institute (ACI), American Society of Civil Engineers (ASCE), and Institute of Electrical and Electronics Engineers (IEEE), the Nuclear Energy Institute (NEI), Electric Power Research Institute (EPRI), representatives from the U.S. Department of Energy (DOE), national laboratories including Idaho National Laboratory (INL), Savannah River National Laboratory (SRNL), and Academia representatives, among others (see Enclosure 2 for the full list of attendees). The presentations from the meeting can be found at <https://www.nrc.gov/about-nrc/regulatory/standards-dev/standards-forum/2021.html>.

Summary

The Standards Forum opened with remarks by Louise Lund, NRC Standards Executive, covering the purpose of the Standards Forum, an overview of the Agenda, and prior internal and external codes and standards activities upon which the Standards Forum was built. This year's event included three sessions. These sessions covered recent codes and standards initiatives across SDOs and within the NRC, recent developments related to Codes and Standards for New and Advanced Reactors, and ongoing activities supporting the development of standards for advanced manufacturing.

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¹ Public Meeting Notice: <https://www.nrc.gov/pmns/mtg?do=details&Code=20211034>

The discussions were valuable to understanding areas for further collaboration across SDOs and how the NRC and stakeholder groups can be more effective in developing, updating, and meeting the codes and standards needs. The following is a summary of the discussions in the sessions.

Session 1: Overview of Recent Codes and Standards Initiatives

Session 1 was moderated by Ronaldo Jenkins, Senior Project Manager in RES, Division of Engineering (DE). The session included five presentations as follows:

1. ANS/ASME Nuclear Standards Collaborative to Support Advanced Reactor Standards Needs (*Donald Eggett, ANS and Thomas Vogan, ASME*)
2. Recent NEI Codes and Standards Initiatives for Advanced Reactors (*Mark Richter, NEI*)
3. NEI Codes and Standards Task Force Initiatives (*Thomas Basso, NEI*)
4. Rulemaking Plan on Revision of Inservice Testing and Inservice Inspection Program Update Frequencies Required in 10 CFR 50.55a (*David Rudland, NRC*)
5. Regulatory Guidance Framework for IEEE Electrical Standards (*Sheila Ray, NRC*)

The session opened with a presentation and discussion on the ANS/ASME Nuclear Standards Collaborative. This is a centralized industry led team aimed at coordinating and collaborating with SDOs to support the reactor designers, regulators, and other interested stakeholders in the development of industry standards and/or guidelines for advanced reactor designs. Near term milestones include, in part, developing a roadmap and prioritized list of the next needed advanced reactors standards, and developing proposals for funding and resource development for the next highest priority standards. This presentation was followed by two presentations by NEI, the first one on NEI's participation and perspectives on efforts related to advanced reactor standards and the second one on an update of NEI's Codes and Standards Task Force activities including activities related to ASME Boiler and Pressure Vessel (BPV) Code Section III, Section XI, and the Operation and Maintenance (O&M) Code. These presentations were followed by an NRC staff presentation on the status of SECY-21-0029 which, in part, requests Commission approval to initiate a rulemaking to amend 10 CFR Part 50.55a to extend the interval of inservice testing (IST) and inservice inspection (ISI) program updates from 120 months to 240 months. The session ended with a second presentation by NRC staff that discussed updates to the regulatory framework for the endorsement of IEEE electrical standards.

Session 2: Recent Developments in Codes and Standards for New and Advanced Reactors

Session 2 was moderated by Alexander Chereskin, Materials Engineer in NRR, Division of Advanced Reactors and Non-Power Production and Utilization Facilities. The session included seven presentations as follows:

1. Qualification of High Temperature Materials and their Incorporation into ASME Section III, Division 5 (Sam Sham, INL and Richard Wright, Structural Alloys LLC)
2. ASME Code Case: Steel Plate Composite Containment Vessel (SCCV) (Amit Varma, Purdue University)
3. OM-2 Inservice Testing for Gen-4 and Beyond (Augi Cardillo and Tom Ruggiero, ASME)
4. EPRI Project Updates (Samuel Johnson and Salvador Villalobos, EPRI)
5. ASCE 1, 4, and 43 Risk-informed, Performance-based Standards (Andrew Whittaker)

6. Plan for Regulatory Guides on ASCE Standards 1, 4, and 43 for Risk-Informed Applications (Jim Xu, NRC)
7. Updates on ACI 349 Development of Codes and Standards (Adeola Adediran, ACI)

This session opened with a presentation on high temperature materials for advanced reactors. The presentation provided a discussion on aspects related to ASME Section III, Division 5 rules and discussed pathways to increase the availability of high temperature alloys for advanced reactors. This presentation was followed by a presentation on ASME's Code Case for steel-plate composite (SC) containment vessel construction. This presentation included a description of the SC technology, its performance, example implementation cases, and motivation for its use, including the potential for reducing construction schedules, among others. The presentation also described the overall structure for the Code Case and highlighted some of the design parameters. This presentation was followed by a presentation on the plans for the development of a new ASME O&M Code. The presentation described the scope of the existing O&M Code and its applicability to light water reactors. The presentation stated that the current O&M Code does not currently include consideration of Small Modular Reactors. The intended applicability of the new O&M Code is any plant/technology. The fourth presentation provided updates on ongoing EPRI research projects including (1) exploring the behavior of large high strength rebar (lap splices and mechanical couplers), (2) best practices for self-consolidating concrete (SCC) for mass concrete structures including alternatives for lowering the heat rise in SCC mixtures, and (3) evaluation of concrete strength at elevated temperatures (i.e., temperatures above the temperature limits in ACI 349). The fifth and sixth presentations addressed updates on ASCE 1, 4, and 43 standards and NRC plans for their endorsement, respectively. The presentation on ASCE 1, 4, and 43 included discussions on achieving limit states other than limit state D (i.e., limit state for large light water reactors), seismic isolation provisions in ASCE 4 and 43, and planned developments, among others. The associated NRC presentation provided the anticipated timeframe for issuance of draft guides endorsing these ASCE standards. The session ended with a presentation on ACI 349 updates. The presentation discussed the ongoing and planned activities for ACI 349 and identified topics in ACI 349 and other related standards that could benefit from additional coordination across multiple SDOs.

Session 3: Advanced Manufacturing

Session 3 was moderated by Matthew Hiser, Materials Engineer in RES/DE. The session included four presentations as follows:

1. NRC Regulatory Approach for Advanced Manufacturing Technologies (*Robert Davis, NRC*)
2. EPRI Advanced Manufacturing Methods (AMM) Roadmap (*David Gandy, EPRI*)
3. ASME Section III, SubGroup - MF&E. Materials, Fabrication and Examination, TG-AM Task Group Advanced Manufacturing (*Daniel Mann, ASME*)
4. ASME Criteria for Powder Bed Fusion Additive Manufacturing (*George Rawls, SRNL and David Gandy, EPRI*)

This session opened with a presentation on NRC's regulatory approach for advanced manufacturing technologies (AMTs). The presentation provided an overview and status on NRC's AMT Action Plan, AMT guidelines development, and alternative regulatory pathways for the implementation of an AMT, among others. This presentation was followed by a

presentation on EPRI's Advance Manufacturing Methods (AMM) roadmap. The presentation described the consideration of three roadmaps for (1) primary pressure boundary (Class 1) components, (2) reactor internals, and (3) other components (e.g., obsolete parts, classes 2 & 3, etc.). The third presentation provided a discussion on ongoing activities under ASME's Subgroup, Materials, Fabrication and Examination, Task group on Advanced Manufacturing. The goal of the task group is to write code rules for the adoption of advanced manufacturing processes by Section III, Division 1, and their incorporation into the 2023 and future Editions of ASME Code Section III. The task group plans on addressing the Powdered Metal/Hot Isostatic Pressing (PM/HIP) and Direct Energy Deposition Gas Metal Arc Additive Manufacturing (DED-GMAAM) methods in the 2023 Edition of the Code and the Laser Powdered Bed Fusion (LPBF) method in the 2025 Edition. The session ended with a presentation that provided an overview of ASME PTB -13 -2021 "Criteria for Pressure Retaining Metallic components using Additive Manufacturing." The overview focused on the criteria for powder bed fusion additive manufacturing and discussed the criteria covered in the document with respect to scope, highlighted the scope, materials, thermal treatment, design, additive manufacturing procedure and its qualification, qualification testing of additive manufactured components, and production builds, among others. PTB-13 is anticipated to serve as the baseline for future development of ASME additive manufacturing (AM) powdered bed fusion (PBF) Code Cases and Standards development (a Code Case for Section III is being developed for 316 L material using the AM PBF Process).

The 2021 Standards Forum ended with closing remarks by Louise Lund, NRC Standards Executive. The Forum facilitated the sharing of information and perspectives with ongoing standards related efforts as well as needs for further standards development and updates. Specific areas undergoing revisions and updates across multiple standards were highlighted as well as pathways for incorporation of new materials, methods, and technologies into multiple standards. The discussions also covered ongoing research that is anticipated to inform future standards updates and identified opportunities and areas for further coordination and collaboration across SDOs. Further, the discussions covered NRC efforts to streamline the endorsement of standards in NRC Regulations and Regulatory Guides. The discussions during the Forum are expected to lead to standards with wide ranging support that are more easily utilized by the NRC and licensees.

It is anticipated that the next NRC Standards Forum will be scheduled for Fall 2022.

ENCLOSURES:

Enclosure 1 - 2021 Standards Forum Agenda

Enclosure 2 - 2021 Standards Forum List of Attendees

SUBJECT: SUMMARY OF THE 2021 NRC STANDARDS FORUM
DATE: OCTOBER 12, 2021

DISTRIBUTION:

K. Song, RES
M. Rolon Acevedo, RES
R. Jenkins, RES
D. Rudland, NRR
S. Ray, NRR
A. Chereskin, NRR
J. Pires, RES
M. Sircar, RES
J. Xu, RES
M. Hiser, RES
R. Davis, NRR

ADAMS Accession Package No.: ML21256A295

OFFICE	RES/DE/RGPMB	RES/DE/RGPMB	RES/DE/RGPMB
NAME	B. Curran	R. Roche-Rivera	M. Rahimi
DATE	10/08/2021	10/08/2021	10/12/2021

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**U.S. NUCLEAR REGULATORY COMMISSION
NRC Standards Forum**

Agenda

September 15, 2021

10:00 AM to 5:00 PM

Time	Topic	Speaker
10:00 – 10:10	Welcome, logistics, introductions, and objectives	NRC
10:10 – 12:00	<p>Overview of Recent Codes and Standards Initiatives</p> <ol style="list-style-type: none"> 1. ANS/ASME Nuclear Standards Collaborative to Support Advanced Reactor Standards Needs (<i>Donald Eggett, ANS and Thomas Vogan, ASME</i>) 2. Recent NEI Codes and Standards Initiatives for Advanced Reactors (<i>Mark Richter, NEI</i>) 3. NEI Codes and Standards Task Force Initiatives (<i>Thomas Basso, NEI</i>) 4. Rulemaking Plan on Revision of Inservice Testing and Inservice Inspection Program Update Frequencies Required in 10 CFR 50.55a (<i>David Rudland, NRC</i>) 5. Regulatory Guidance Framework for IEEE Electrical Standards (<i>Sheila Ray, NRC</i>) 	ANS, ASME, NEI, NRC
12:00 – 12:45	Lunch Break	--
12:45 – 3:05	<p>Recent Developments in Codes and Standards for New and Advanced Reactors</p> <ol style="list-style-type: none"> 1. Qualification of High Temperature Materials and their Incorporation into ASME Section III, Division 5 (<i>Sam Sham, INL and Richard Wright, Structural Alloys LLC</i>) 2. ASME Code Case: Steel Plate Composite Containment Vessel (SCCV) (<i>Amit Varma, Purdue University</i>) 3. OM-2 Inservice Testing for Gen-4 and Beyond (<i>Augi Cardillo and Tom Ruggiero, ASME</i>) 	ACI, ASCE, ASME, EPRI, INL, NRC, Purdue University,

	<p>4. EPRI Project Updates (<i>Samuel Johnson, Hasan Charkas, and Salvador Villalobos, EPRI</i>)</p> <p>5. ASCE 1, 4, and 43 Risk-informed, Performance-based Standards and Plan for Regulatory Guides on ASCE Standards 1, 4, and 43 for Risk-Informed Applications (<i>Andrew Whittaker and George Abbat, ASCE, and Jim Xu, NRC</i>)</p> <p>6. Updates on ACI 349 Development of Codes and Standards (<i>Adeola Adediran, ACI</i>)</p>	Structural Alloys LLC
3:05 – 3:20	Break	--
3:20 – 4:50	<p>Advanced Manufacturing</p> <p>1. NRC Regulatory Approach for Advanced Manufacturing Technologies (<i>Robert Davis, NRC</i>)</p> <p>2. EPRI Advanced Manufacturing Methods (AMM) Roadmap (<i>David Gandy, EPRI</i>)</p> <p>3. ASME Section III, SubGroup - MF&E. Materials, Fabrication and Examination, TG-AM Task Group Advanced Manufacturing (<i>Daniel Mann, ASME</i>)</p> <p>4. ASME Criteria for Powder Bed Fusion Additive Manufacturing (<i>George Rawls, SRNL and David Gandy, EPRI</i>)</p>	ASME, EPRI, NRC, SRNL
4:50 – 5:00	Summary of key takeaways and closing remarks	NRC

U.S. NUCLEAR REGULATORY COMMISSION

NRC Standards Forum

List of Attendees

September 15, 2021

Name	Affiliation	Name	Affiliation
Chakrapani Basavaraju	U.S. Nuclear Regulatory Commission (NRC)	Meraj Rahimi	NRC
Mekonen Bayssie	NRC	David Rahn	NRC
Gurjendra Bedi	NRC	Sheila Ray	NRC
Eric Benner	NRC	Wendy Reed	NRC
Michael Benson	NRC	Robert Roche-Rivera	NRC
Bob Caldwell	NRC	Marcos Rolon	NRC
Alex Chereskin	NRC	David Rudland	NRC
Robert H Davis	NRC	Steve Ruffin	NRC
David Desaulniers	NRC	Thomas Scarbrough	NRC
Michael Farnan	NRC	Jesse Seymour	NRC
Kate Gresh	NRC	Daniel Shapiro	NRC
Nicholas Hansing	NRC	Madhumita Sircar	NRC
Matthew Hiser	NRC	Frederick Sock	NRC
Allen Hiser	NRC	Kyle Song	NRC
Keith Hoffman	NRC	George Thomas	NRC
John Honcharik	NRC	Rob Tregoning	NRC
Kaihwa Hsu	NRC	John Tsao	NRC
Jason Huang	NRC	Ian Tseng	NRC
Amy Hull	NRC	Weijun Wang	NRC
Ata Istar	NRC	Bob Wolfgang	NRC
Raj Iyengar	NRC	Yuken Wong	NRC
Ronaldo Jenkins	NRC	Jim Xu	NRC
Daniel Ju	NRC	Mark Yoo	NRC
Harriet Karagiannis	NRC	Kerry Sutton	American Concrete Institute
William Kennedy	NRC	Yiren Chen	Argonne National Laboratory (ANL)
Yong Kim	NRC	Kathryn Murdoch	American Nuclear Society (ANS)
Patrick Koch	NRC	Patricia Schroeder	ANS
Yueh-Li Li	NRC	Kate Hyam	American Society of Mechanical Engineers (ASME)
Bruce Lin	NRC	Oliver Martinez	ASME
Louise Lund	NRC	Thomas Ruggiero	ASME
Tim Lupold	NRC	Kimberly Verderber	ASME
Shah Malik	NRC	Todd Anselmi	Battelle Energy Alliance/Idaho National Laboratory (INL)
Kamal Manoly	NRC	F George Abatt	Becht Engineering
Jan Mazza	NRC	Lisa Anderson	Bechtel
John Nakoski	NRC	Kai Zhang	Bechtel
Carol Nove	NRC	Sanjay Dankar	Bechtel
Donald Palmrose	NRC	Farhang Ostadan	Bechtel
Leah Parks	NRC	Vaughan Weston	Bechtel
Pravin Patel	NRC	Kevin Burg	Bettis Lab
Bob Pettis	NRC	Brian Grimes	Brian Grimes Inc.
Steve Philpott	NRC	Fred Madden	Certrec
Jose Pires	NRC	George Stoyanov	Canadian Nuclear Safety Commission (CNSC)

Name	Affiliation	Name	Affiliation
Joey Wang	CNSC	Charles Martin	Longenecker & Associates
Mervah Khan	CSA Group	David Thompson	Manufacturers Standardization Society
Deann Raleigh	Curtiss Wright	Robert Keating	MPR Associates
Jeffrey Feit	U.S. Department of Energy (DOE)	Suzanne McKillop	MPR Associates
Susan Lesica	DOE	Nassia Tzelepi	National Nuclear Laboratory
Dave Hinspater	Dominion Energy	Thomas Basso	Nuclear Energy Institute (NEI)
Amanda Jenks	Dominion Engineering, Inc.	Mark Richter	NEI
Donald Eggett	Eggett Consulting LLC	Keith Consani	National Institute of Standards and Technology (NIST)
Scott Jones	Emerson Automation Solutions	Shawn Moylan	NIST
Steve Norman	Enercon Services, Inc.	Paul Witherell	NIST
Ron Gaston	Entergy	James DiPaolo	NNL
Robert Kalantari	EPM	Augustine Cardillo	NuScale Power
Rob Burg	EPM	Tim McDonald	NuScale Power
Greg Frederick	Electric Power Research Institute (EPRI)	Ming Han	OPG
David Gandy	EPRI	Steven Arndt	Oak Ridge National Laboratory (ORNL)
Samuel Johnson	EPRI	George Flanagan	ORNL
Patrick O'Regan	EPRI	David Holcomb	ORNL
John Richards	EPRI	DeLeah Lockridge	ORNL
Stephen Tate	EPRI	Mike Poore	ORNL
Salvador Villalobos	EPRI	Adam Smith	ORNL
Kelli Voelsing	EPRI	Yanli Wang	ORNL
Brendan Casey	Exelon	Tom Roberts	POMO18 Consult LLC
Jim Cirilli	Exelon	Amit Varma	Purdue University
Tom Loomis	Exelon	Rufino Ayala	Rock Creek Innovations, LLC
Mark Weis	Exelon	Arthur Eberhardt	Sargent & Lundy
Kurt Harris	Flibe Energy, Inc.	Tom Vogan	Sargent & Lundy
Daniel Mann	Flowserve	Robert Budnitz	Self
Farshid Shahrokhi	Framatome Inc.	Nilesh Chokshi	Self
Lamia Chouha	GE Hitachi	Steven Doctor	Self
Tariq Elborno	GE Hitachi	Mark Linn	Self
Dennis Henneke	GE Hitachi	John Miller	Self
Alan Ketin	GE Hitachi	Said Bolourchi	Simpson Gumpertz & Heger
Kyung-Sik Lee	GE Hitachi	Ricardo Medina	Simpson Gumpertz & Heger
Ai-Shen Liu	GE Hitachi	Melanie Brown	Southern Nuclear
Ronald Ragan	GE Hitachi	DeLisa Pournaras	Southern Nuclear
Jaspal Saini	GE Hitachi	Biswajit Dasgupta	Southwest Research Institute
Jordan Supler	GE Hitachi	Adeola Adediran	SRR
Mark Svajger	GE Hitachi	Frank Schaaf	Sterling Refrigeration Corp
Luben Todorovski	GE Hitachi	Leonard Laskowski	Structural Integrity Associates
Ronald Lippy	GSES True North	Brett McGlone	Swagelok Company
Patrick Vallejos	HMIS	Adam Stein	The Breakthrough Institute
Michael McMurtrey	INL	Helen Mearns	U.S. DHS S&T CSAC
Gustavo Reyes	INL	Andrew Whittaker	University at Buffalo
Ryann Rupp	INL	Boris Jeremic	University of California
Ting-Leung Sham	INL	Kenneth Balkey	University of Pittsburgh
Franklin Hope	Jensen Hughes	Connor Dickey	University of Pittsburgh
Margaret Ellenson	Kairos Power	Sevda Sanver	University of Pittsburgh
Irving Jang	Kairos Power	John Fletcher	USNC
Bob McReynolds	Kairos Power	Sergey Anikanov	WEC
Mark Peres	Kairos Power	Suresh Channarasappa	WEC
N P Kadambi	KECPL	Daryl Harmon	WEC
Zia Zafir	Kleinfelder	Don Williams	XCEL Engineering