

Update on Industry Codes and Standards Initiatives



- **Moderator:** Meraj Rahimi, Branch Chief, RES/DE/RGPMB
- **Panelists/Speakers:**
 - Donald Eggett (ANS)
 - Andrew Sowder (EPRI)
 - Tom Basso (NEI)
 - Rachel Romano (ASME)
 - Ben Holtzman (NEI)
 - Robert Konnik (IEEE)



ANS Nuclear Standards Collaborative (NSC) to Support Advanced Reactor Standards Needs

NRC Standards Forum
September 28, 2022
Donald R. Eggett, Chair
Andrew Sowder, Vice-Chair
ANS Standards Board

Background

Multiple reports have been issued and workshops held identifying the need for standards for the advanced reactor community. Some of these have included:

- From 2015 to 2017, the NRC and the U.S. Department of Energy (DOE) co-hosted three Advanced Reactor Workshops. The NRC has transitioned from workshop format to more frequent periodic stakeholder meetings.
- NRC Standards Forum on advanced reactors (September 2017)
- ORNL/SR-2017/520, Assessment of Applicability of Standards Endorsed by Regulatory Guides to Sodium Fast Reactors (September 2017)
- ANS/NRC Workshop to Develop a Strategic Vision for Advanced Reactor Standards (May 2018)
- NEI 19-03 (Rev. 1), Advanced Reactor Codes and Standards Needs Assessment (March 2020)
- ANS/NEI Advanced Reactor Codes and Standards Workshop (June 2020)
- NRC Standards Forum emphasized need for better industry coordination (October 2020).
- NRC Standards Forum (September 2021) aimed the discussion at collaborating/accelerating development of C&Ss and NRC endorsement of such in its regulations and reg guides.

ANS/EPRI Joint Nuclear Standards Collaborative Proposal

ANS **proposed** a Nuclear Standards Collaborative (NSC) in 2021 with ASME/EPRI in mind. EPRI has since committed to full engagement.

— a “**centralized industry led team**”— to ensure there is coordination and collaboration among standards development organization: (SDOs) to support the reactor designers, regulators, and other stakeholders to develop industry standards and/or guidelines in support of the designers’ advanced reactor designs.



This proposal parallels the focus of NRC’s Forums:

“... aims to identify standards needs for the nuclear industry that are not currently being addressed by standards development organizations (SDOs) such as ASTM, ASME, ACI,ANS, IEEE, etc.”

Focus of NSC

Primary focus is on the integration and harmonization among all SDOs to support advanced reactor designers on the needs for developing such standards. Though the focus will be on advanced reactors, nonreactor nuclear facilities and current operating reactors may be given some consideration relative to their prioritized needs for consensus standards or industry guidelines.



Objectives of NSC

- Develop appropriate interrogatories, agendas, and other actions necessary to **facilitate strategies and action plans that support the development of codes, standards, and other guidance** that foster licensing, design, construction, and operation of advanced reactors. Specific actions include:
 - Establish a list of advanced reactor needs **using existing industry resources.**
 - Solicit additional **standards** needed from Nuclear Standards Collaborative members **based on users' prioritization.**
 - Compile a list of all **standards** currently being developed or revised and planned by SDOs and other stakeholders **that will support advanced reactor initiatives.**

Objectives of NSC (Cont'd)

- **Develop a roadmap** for advanced reactor standards needs across all participative SDOs based on above gathered information.
- **Develop** a recommended **list of standards** development priorities with associated targeted milestones **from this roadmap**.
- **Develop plans** that are optimal **in meeting the needs of developers/designers and stakeholder organizations**. Formats may include virtual, face-to-face, or hybrid meetings and the structuring of semi-annual international forums with the mission of assembling stakeholders to obtain their input, comments, priorities, and challenges.

Envisioned NSC Organization



“Transitioning” from NSC to North America Advanced Reactor Roadmap

What is the NAAR Roadmap?

- Industry initiative sponsored by NEI and EPRI
 - A shared vision among industry stakeholders
 - Owned and generated by industry, input from partners/stakeholders
 - Four pillars to success
 - Market Demand
 - Regulatory Efficiency
 - **Technology Readiness**
 - Project Execution
-

Why “Transition” from NSC to NAAR Roadmap

- Complementary in vision and strategic goals
- Broadens stakeholders
- International participation & engagement (CNS, IAEA, WNA, others)
- Envisioned SDO-led committee for accelerating C&S development gets elevated visibility

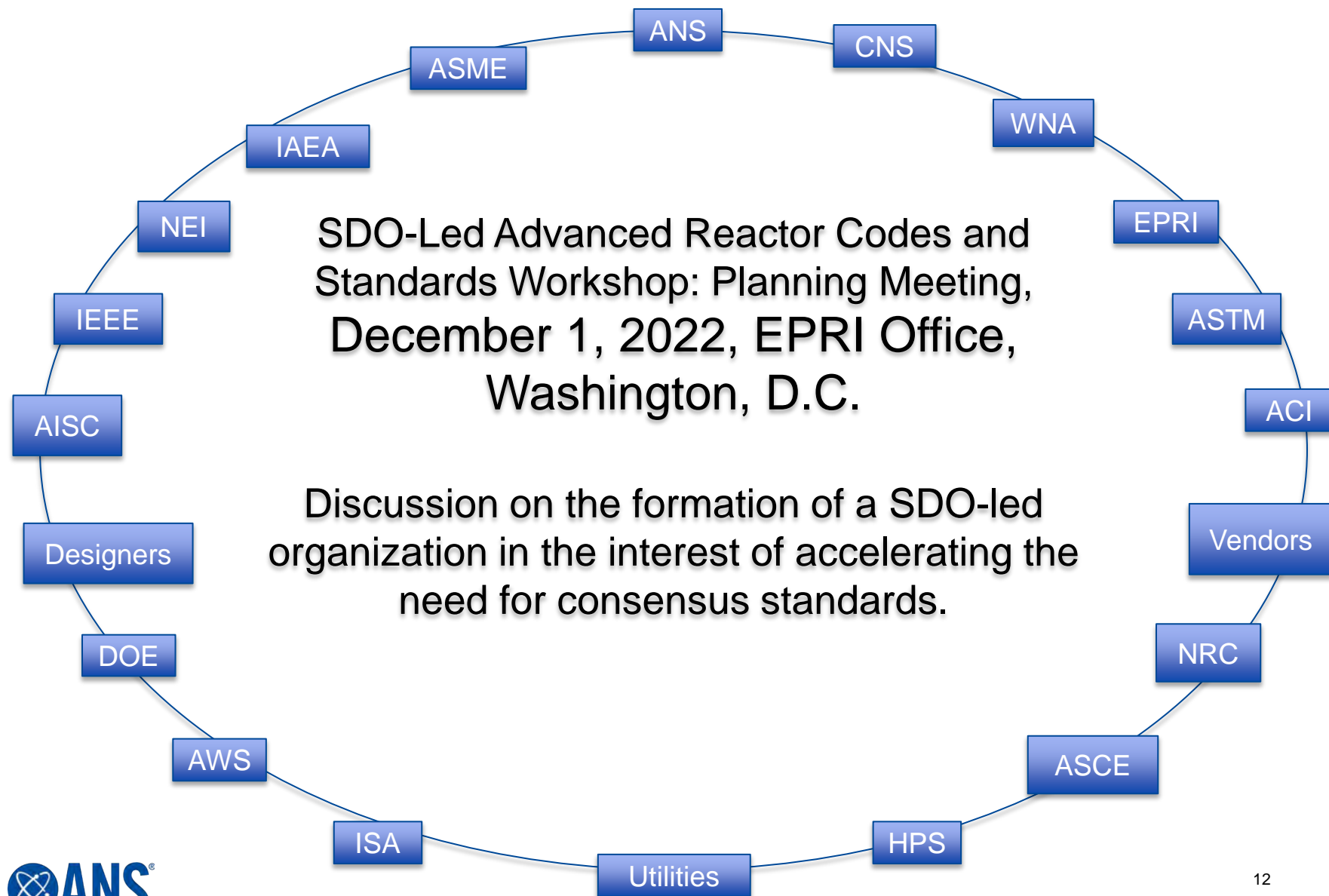
Benefits to Transition and Participation

- **Improve the identification and prioritization of needed standards** through engagement, input and collaboration with industry stakeholders.
- Determine which subject matter is best covered by standards vs. other industry documents (“guidelines”).
- **Incentivize the “harmonization” of integrated codes & standards and collaborative SDO activities.**
- Expedite standards development through an industry process for funding and possible “trial use.”
- Standards that better meet design goals, challenges and development timelines, and provide a path to efficient regulatory approval.

Benefits to Participation (Cont'd)

- SDOs will realize benefits as follows:
 - **Integral part of recommendations** to ensure prioritization of timely needed standards to better plan for and allocate limited supporting resources.
 - Ensure standards are relevant and support industry objectives.
 - **Increased participation of advanced reactor developers/vendors** standards development.
 - Develop more harmonized and better-quality standards through collaboration
 - Establish better collaboration with industry

Envisioned New SDO-led C&S Organization



Summary: What This Transition Does

NAAR Roadmap: A multi-organization campaign dedicated to accelerating the development of industry consensus standards for advanced nuclear energy systems.

Guiding principle: Greater use in determining industry consensus standards, where needed, in the NRC licensing and regulatory processes

Expands involvement through U.S. and international participation

>>

“incentivizes harmonization of C&Ss”

Integration of ANS Nuclear Standards Collaborative (NSC) into NEI-EPRI North American Advanced Reactor Roadmap

Advanced Reactor Roadmap Phase 1: North America

Strategy



A shared (industry-wide) strategy to ensure the success of advanced reactors



Align organizations and foster collaboration in implementing the strategy



Serving government, academic, industrial, and public stakeholders

Timeline

Feb/Mar 2022



ANT RIC Meeting – Present Plan

Kickoff Roadmap Effort

June 2022



Preliminary Analysis of Strategic Elements

Engage Industry Stakeholders

July 2022



Complete Strategic Element Advisory Meeting

September 2022



Issue Draft Roadmap for Review

October 2022



Review and Endorsement

November 2022



Issue Roadmap

EPRI

NEI NUCLEAR ENERGY INSTITUTE

Strategic Framework

- **Goal:** Focus to meet industry strategies and remain relevant in the market
- **Cross-Cutting Elements:** Focus on market pull (meeting customer needs)
- **Pillars:** Align to goals, cross-cutting elements, and organizational ownership/implementation

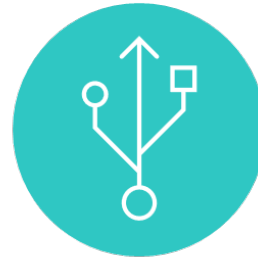
Goal: Enable deployment at scale in 2030's



**Market
Demand**



**Regulatory
Efficiency**



**Technology
Readiness**



**Project
Execution**



Timely

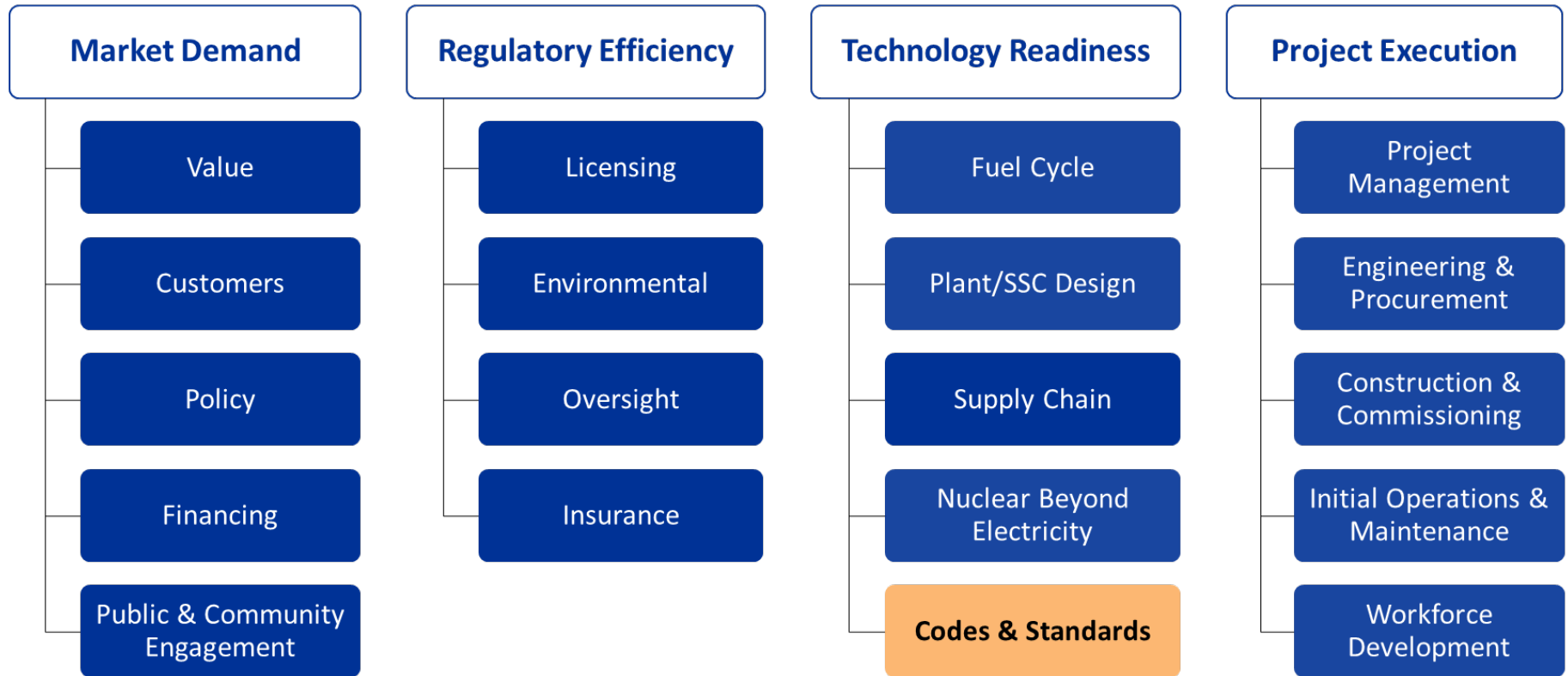


Cost Competitive



Low Risk

Strategic Elements



Codes and Standards for advanced reactors included as a key element within Roadmap

Role of Nuclear Standards Collaborative

- ANS Nuclear Standards Collaborative fully compatible with Roadmap
- Provides the issue ownership for coordinated actions among SDOs
- Accountability to industry executives via Roadmap offers path to priority and resources needed to enable AR commercialization

Connectivity to Industry Executives

Organization

NEI NPAC and AR CEO Committee

NEI New and Advanced Reactor Steering Group
(Market Demand and Regulatory Efficiency)

EPRI Advanced Nuclear Technology Research Integration Committee
(Technology Readiness and Project Execution)

Use Existing Committees Related to the Objectives for Strategic Elements
(e.g., NEI Regulatory WG, EPRI ANT TACs)

Codes & Standards Element

Nuclear Standards Collaborative (SDOs)

Roles and Responsibilities

Provides executive level endorsement and oversight

1. Lead development of strategy
2. Oversight and integration of objective implementation
3. Interactions with key stakeholders (e.g., NGO partners, Government, INL, GAIN, NRIC, etc...)

1. SDOs own C&S coordination and action
2. Informed by AR industry gaps/needs
3. Resourcing from industry to meet gaps/needs

Advanced Reactor Standards Needs

QUESTIONS/COMMENTS



Standards Committee III Strategic Items Update

**NRC Standards Forum
September 28th, 2022**

**Tom Basso
Section III Executive Strategic Advisory Council**

Section III Strategic Priorities

- Strategic priorities focus resources
- Developed by the Section III Leadership
 - Input from industry stakeholders
- Items of Strategic Importance
 - Targets actionable goals for each Code Edition
 - Guides long-term development
- Managed by the Executive Committee

2023 Edition Strategic Priorities

- SI-2023-01 Increasing Value of Section III
 - Objective is to align value with safety
 - Modify requirements that add little or no value independent of risk
 - Develop alternate rules for items commensurate with safety and risk
- SI-2023-02 Improve Section III/XI Interface
 - Objective is to align and modify requirements to improve the transition from construction to in-service inspection
- SI-2023-03 Support for Advanced Manufacturing
 - Objective to support the use of Advanced Manufacturing
 - Provide General Requirements (e.g., QA, process qualification)
 - Provide rules for high temperature service (Division 5)

2023 Edition Strategic Priorities

- **SI-2023-04 Development of Seismic Action Plan**
 - Objective is to develop a road map to modernize and coordinate the develop of seismic design rules
 - Nearing completion of a roadmap
 - Transition to the Execution Phase for 2025 Code Edition
- **SI-2023-05 Implementation of Fatigue Action Plan**
 - Objective is to execute the fatigue action plan developed 2018
 - Accomplished majority original plan
 - Expecting to close out this item with the 2023 Edition
- **SI-2023-06 NCA Rewrite**
 - Objective is to complete the NCA rewrite Phase III
 - Expecting to close out this item with the 2023 Edition

2025 Edition Strategic Priorities

- Currently developing priorities for 2025 Edition
- Expecting carry overs from 2023
 - Increasing the value of Section III
 - Improving the Section III/XI interface
 - Advanced Manufacturing
- Candidates for 2025 Edition
 - Transition to implementation of Seismic Action Plan
 - Support for advanced reactors with a focus on:
 - Design rules for High Temperature Service
 - Materials for High Temperature Service







Proposal to Establish Alternate Requirements for Components Commensurate with Safety and Risk

**NRC Standards Forum
September 28, 2022**

Rachel Romano, MPR Associates

Problem Statement Summary

- Section III is developing alternative requirements commensurate with an item's contribution to safety and risk (e.g., NEI 18-04)
 - Results in increased value for construction
 - Aligned with the design needs of advanced reactors
- Current available options to construct such items:
 - Construct to requirements of Section III
 - Construct to industrial codes and as necessary, apply additional requirements

ASME Section III	Industrial Codes + Additional Requirements
 Rules well suited for nuclear applications	 Value commensurate with item's contribution to safety and risk
 Value may not be commensurate with item's contribution to safety and risk	 Industrial design rules not well suited for nuclear application

Proposed Solution

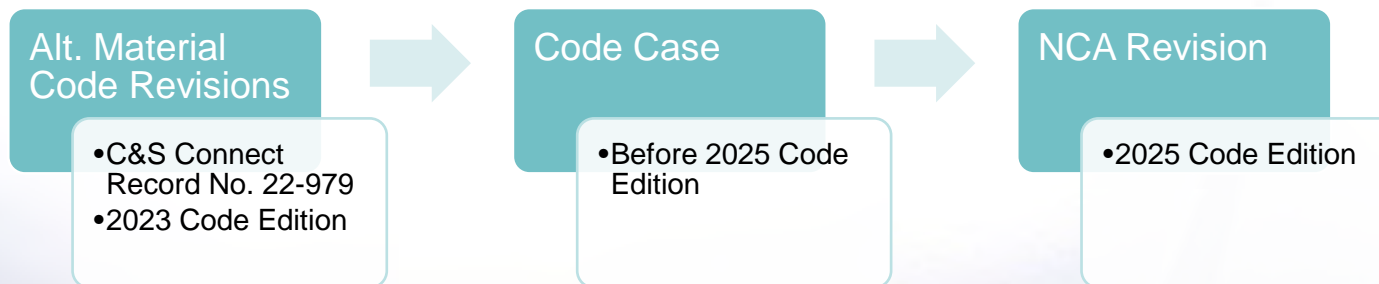
- Provide a new construction option commensurate with an item's contribution to safety and risk via alternative requirements within Section III that:
 - ✓ Uses design rules developed specifically for nuclear applications
 - ✓ Aligns Section III construction requirements with typical industrial codes

Technical Basis:

- Nuclear design rules are already used in nuclear applications
- Construction of low safety significant items to industrial code requirements is already permitted (e.g., 10CFR50.69)

Focus Areas

- Materials, Fabrication, and Examination Requirements
 - Code revisions for alternate material procurement
 - Code Case to permit alternate methods for NDE and testing
- Quality Requirements
 - Subsection NCA revision for alternate quality requirements



Regulatory Strategy

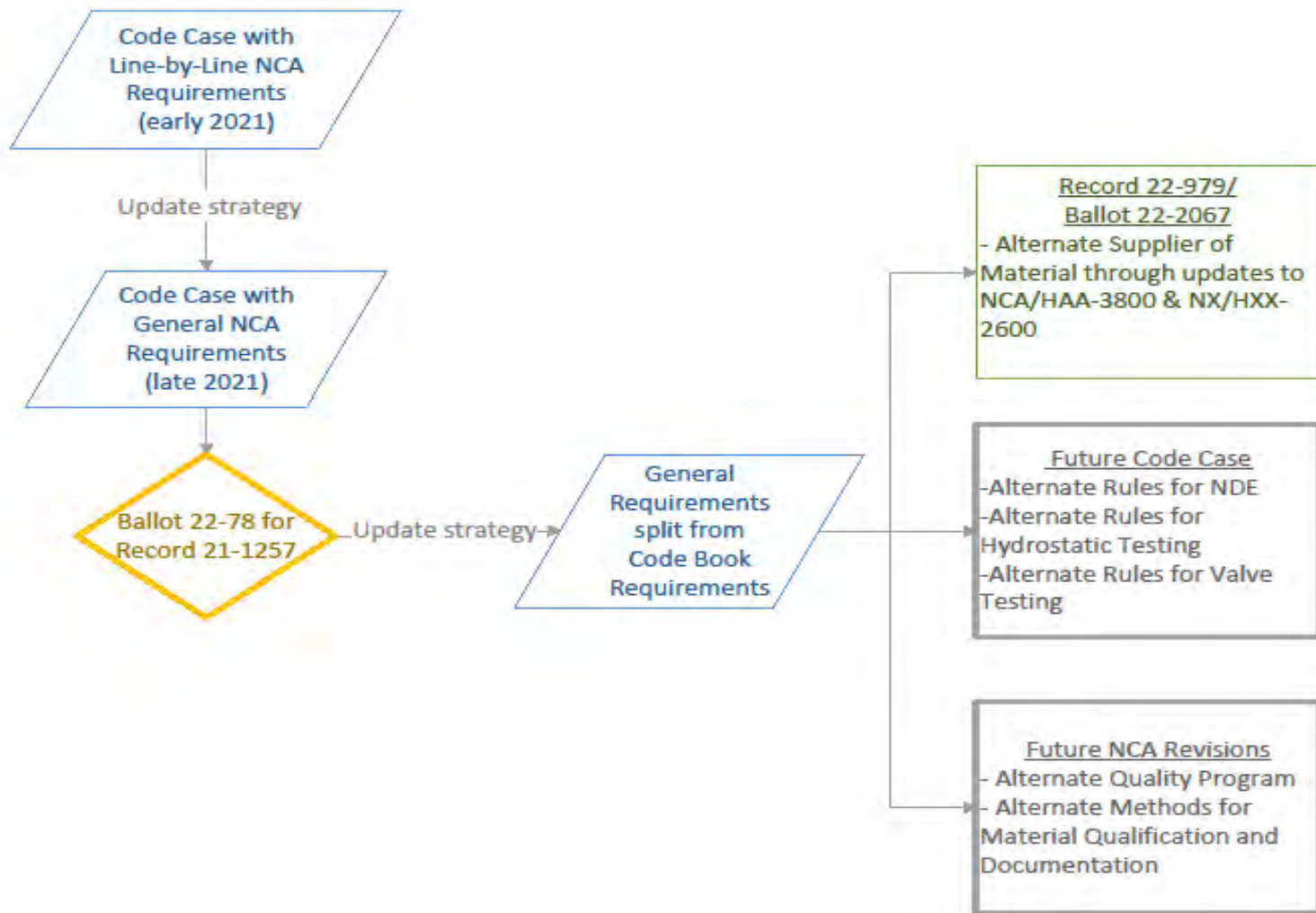
- Reason for a Regulatory Strategy
 - Unique approaches
 - Stakeholder needs
 - Broader and more frequent engagement
- Strategy
 - NRC Drop-in's
 - Public Meetings or Workshops
 - White papers
 - Apply various regulatory options
 - Expedited endorsement

Questions?



Backup Slide

Alternate Requirements Code Case Evolution



Digital Twin Overview

NRC Standards Forum

Ben Holtzman
Nuclear Energy Institute

September 28th, 2022

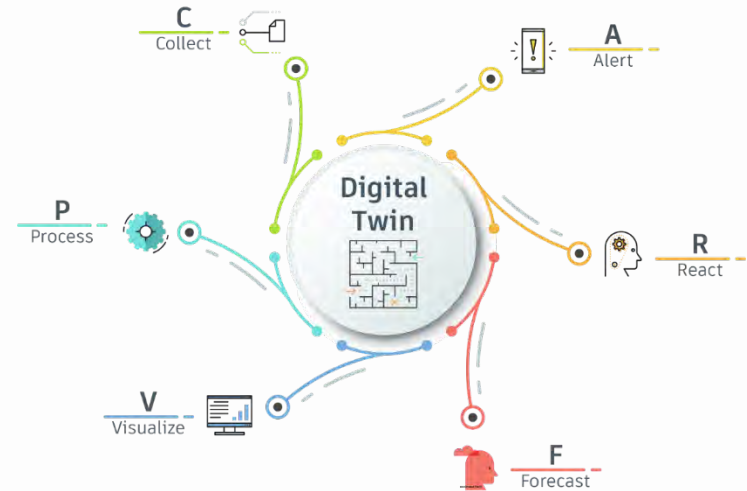


The Next Step of Nuclear Innovation

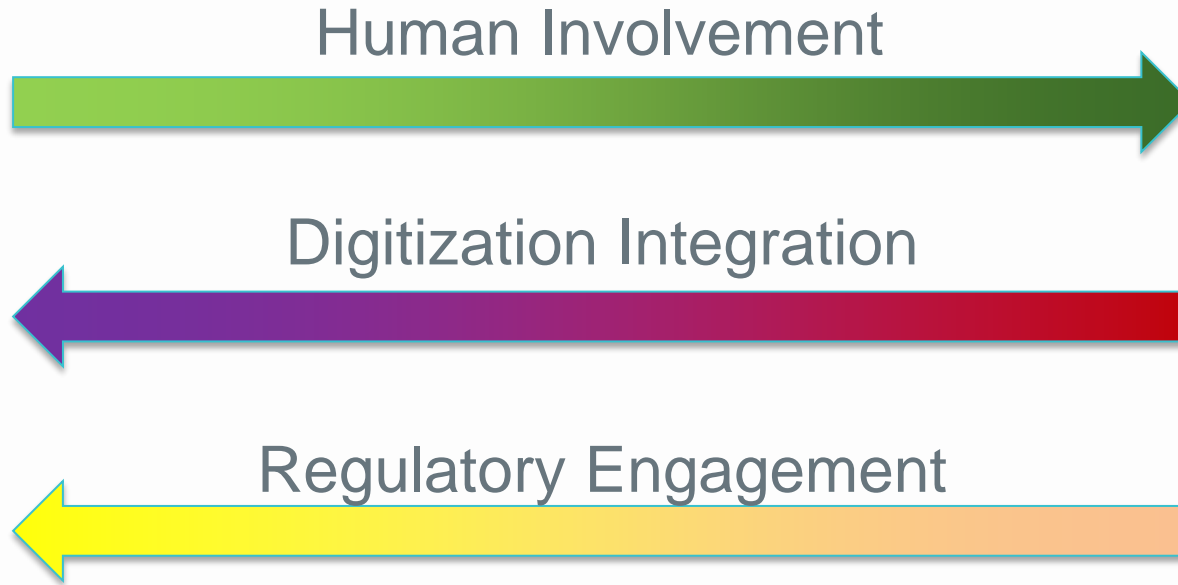
■ Various Applications

- What If Analysis
- Inform Design Activities
- Current Industry
- New Reactors

■ ARPA-E and EPRI leading industry technical development



Measuring Progress



Next Steps

- A Rose by Any Other Name...
 - One Small Step

- New tools but existing regulatory framework
 - No known regulatory gaps to implementation

- EPRI Report October 2022 (3002023904)

Questions?

IEEE NPEC Standards Update

Robert Konnik

IEEE NPEC Secretary

Overview

- ▶ NPEC (Nuclear Power Engineering Committee) has 50 Standards with about 28 currently in revision
- ▶ NPEC's principal subcommittees cover:
 - ▶ Equipment Qualification;
 - ▶ Operating, Aging, Maintenance, Testing and Reliability;
 - ▶ Auxiliary Power;
 - ▶ Human Factors and Control Facilities;
 - ▶ Safety Related Systems
- ▶ IEEE Standards are updated on a 10-year cycle to keep them current
 - ▶ Many standards are in revision for 3 to 6 years
- ▶ Many standards are not specific to reactor technology and standards have been extended from Nuclear Power Generating Stations to Nuclear Facilities
- ▶ Consequences of New Reactor Technology on NPEC Standards is Being Reviewed

Select Standards In Revision

- ▶ IEEE/IEC 60780-323 “IEC/IEEE International Standard - Nuclear facilities -- Electrical equipment important to safety - Qualification” is starting a revision
 - ▶ There has been some discussion with new reactor vendors on possible updates
- ▶ IEEE 383 “Standard for Qualifying Electric Cables and Splices for Nuclear Facilities” is being readied for Ballot
 - ▶ Over the last couple of revisions, there have been updates to address some issues raised because of passive reactors (such as submergence) as well as lessons learned over the last 50 years
 - ▶ This is a test standard, so advanced reactors may not require any changes to the test methodology: Note these standards do not include Test Profiles
- ▶ IEEE 1682 “IEEE Standard for Qualifying Fiber Optic Cables, Connections, and Optical Fiber Splices for Use in Safety Systems in Nuclear Power Generating Stations” was developed in 2011 to address new reactors and control systems
 - ▶ This standard is in ballot now with some updates based on experience gained since the initial revision

Additional Standards

- ▶ IEEE 2425 “Standard for Electromagnetic Compatibility Testing of Electrical and Instrumentation and Control Equipment at Nuclear Power Generating Stations and Other Nuclear Facilities” is a new standard being developed that should be in ballot soon
- ▶ In SC2 a new subcommittee has been formed for the IEEE/IEC 62582 standards on condition monitoring. These have been developed in the last decade and many are now being revised.
- ▶ IEEE 1205 “IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Electrical Equipment Used in Nuclear Power Generating Stations and Other Nuclear Facilities” in Revision
- ▶ IEEE 317 “IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations” in Revision

In Ballot

- ▶ IEEE 338 “IEEE Standard for Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems” in Ballot
- ▶ IEEE 334 “IEEE Standard for Qualifying Continuous Duty Class 1E Motors for Nuclear Power Generating Stations” in Ballot
- ▶ IEEE 420 “IEEE Standard for the Design and Qualification of Class 1E Control Boards, Panels, and Racks Used in Nuclear Power Generating Stations” in Ballot
- ▶ IEEE/IEC 62582 Series on Condition Monitoring “IEC/IEEE International Standard - Nuclear power plants - Instrumentation and control important to safety - Electrical equipment condition monitoring methods”
 - ▶ Part 2: “Indenter measurements” in Ballot
 - ▶ Part 3: “Elongation at break” in Ballot
 - ▶ Part 4: “Oxidation induction techniques” in Ballot
 - ▶ Note, Part 1: “General” in Draft

Published in 2022

- ▶ IEEE 577-2022 “IEEE Standard Requirements for Reliability Analysis in the Design and Operation of Safety Systems for Nuclear Power Generating Stations and Other Nuclear Facilities”
- ▶ IEEE 741-2022 “IEEE Standard for Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations”
- ▶ IEEE 765-2022 “IEEE Standard for Preferred Power Supply (PPS) for Nuclear Power Generating Stations (NPGS)”
- ▶ IEEE 1786-2022 “IEEE Guide for Human Factors Applications of Computerized Operating Procedure Systems (COPS) at Nuclear Power Generating Stations and Other Nuclear Facilities”

The background features a light blue gradient with a pattern of wooden blocks, each marked with a question mark. The blocks are scattered across the frame, some in sharp focus and others blurred. The overall aesthetic is clean and modern, with a focus on the theme of inquiry.

QUESTIONS