Alternate Requirements for Components Commensurate with Safety or Risk

Workshop on Advanced High Temperature Reactors

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Secretary, TG on Alternate Requirements

October 27, 2024

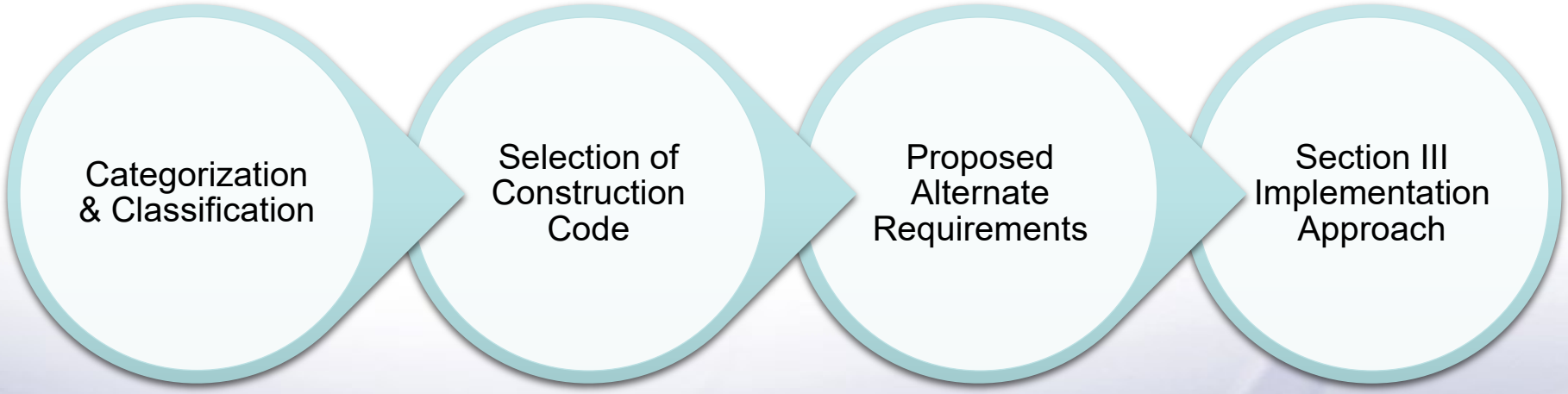
Agenda

- Introduction
- Background and Scope
- Section III Alternative Requirements
  - Completed Actions
  - Current Work
  - Next Steps

Introduction

Purpose:

Develop the technical basis for proposed alternate requirements for the construction of ASME Section III, Division 5 nuclear items commensurate with an item's contribution to safety or risk



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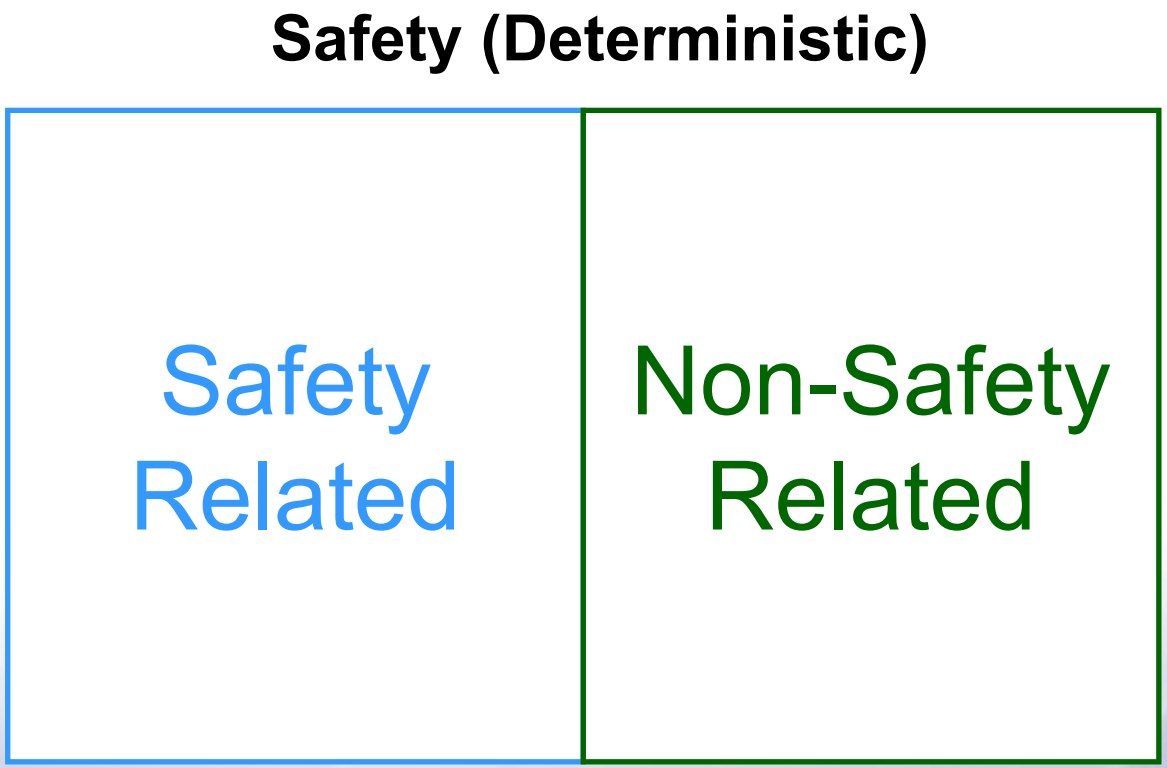
Categorization & Classification

- Traditional categorization process is deterministic:



Categorization & Classification

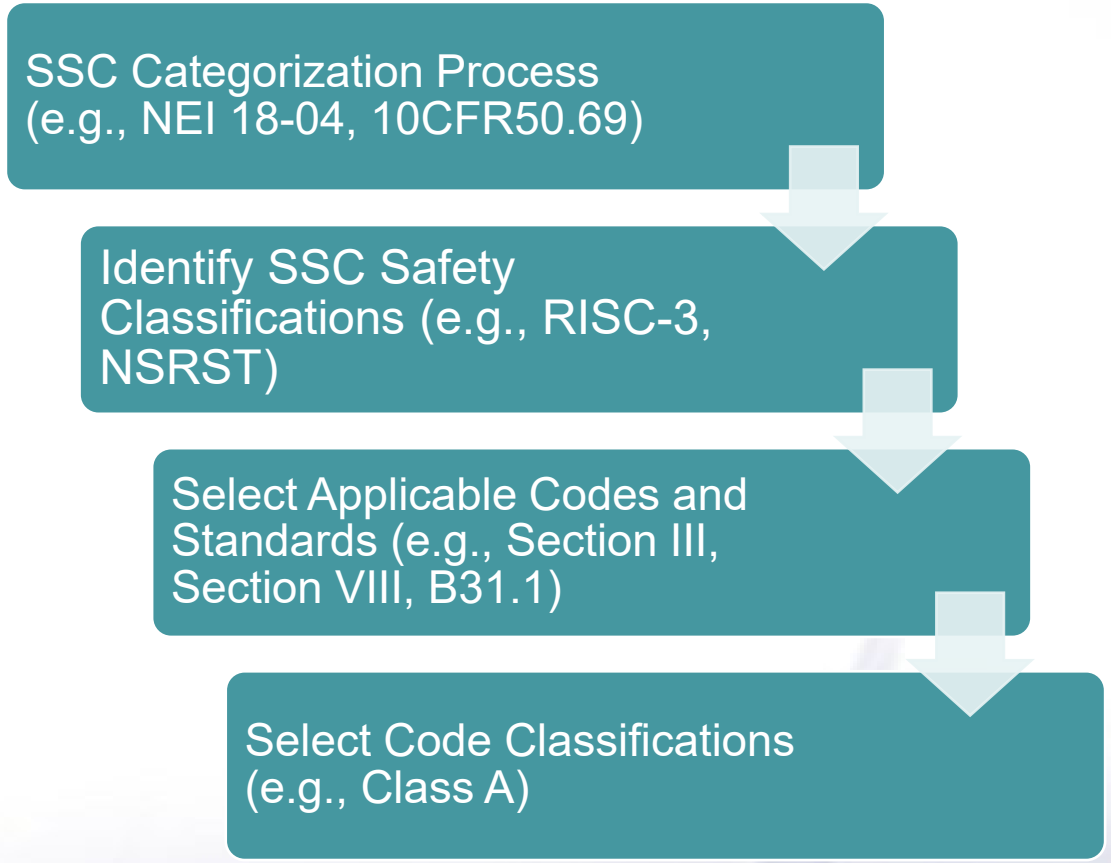
- Traditional categorization process is deterministic:
  - Safety Related or Non-Safety Related
- Risk-based approaches for LWRs consider Core Damage Frequency and Large Early Release Frequency

Risk-Informed Safety Classifications

"RISC-1" SSCs Safety-Related Safety Significant	**"RISC-2" SSCs** Nonsafety-Related Safety Significant
"RISC-3" SSCs Safety-Related Low Safety Significant	**"RISC-4" SSCs** Nonsafety-Related Low Safety Significant

Categorization & Classification

- Paradigm shift in advanced reactor safety basis from traditional nuclear reactors
- Categorization processes developed, and some endorsed, that recognize this paradigm shift



Categorization & Classification

- Paradigm shift in
  ad
  ba
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- Ca
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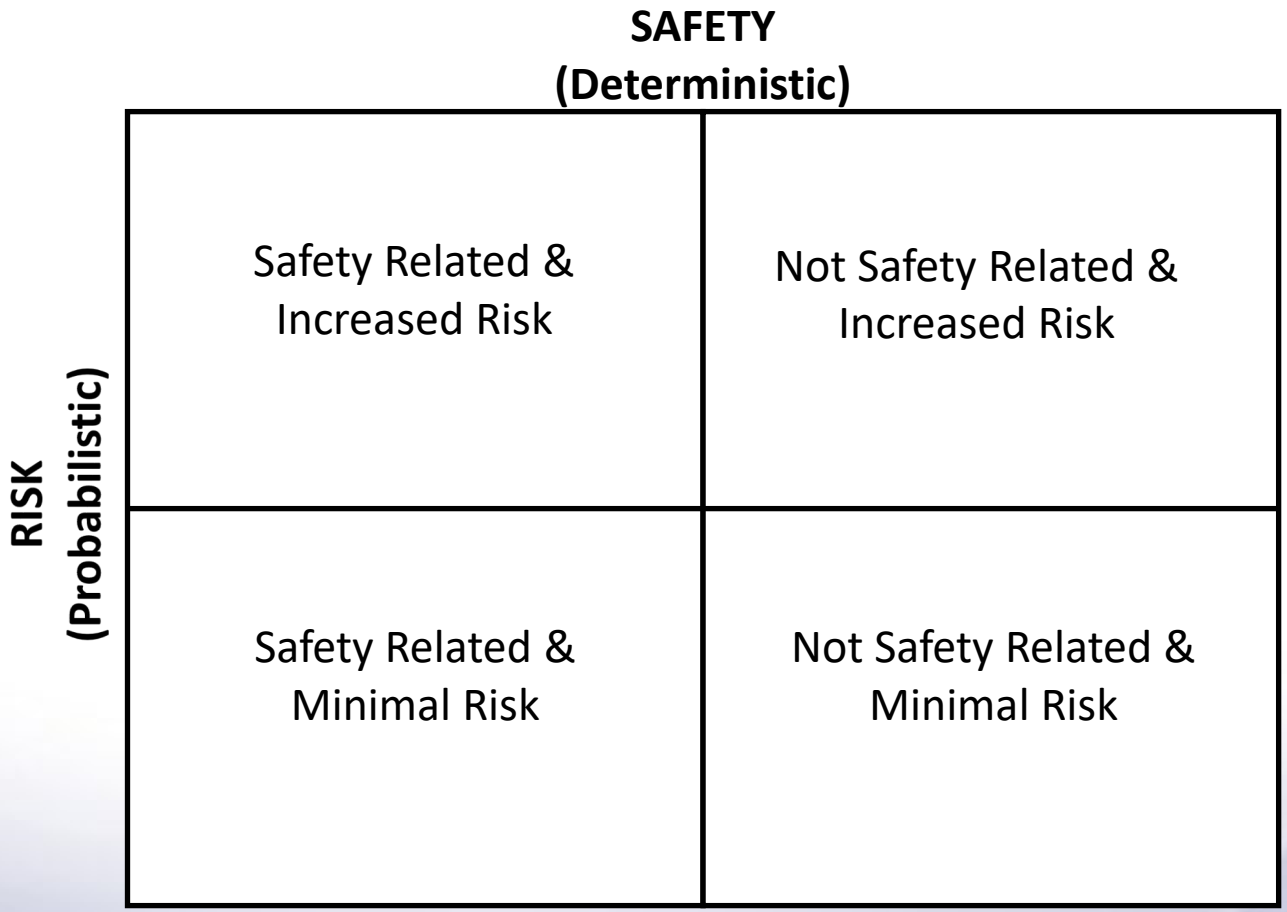
SSC Categorization Process
(e.g., NEI 18-04)

Nuclear Codes and Standards do not yet fully recognize advancements in categorization and classification of systems, structures, and components

(e.g., Class A)

Categorization & Classification



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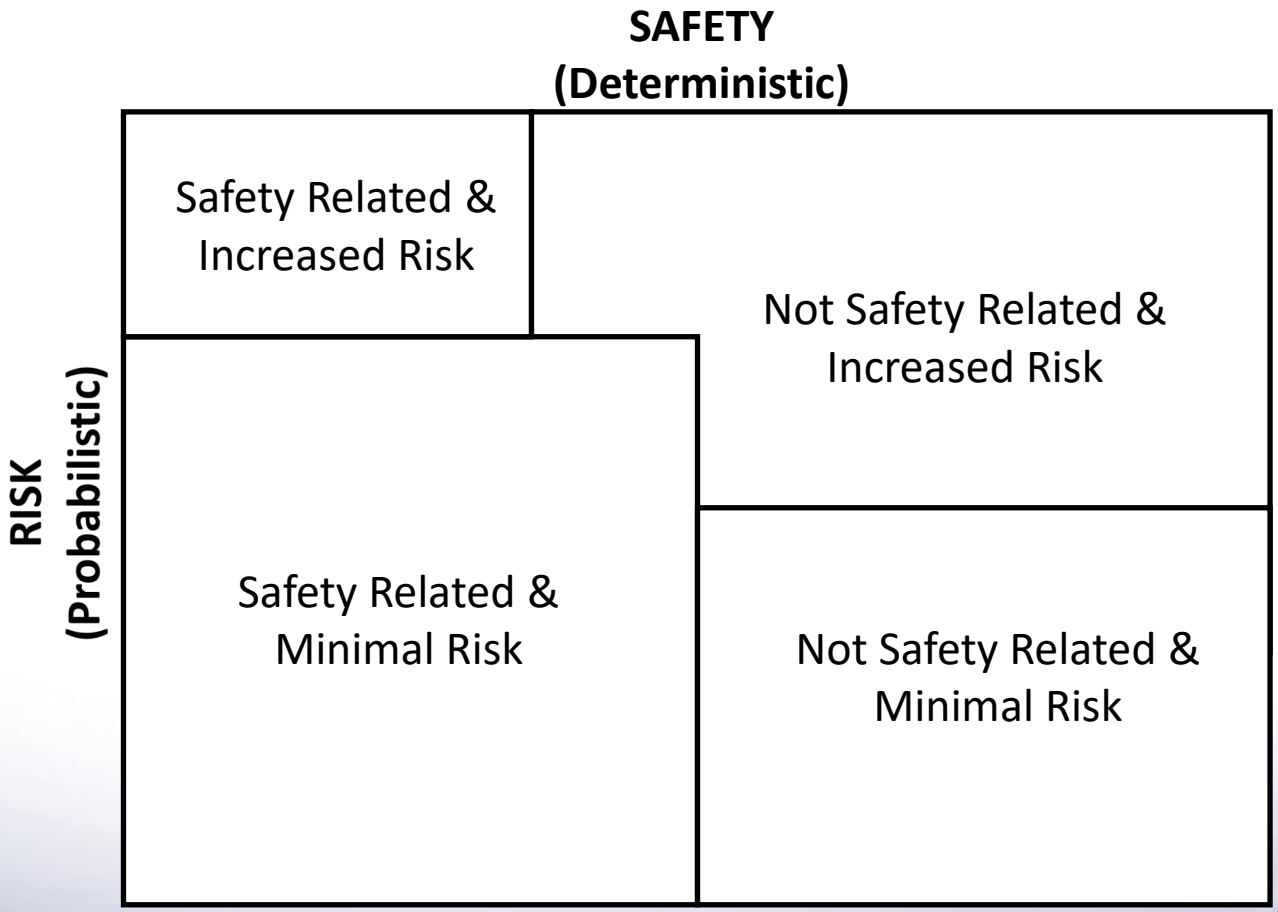
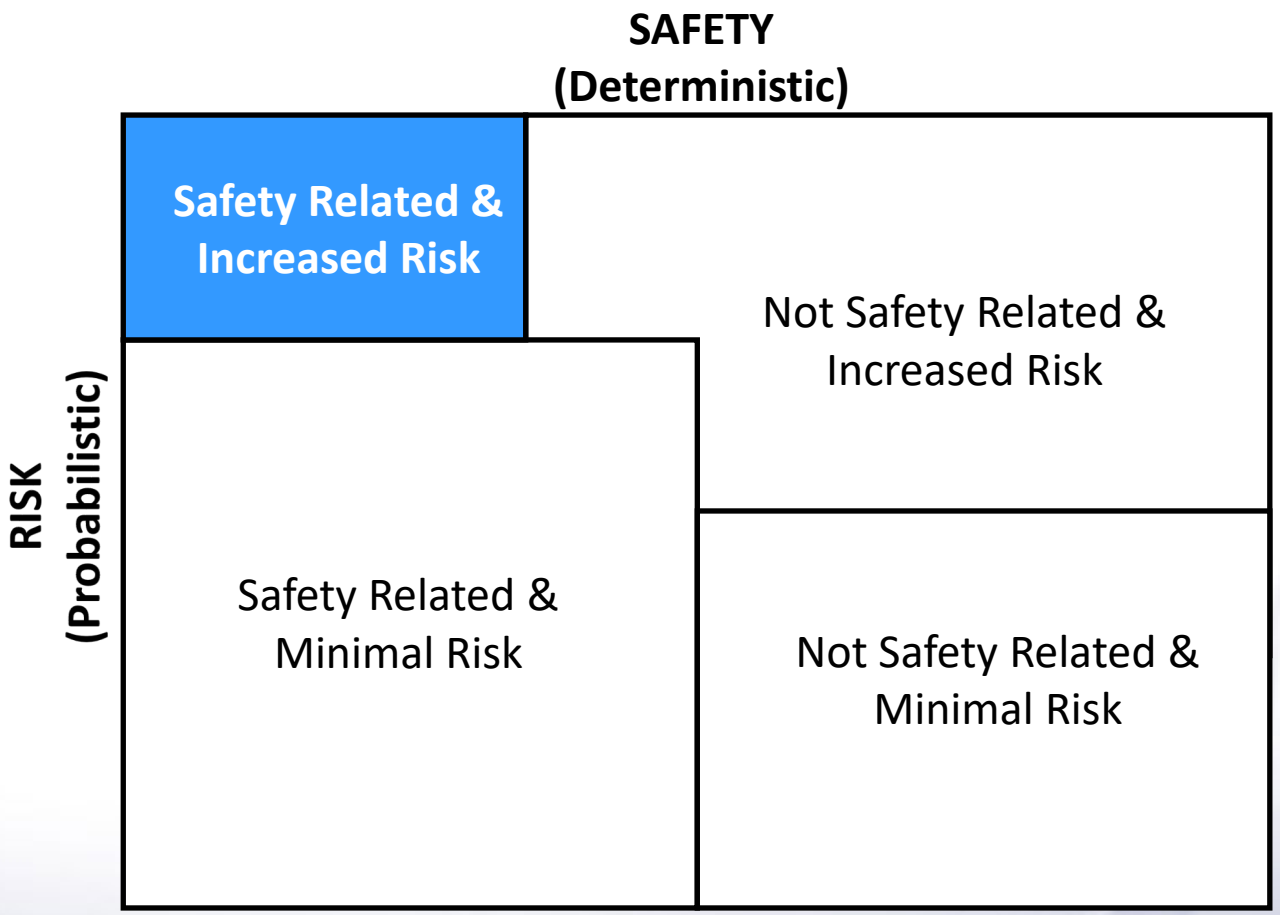


Categorization & Classification

Nuclear Codes

- Section III: pressure vessels, pumps, valves, piping, core supports, containments
- ACI 349 Concrete
- N690 Steel Structures
- NQA-1 Quality Assurance



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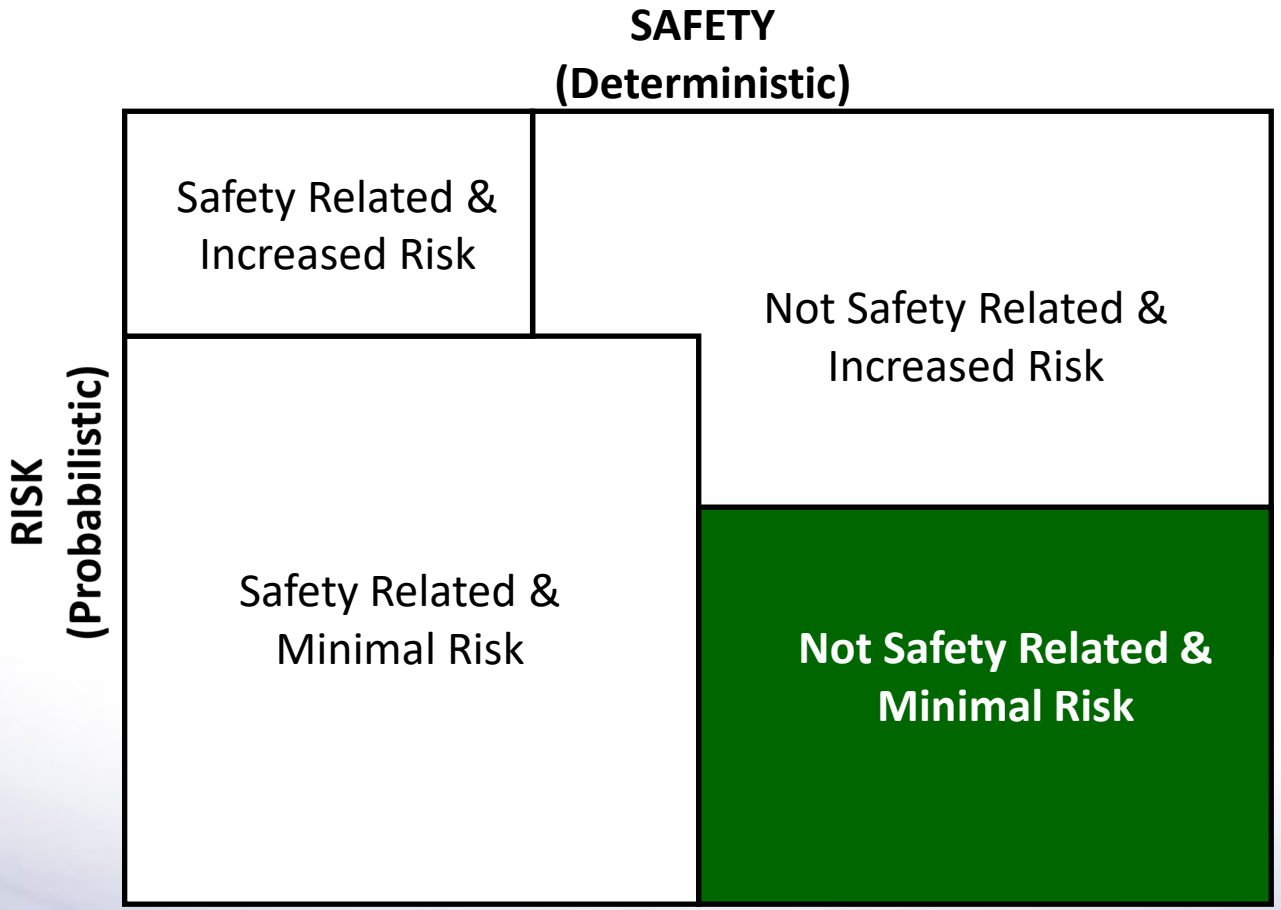

Industrial Codes

- Section VIII pressure vessels
- API Standards pumps
- B16.34 valves
- B31 series piping
- AISC steel
- ACI 318 Concrete
- ISO-9000 Quality

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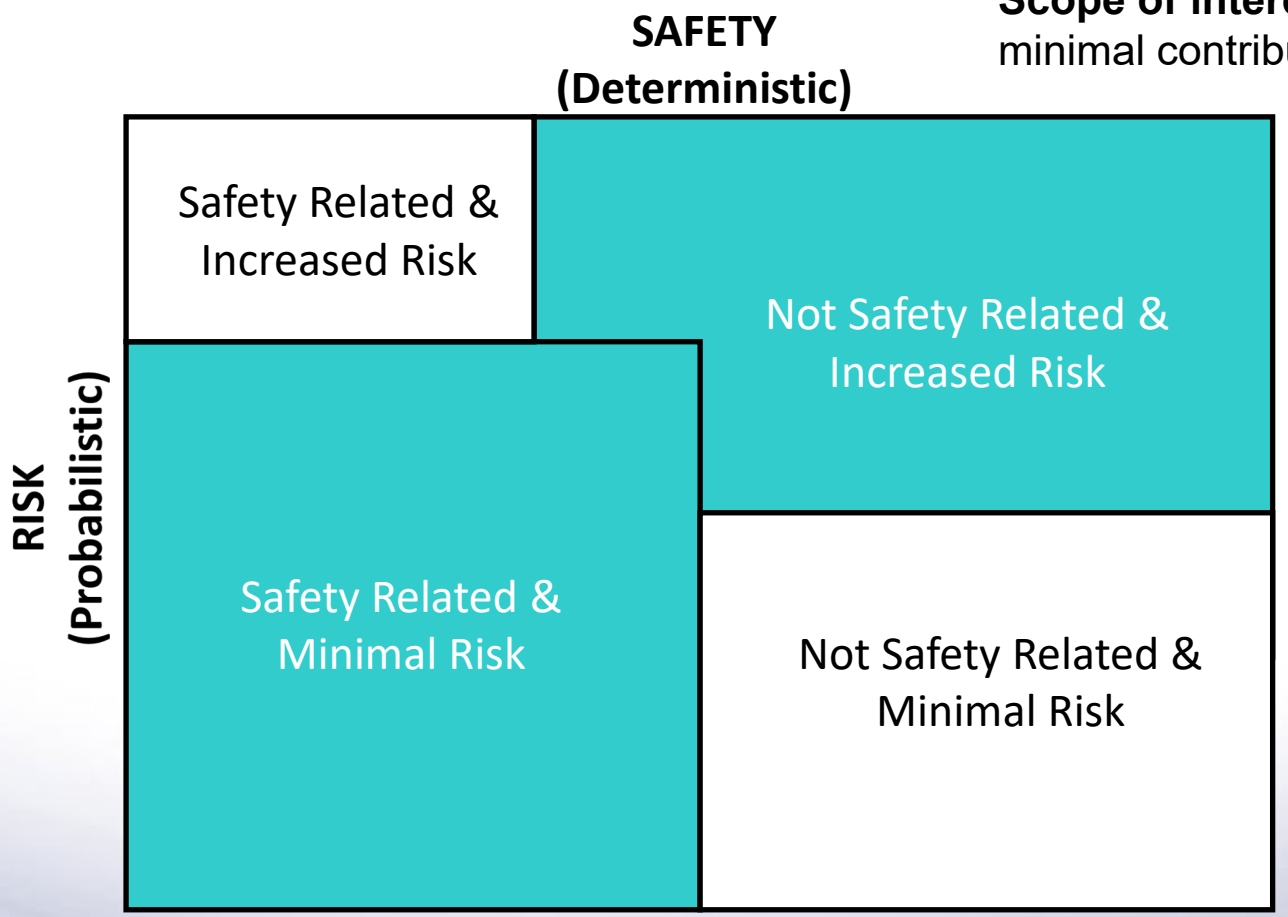
Categorization & Classification

Scope of interest: Items with minimal contribution to safety or risk



Selection of Construction Codes

Scope: Items with minimal contribution to safety or risk

Current available options for construction:

1. Construct to requirements of Nuclear Codes (Section III, ACI 349, AISC N690, NQA-1)

2. Construct to industrial codes (Section VIII, B16.34, B31 series, etc.) and as necessary, apply additional requirements

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Why Section III?

- Advantages
  - Nuclear Design Rules are well-understood and accepted by the regulator
  - Service Levels allow appropriate consideration of infrequent events
  - Rigorous quality requirements

- Disadvantages
  - Not competitive on cost or schedule (compared to commercial construction)
  - Requirements may not be appropriate for components with minimal contribution to safety or risk

Section III Alternate Requirements Introduction

- BPV III Strategic Initiative - Increasing Value of Section III
  - Section III must take advantage of emerging technology, sound lifecycle management, and utilization of risk-based categorization & treatment of structures, systems, and components for nuclear power reactors to improve commercial viability
  - To remain viable, Section III must also address unique aspects of Advanced Reactors

Section III Alternate Requirements

- Provide a new construction ***option*** for Section III, Div 5 items commensurate with their contribution to safety and risk via alternative requirements that:
  - ☑ Uses design rules developed specifically for nuclear applications
  - ☑ Aligns Section III construction requirements with typical industrial codes to increase value for construction

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)

Proposed Alternate Requirements

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

Implementation Approach

- Materials, Fabrication, and Examination Requirements
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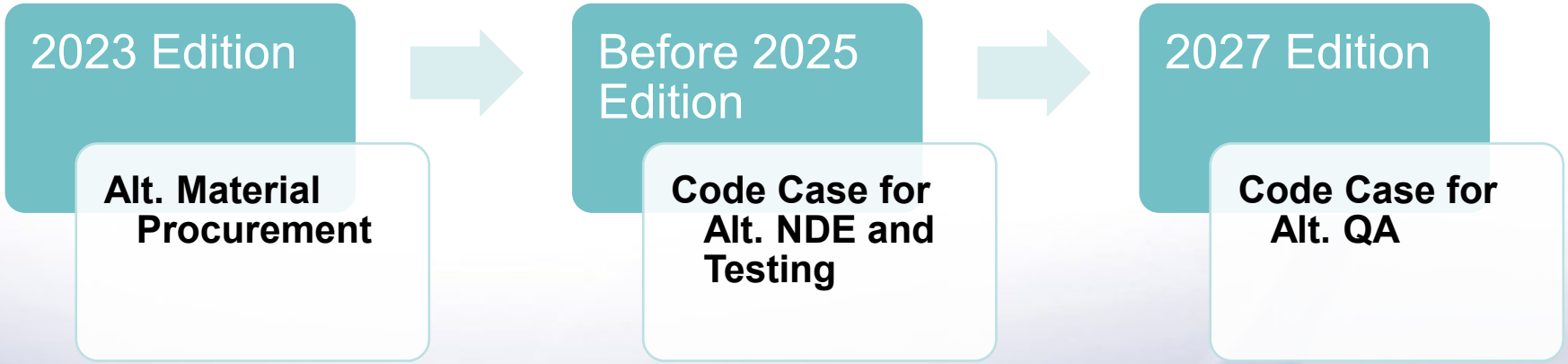

Alternate Material Procurement

- Alternate requirements for **material procurement** of items commensurate with their contribution to safety or risk
  - Allow material procurement from industrial supplier

- Permitted for all Classes in Division 5
  - Changes to Division 5 Subsections HBA and HBB, not Subsection NB
  - Changes to referenced Division 1 Subsections NCD, NE, NG and NF

Material Procurement (2023 Ed)

NCD-2600 MATERIAL ORGANIZATIONS' QUALITY SYSTEM PROGRAMS

NCD-2610 DOCUMENTATION AND MAINTENANCE OF QUALITY SYSTEM PROGRAMS

(d) For the purpose of this paragraph, items commensurate with their contribution to safety or risk are defined as given in (1) and (2) below.

(1) The Owner or the Owner's designee has established that the exemption is consistent with the safety or risk significance of the item. The determination of the safety or risk significance of the item to design and operations is beyond the scope of this Section. Appropriate guidance for the safety or risk significance of the item shall be derived from system criteria documents for specific types of nuclear power systems and may be found in the requirements of regulatory and enforcement authorities having jurisdiction at the site.

NCA-3311.3 Exclusions. Metallic material falling within the exclusions of NB/NCD/NE/NF/NG-2610 or material that is allowed by this Section to be furnished with a Certificate of Compliance, is exempted from the requirements of NCA-3300, except

(a) Certified Material Test Reports or Certificates of Compliance shall meet the requirements of NCA-1225.1

(b) for Class 1 construction only, material identification and marking shall meet the requirements of NCA-4256.3

Implementation Approach

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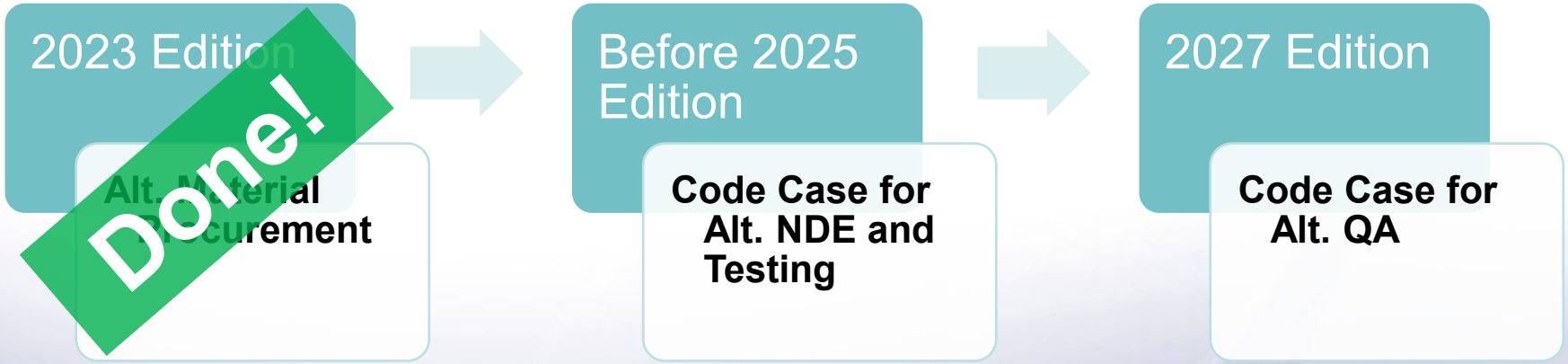

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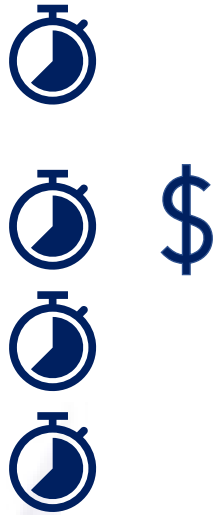
Code Case on NDE and Testing

- Record 23-15: Code Case to permit additional NDE and Testing Approaches
  - Provide minimum requirements that are aligned with industrial code requirements

- Scope: Section III Division 5
  - Class A Low Temperature and Elevated Temperature (Subsection HB)
  - Class B Low Temperature and Elevated Temperature (Subsection HC)
  - Supports, Low Temperature (Subsection HF)

Code Case on NDE and Testing

- Alternate Examination and Testing Requirements
  - Allow ultrasonic inspection for piping as an alternative to radiography
  - Allow random and progressive sampling for nondestructive examinations of moderate energy piping
  - Allow system leak test as an alternative to hydrostatic leak test for moderate energy piping
  - Allow shorter hold times for valve pressure testing



- Basis: minimum requirements aligned with industrial standards (B31.1, B31.3, B16.34)

Implementation Approach

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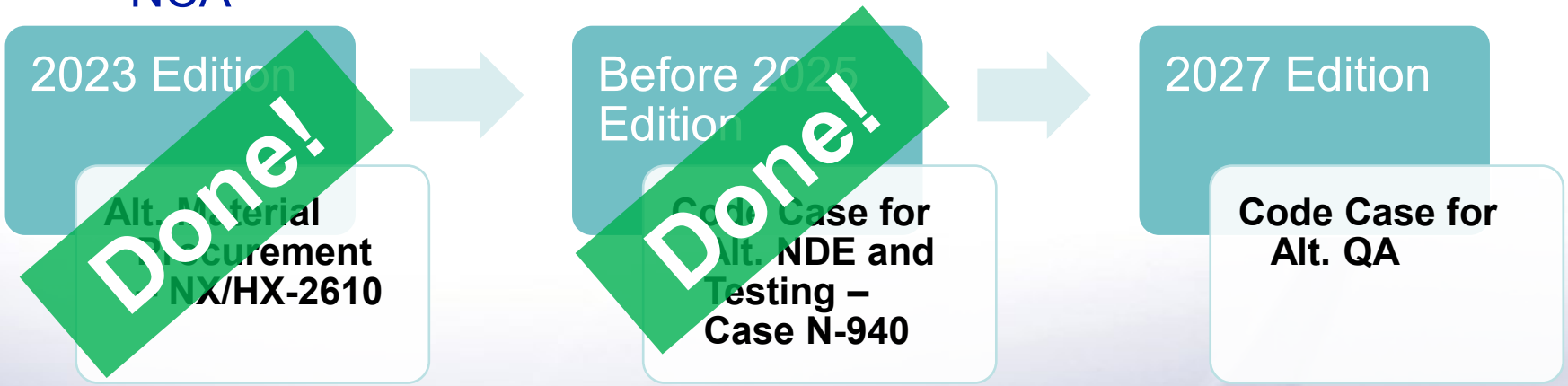

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Alternate QA Requirements

Opportunity: What alternate requirements for Quality Assurance for items with minimal contribution to safety or risk are appropriate? How and where do we communicate these alternative requirements?

Current Approach to Quality Assurance in Section III: Reference NQA-1 with some additional requirements

Scope for Alternate Requirements: Metallic items with minimal contribution to safety or risk as defined in NX/HX-2610

Alternate QA Requirements

Guiding principles:

- Remove or replace Section III QA requirements that are not appropriate for items with minimal contribution to safety or risk
- Minimum requirements consistent with 10CFR50.69 RISC-3 components and industrial standards
- Avoid causing negative impact to operating fleet
- Provide consistency and common expectations for the industry regarding implementation of requirements based on consensus standard approval

Alternate QA Requirements

Detailed Approach:

- Alternate Minimum Requirements for:
  - General Requirements (i.e., QA Program)
  - Auditing of subcontracted services
  - Role of ANI modified but maintained
- Maintain Requirements for:
  - Certification and Stamping (NCA-8000)
  - ANI inspection of constructed items
  - Corrective Action Program
- Owner to provide supplemental requirements, as needed

Goal is publication of the Alternate QA Requirements in the 2027 Edition of the Code

Next Steps: Alternate QA Requirements

Meetings: Task Group on Alternate Requirements, NRC public meetings, ASME Committee engagement through presentations and balloting

Interested in supporting this effort? Reach out to Rachel (rromano@mpr.com) or Jie Wen, TG Chair (jwen@jensenhughes.com) to be added to the TG mailing list

Summary

- Plant design approaches recognize unique aspects of advanced designs
- Codes and Standards have not evolved to align with safety and risk requirements for advanced reactors
- Section III is leading the industry in thinking differently
  - Alternatives are available or in-progress for items with minimal contribution to safety or risk
- Increase competitiveness of advanced nuclear

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Questions?

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