

Next Steps on 10 CFR Part 53: Updates on Developing a New Regulatory Framework for Advanced Reactors

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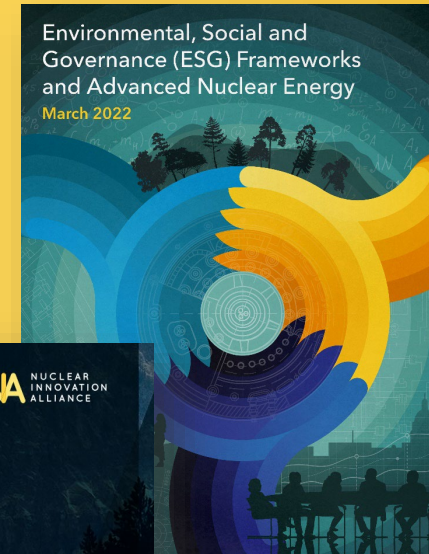
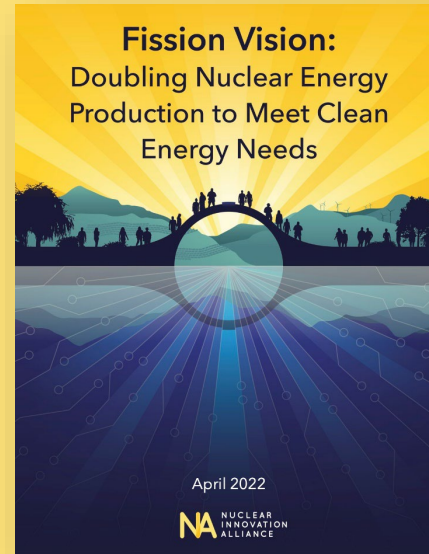
Nuclear Innovation Alliance

March 29, 2024



What is Nuclear Innovation Alliance (NIA)?

- NIA is a non-profit, non-partisan, “think-and-do” tank working to help create the conditions for success for advanced nuclear energy so it can be part of the climate and energy solution.
- NIA identifies barriers, performs analysis, engages with stakeholders and policy makers, and nurtures entrepreneurship through its Nuclear Innovation Bootcamp.



Developing a new regulatory framework for advanced reactors can enable effective, efficient, and predictable licensing

Existing regulatory frameworks for new reactors

A (brief) history of Part 53 rulemaking for advanced reactors

Current status and next steps on Part 53 rulemaking process

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Initial nuclear regulations in the United States were used to license a variety of different reactor technologies



Pathfinder Nuclear Generating Station (1966)
Superheated boiling water reactor
62.5 MW_e reactor

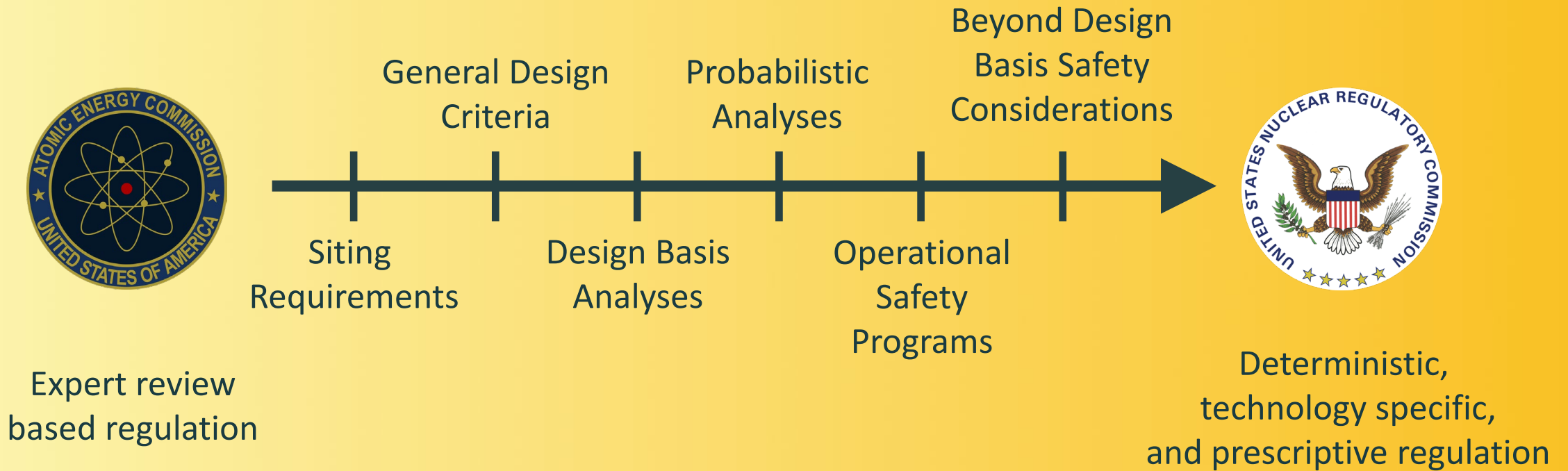


Hallam Nuclear Generating Station (1963)
Liquid sodium and graphite moderated
75 MW_e reactor



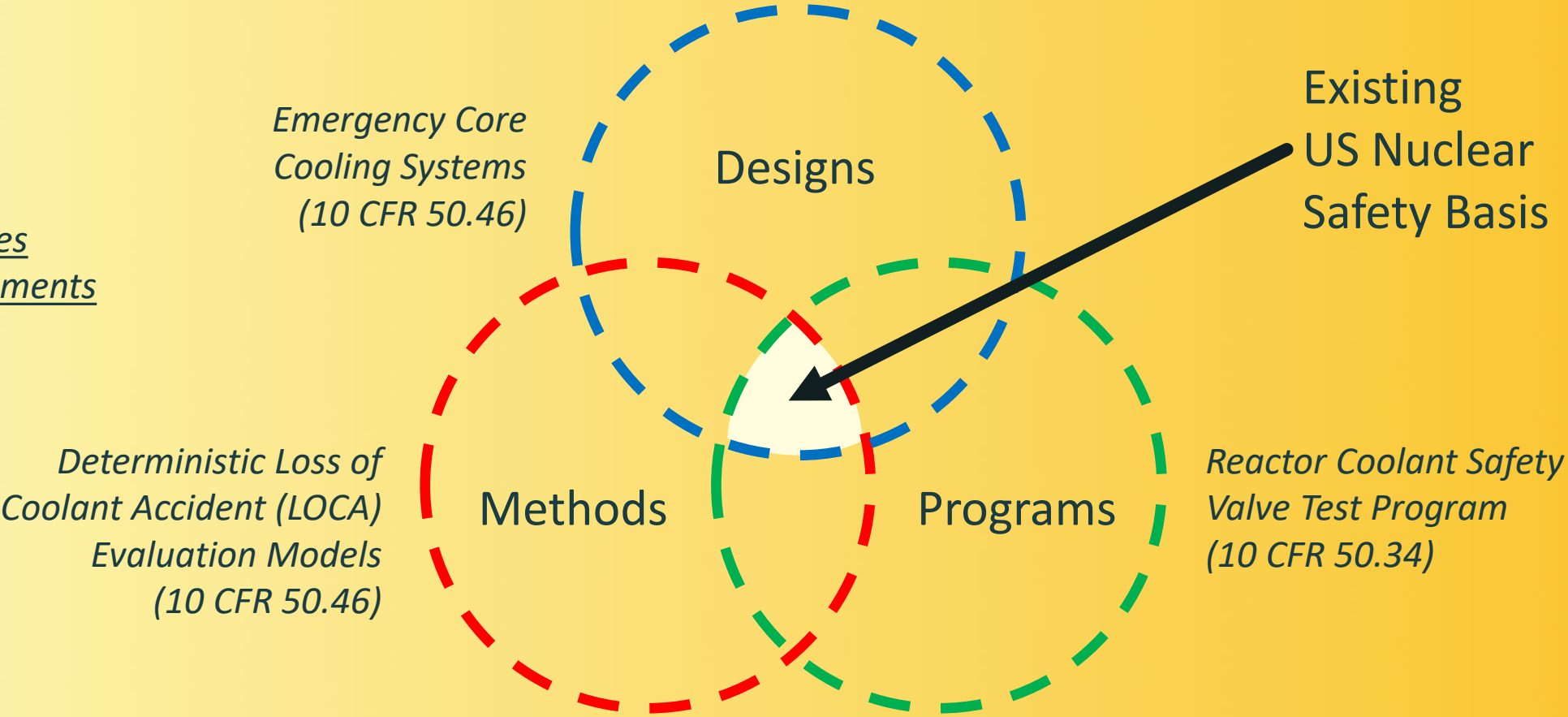
Piqua Nuclear Generating Station (1963)
Organic cooled and moderated
45.5 MW_{th} reactor

Nuclear regulations were optimized over time to enable the more efficient regulation of large light water reactors






Existing nuclear regulation leverages a combination of design, method, and program requirements to ensure safety

Examples
Requirements



Use of existing nuclear regulation for advanced reactors will require regulatory exemptions for many requirements

-  Designs *Emergency Core Cooling Systems (10 CFR 50.46)*
-  Methods *Deterministic LOCA Evaluation Models (10 CFR 50.46)*
-  Programs *Reactor Coolant Safety Valve Test Program (10 CFR 50.34)*



Existing regulatory requirements can impede advanced reactor licensing due to inherent framework characteristics

Existing Regulatory Framework

Technology-Specific

Deterministic

Prescriptive

Limits licensing of non-LWRs

Limits use of risk insights

Limits technology innovation

Future Regulatory Framework

Technology-Inclusive

Risk-Informed

Performance Based

Licensing Modernization Project (LMP) created a method for advanced reactors using existing regulations with exemptions

- Technology-inclusive, risk-informed, and performance-based methodology to inform the licensing basis and content of applications for non-light-water reactors (non-LWRs)
- Licensing Modernization Project (LMP) led by Southern Company and the industry's Advanced Reactor Regulatory Task Force produced the industry guidance document [NEI 18-04](#) in 2019
- NEI 18-04 was supported by staff in [SECY-19-0117](#) for use with advanced reactors and endorsed for usage by NRC in [Regulatory Guide 1.233](#) in 2020

Technology-inclusive, risk-informed,
and performance-based process

Selection and Evaluation of
Licensing Basis Events

Classification of System,
Structure, and Components

Determination of Defense in
Depth Adequacy Process

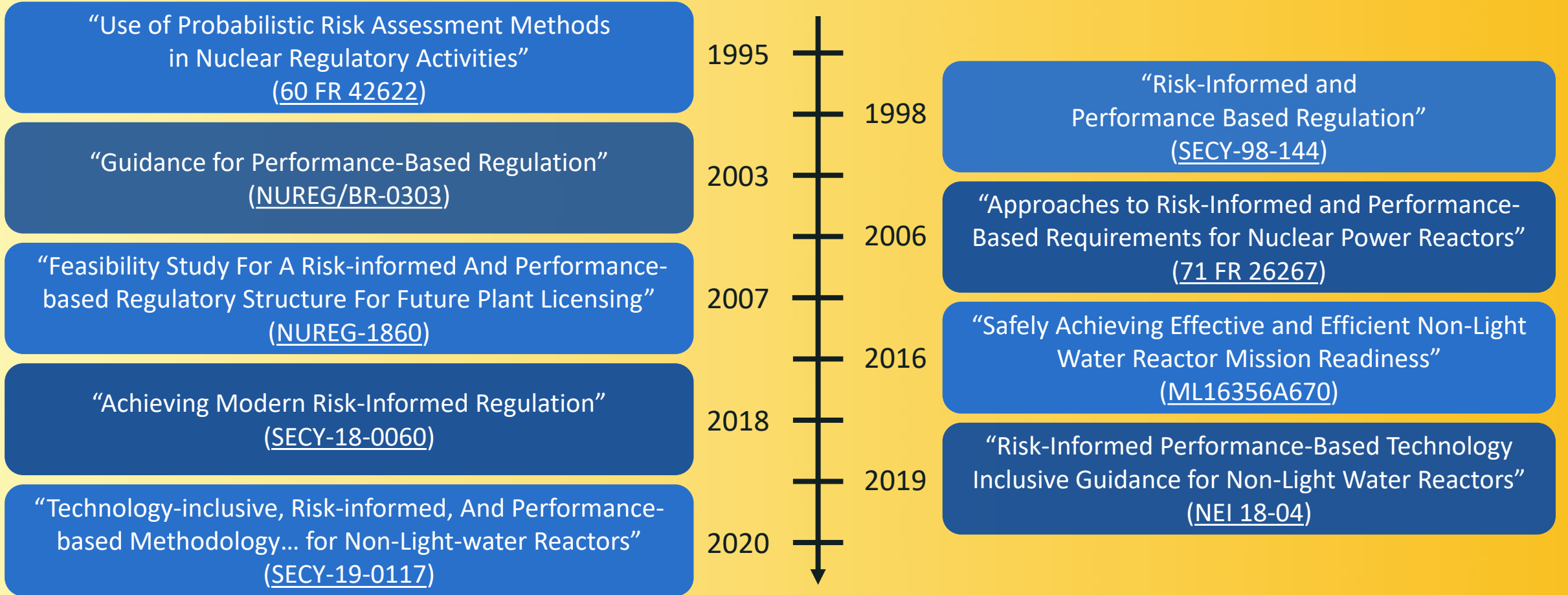
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Advanced reactor rulemaking builds on decades of NRC work on risk-informed, performance-based regulations



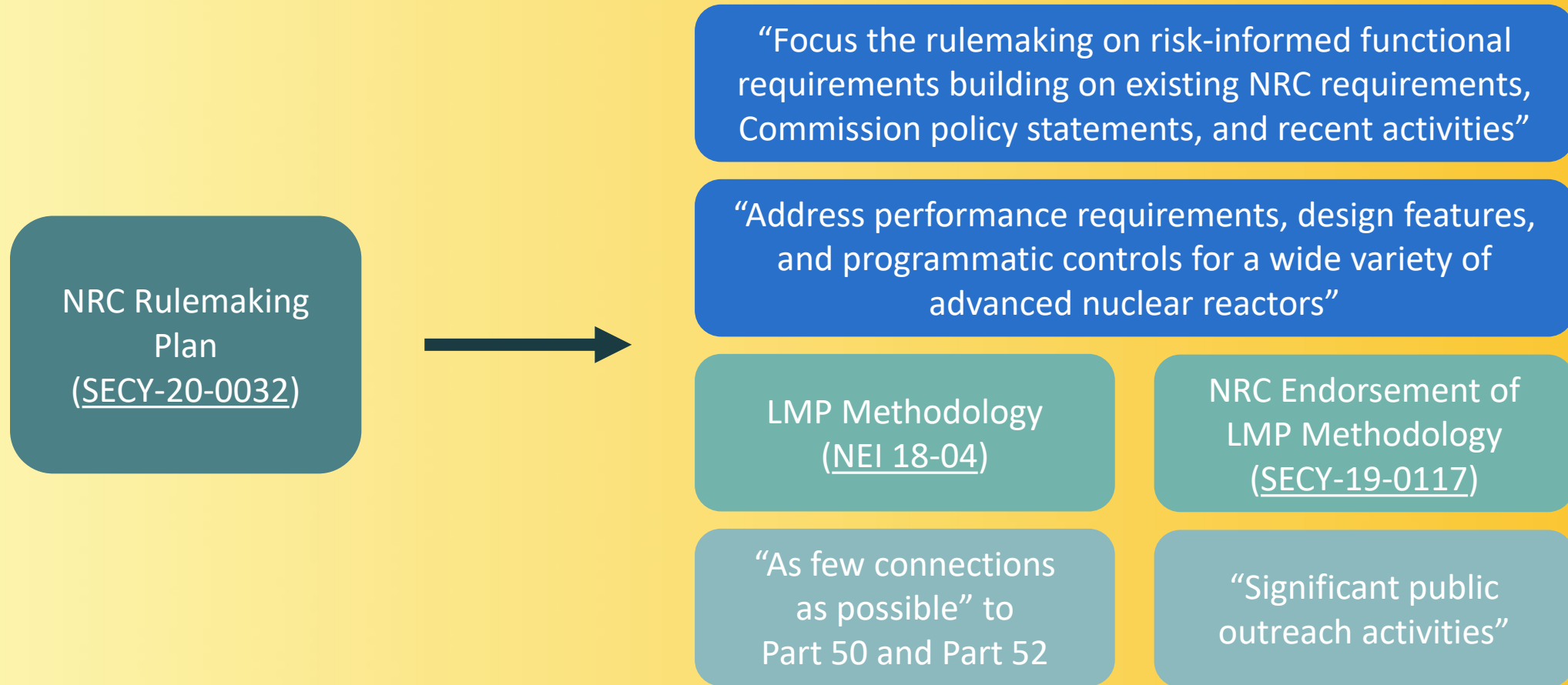
Nuclear Energy Innovation and Modernization Act (NEIMA) in 2019 directed NRC to begin the Part 53 rulemaking

(4) Technology-inclusive Regulatory Framework.—
Not later than December 31, 2027, the Commission shall complete a rulemaking to establish a technology-inclusive, regulatory framework for optional use by commercial advanced nuclear reactor applicants for new reactor license applications.

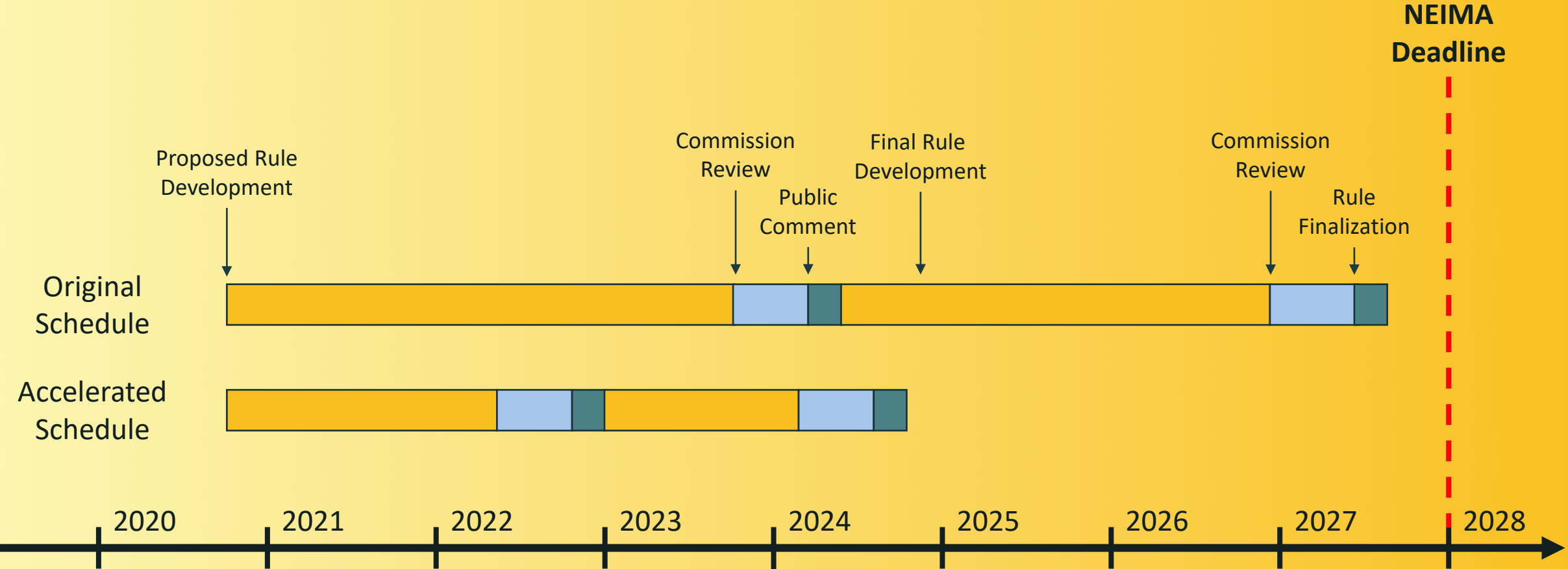


Bipartisan Cosponsors on Committee
Passed by Unanimous Consent in Senate
Passed by 361 – 10 in House
Signed into law in January 2019

NRC staff planned to build on LMP methodology as the technical basis for Part 53 regulatory framework



Stakeholder and policymaker feedback led to acceleration of the rulemaking development process



Accelerated initial NRC staff development of Part 53 proposed draft rule resulted in an LMP-like framework

Draft Proposed Rule Outline in Summer 2021

- Subpart A, General Provisions
- Subpart B, Technology-Inclusive Safety Objectives
- Subpart C, Design and Analysis
- Subpart D, Siting Requirements
- Subpart E, Construction and Manufacturing Requirements
- Subpart F, Requirements for Operation
- Subpart G, Decommissioning Requirements
- Subpart H, Applications for Licenses, Certifications and Approvals
- Subpart I, Maintaining and Revising Licensing Basis Information
- Subpart J, Reporting and Administrative Requirements

Probabilistic Risk Assessment
(PRA) in a Leading Role

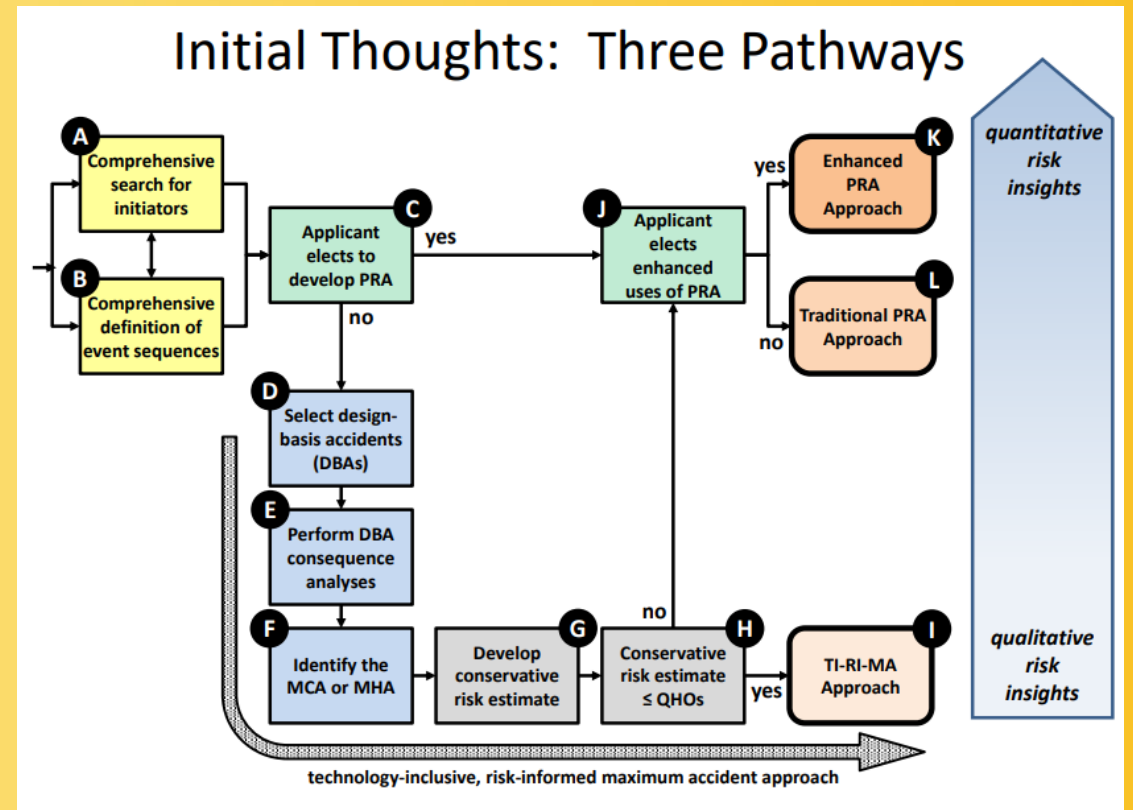
Additional Required Licensing
Metrics Based on PRA

Additional Required Plant
Operating Programs

External stakeholder feedback on the LMP-like framework resulted in NRC development of non-PRA methodologies

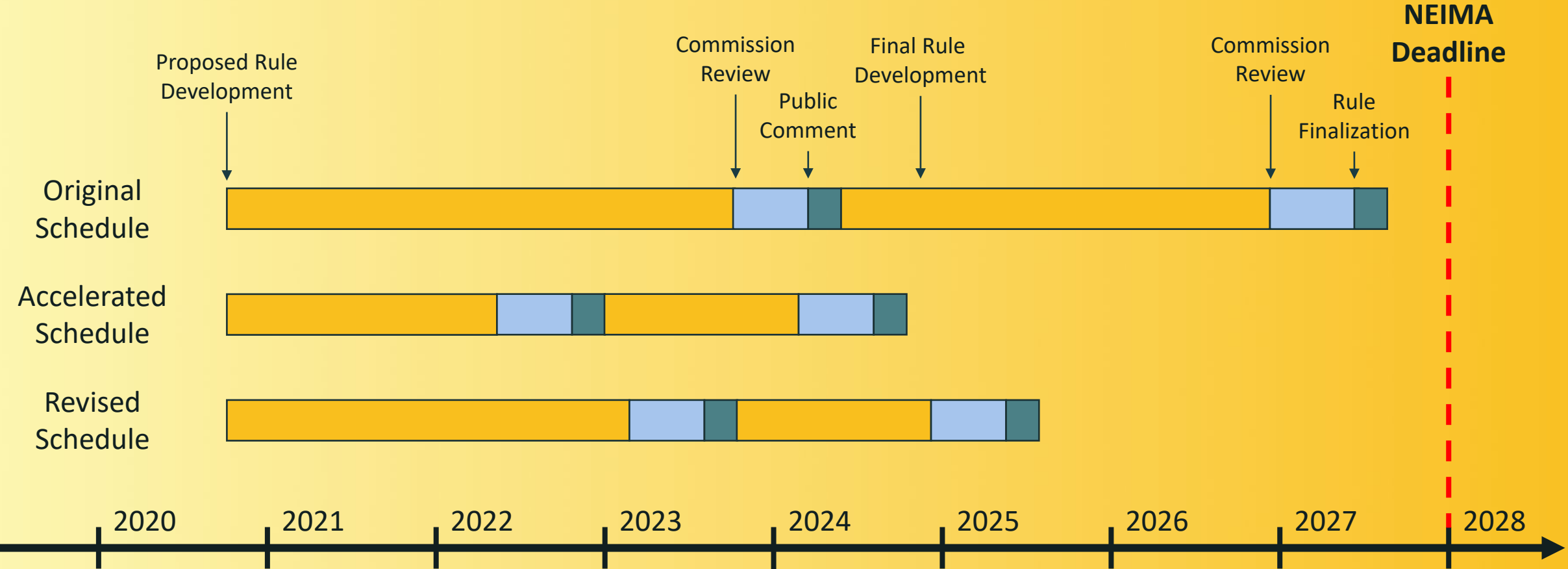
Part 5X Supplement: “Technology-inclusive alternative requirements for commercial nuclear plants”

- Leveraging Part 50 requirements
- Aligning with international requirements
- More options for risk analysis
 - Enhanced PRA approach
 - Traditional PRA approach
 - Technology-inclusive, risk-informed maximum accident (TI-RI-MA) approach



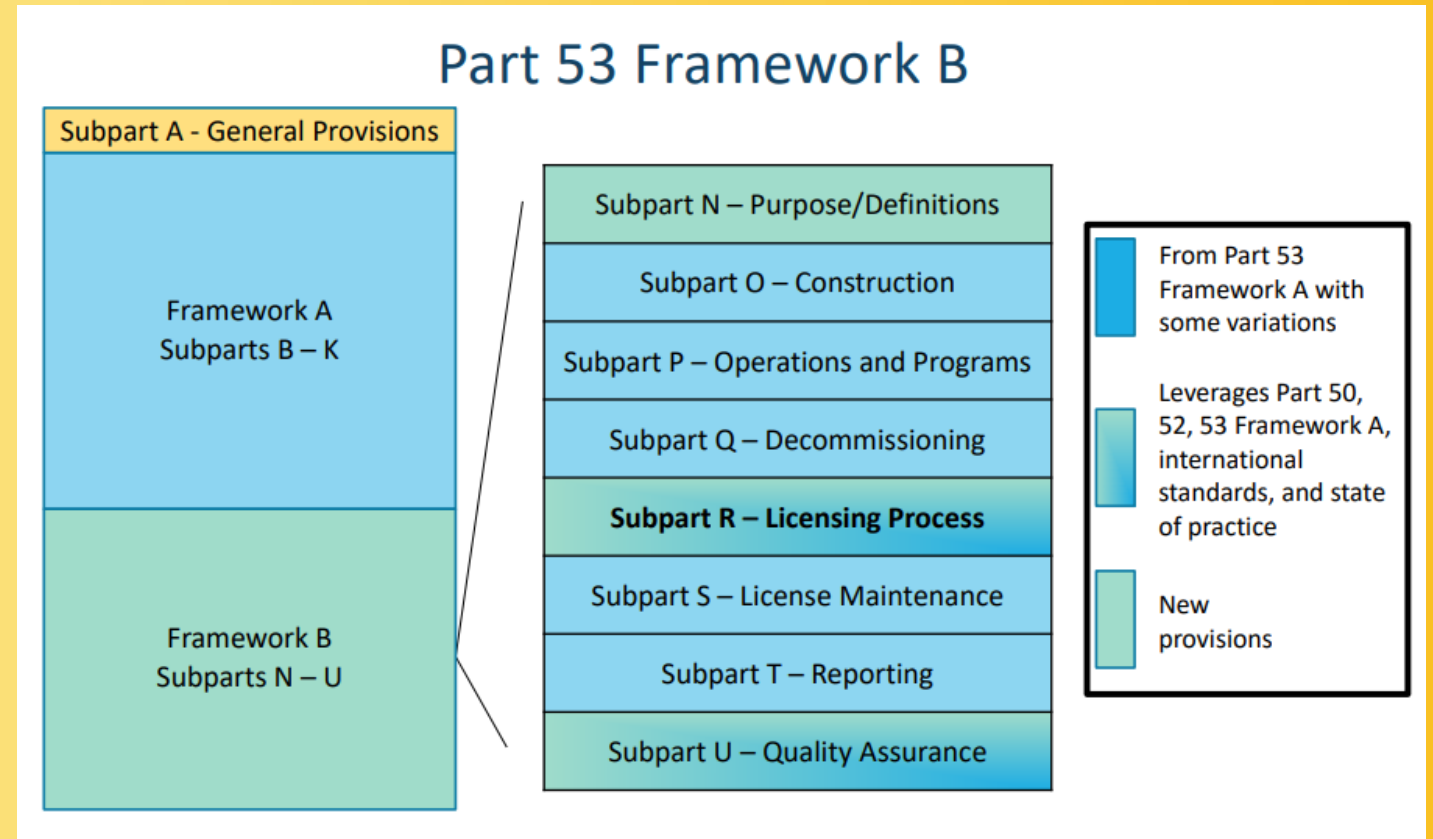
[NRC Presentation on Part 53 \(Nov. 10, 2021\)](#)

Inclusion of new deterministic framework for advanced reactors resulted in extension of rulemaking schedule



NRC staff incorporation of deterministic framework resulted in development of a second licensing pathway

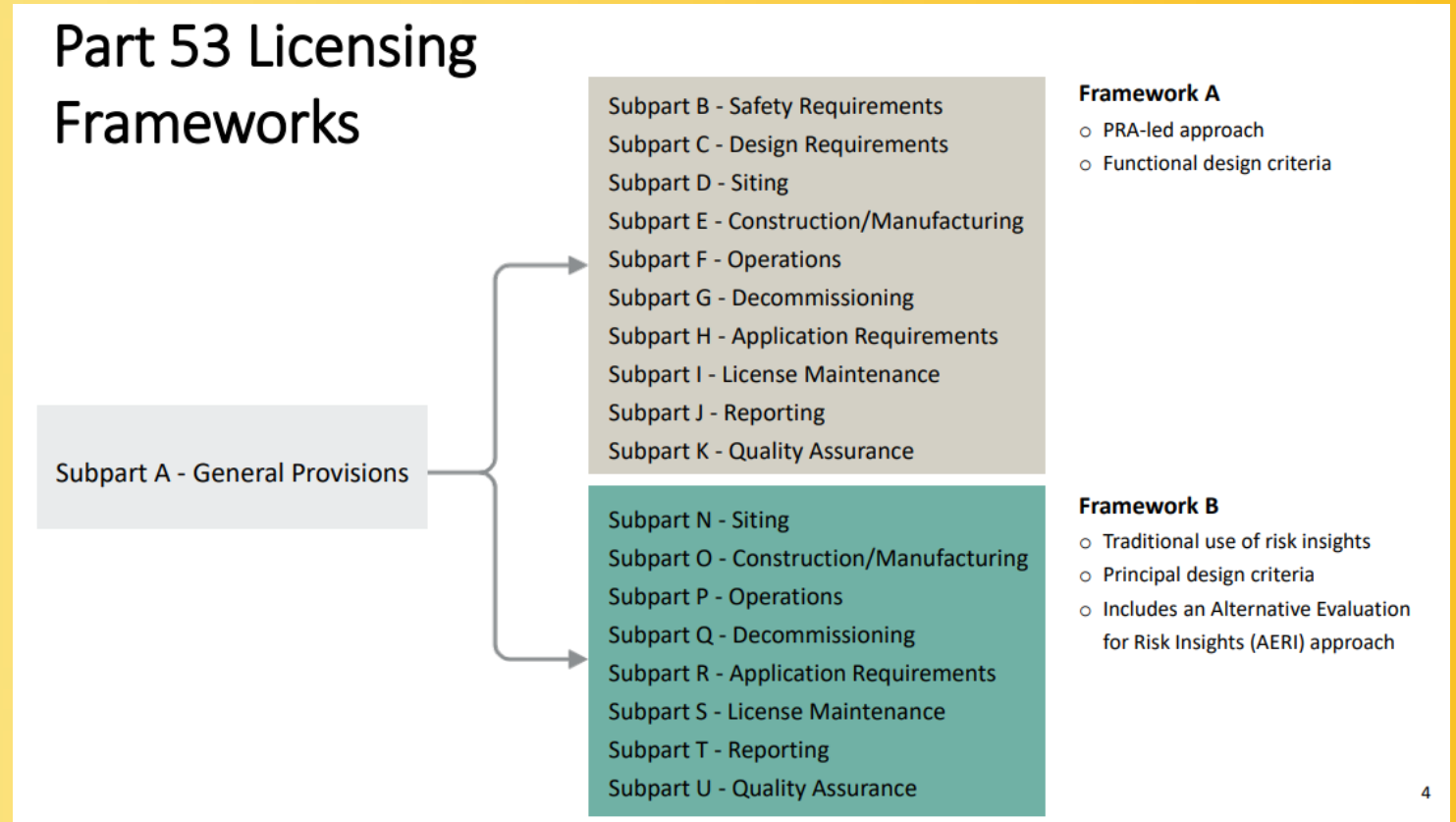
- Incorporated applicable existing Part 53 framework innovations
- Leveraged Part 50 and Part 52 rule language
- Considered compatible with international standards
- Developed unique rule language including traditional use of risk-insights, Alternative Evaluation for Risk Insights (AERI) approach, and Principal Design Criteria (PDC)



[NRC Presentation on Part 53 \(May 11, 2022\)](#)

NRC staff draft proposed rule was submitted to the Commission in March 2023 for review and approval

- Draft proposed rule was submitted to Commission in [SECY-23-0021](#)
- “Framework B would largely replicate the existing licensing approach in 10 CFR Part 50 and 10 CFR Part 52 but would modify it to be technology neutral.”
- 1173 page Draft Proposed Rule Federal Register Notice
- Additional supporting documentation and draft regulatory guidance



[NRC Presentation on Part 53 \(October 12, 2022\)](#)

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External stakeholders expressed concern during draft rule development on the direction of the Part 53 rulemaking process

Too complex

Overly lengthy rule with multiple frameworks

Too much detail in rule compared to guidance

New terminology without precedent

Repeated requirements instead of citing them

Overly burdensome

Additional regulatory metrics (e.g., QHOs)

Additional operational program requirements

New requirements for design and licensing

Prescriptive analysis and program requirements

Limited benefits

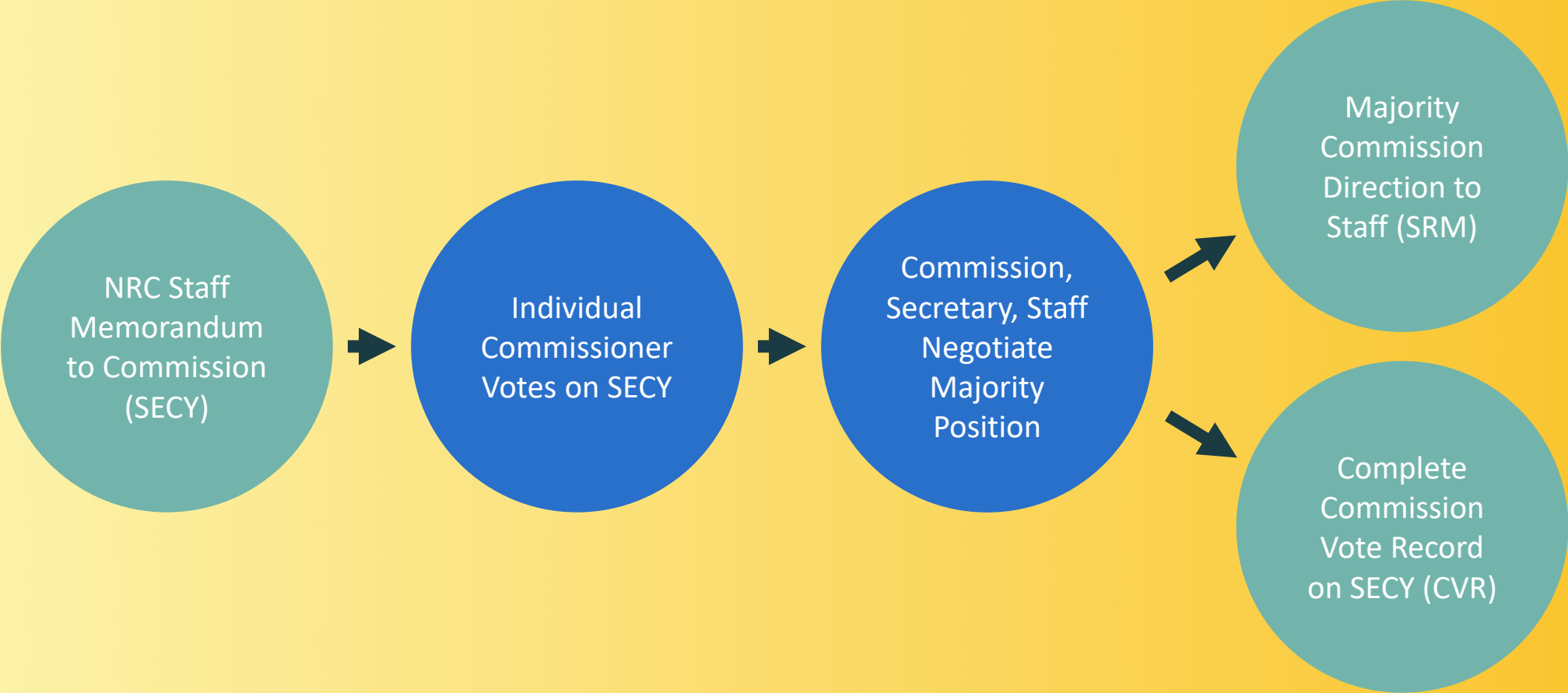
Replicates requirements in Part 50 and Part 52

Improvement over use of LMP is not clear

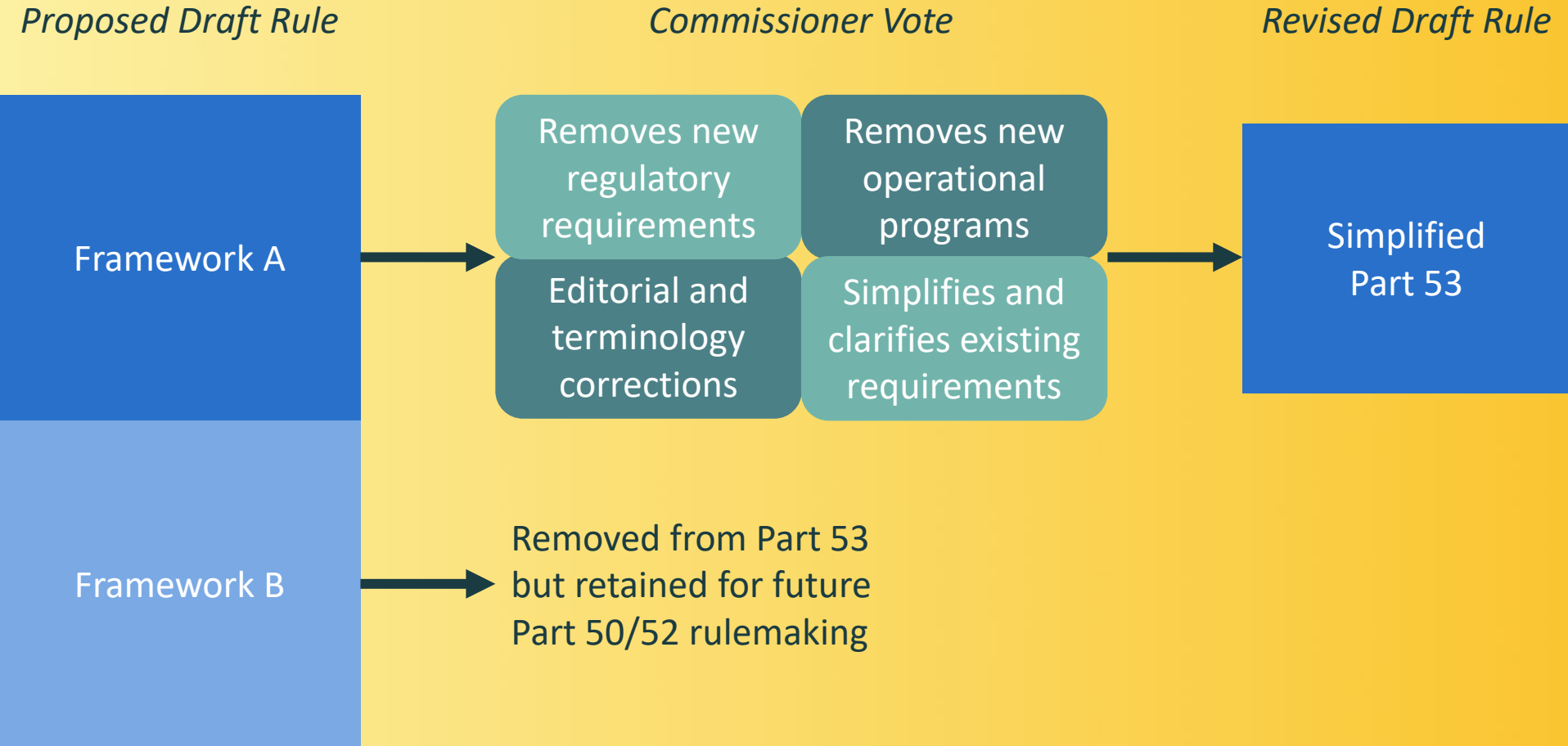
Regulatory exemptions may still be needed

Part 53 may not improve licensing timelines

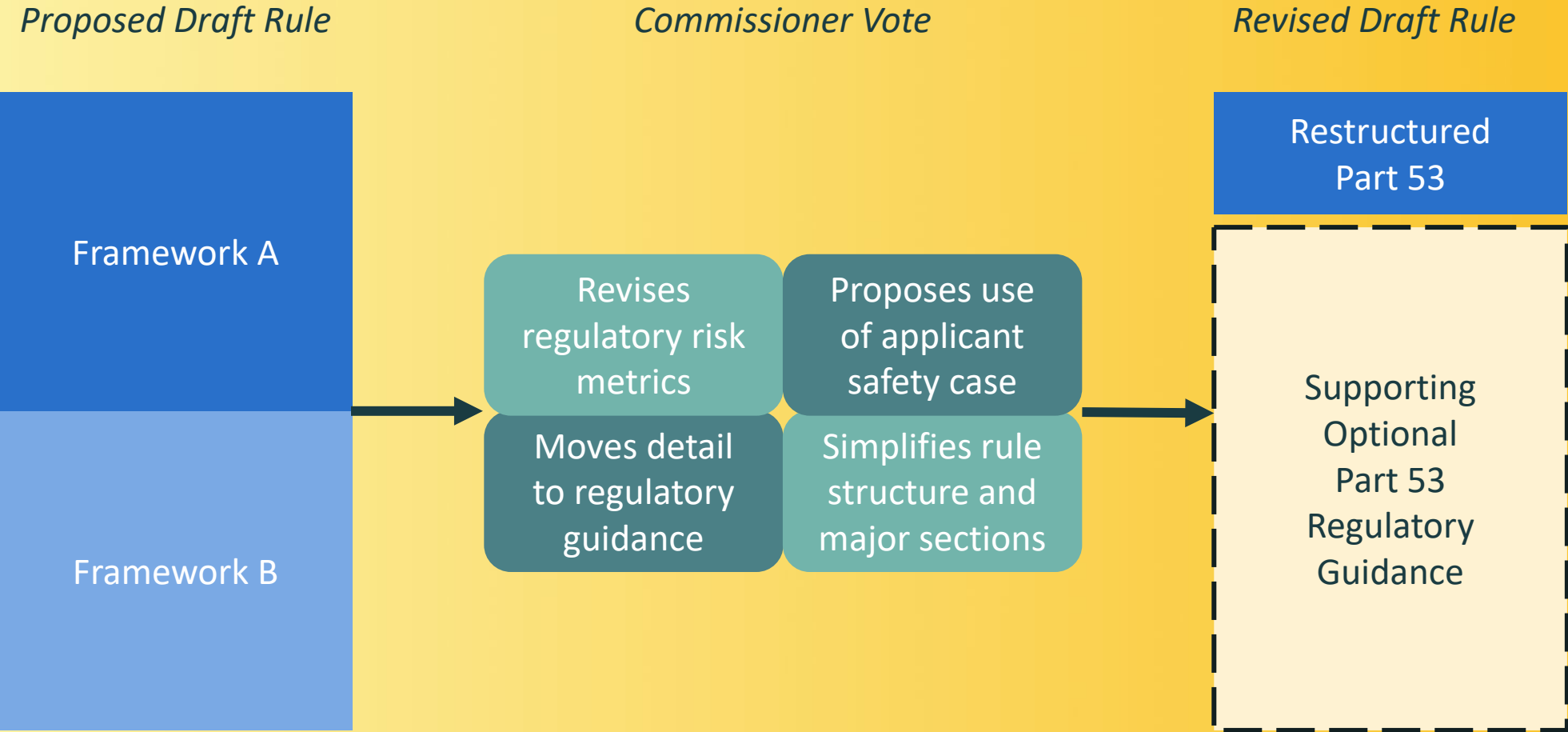
Commission voting process on policy issues is a combination of public and confidential processes



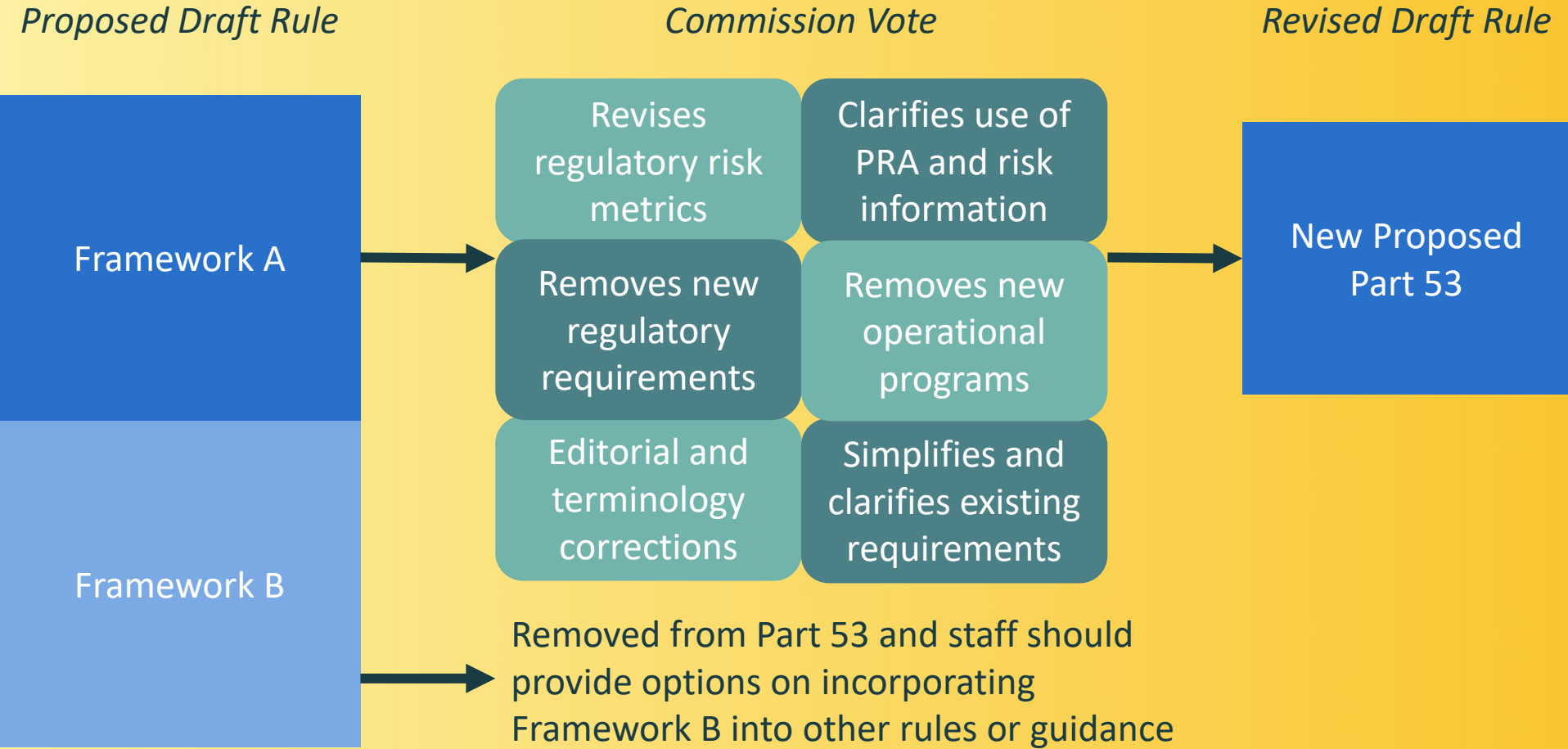
Commissioner Caputo's vote on Part 53 provided direction on reducing the complexity and scope of the rule



Commissioner Wright's vote on Part 53 provided direction on how to overall reorganize and restructure the rule



Commission vote on Part 53 provided substantial direction to the NRC staff to modify the proposed draft rule



Commission SRM addressed many external stakeholders concerns about the content and direction of the Part 53



Revised to Comprehensive Risk Metric



New program requirement eliminated



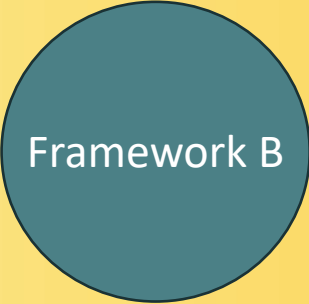
Role of PRA for Part 53 licensing clarified



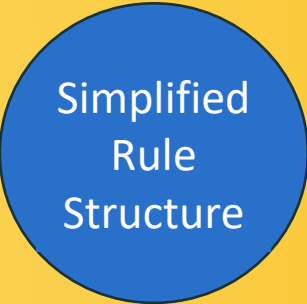
ALARA design requirement eliminated



Quality assurance requirements aligned with Part 50 App. B



Framework B methodologies removed

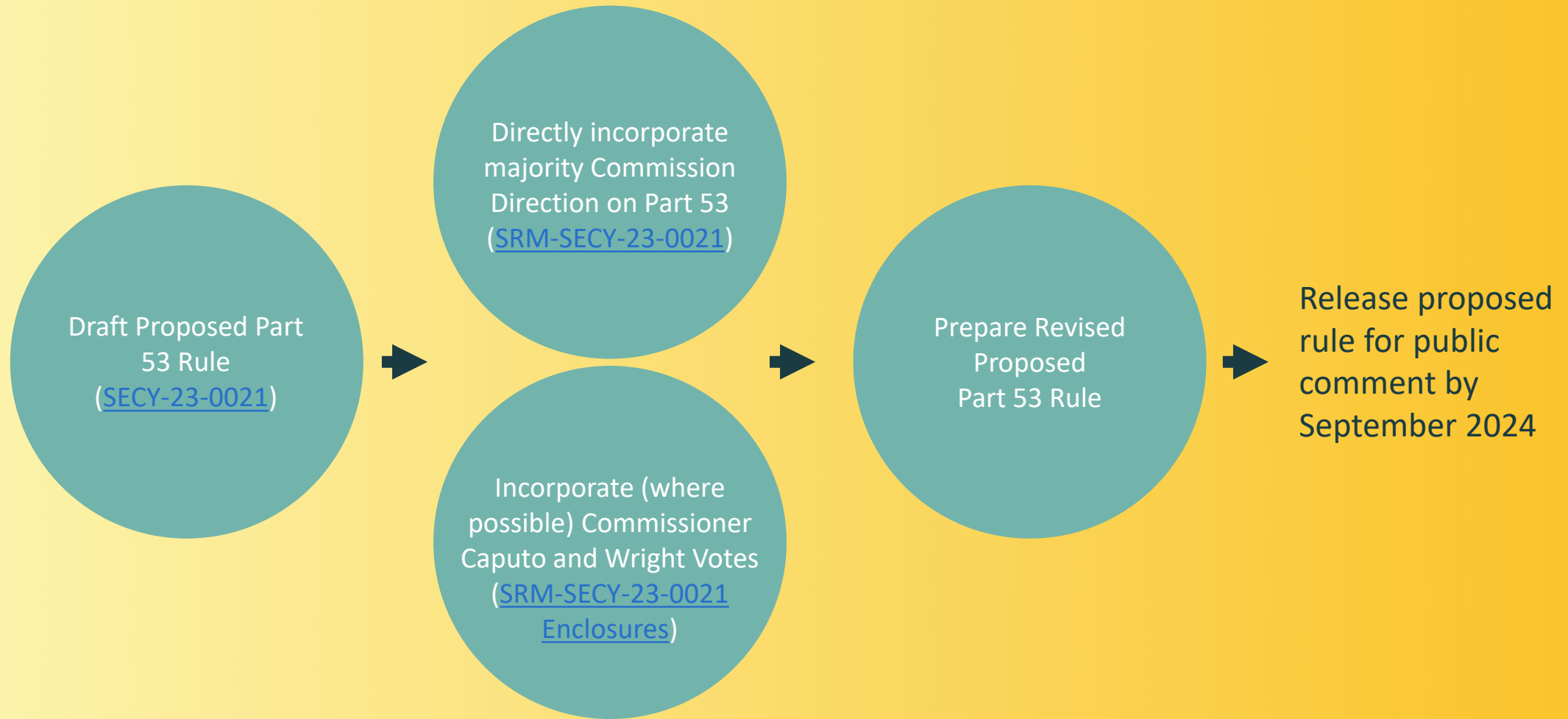


Overall rule shortened and simplified

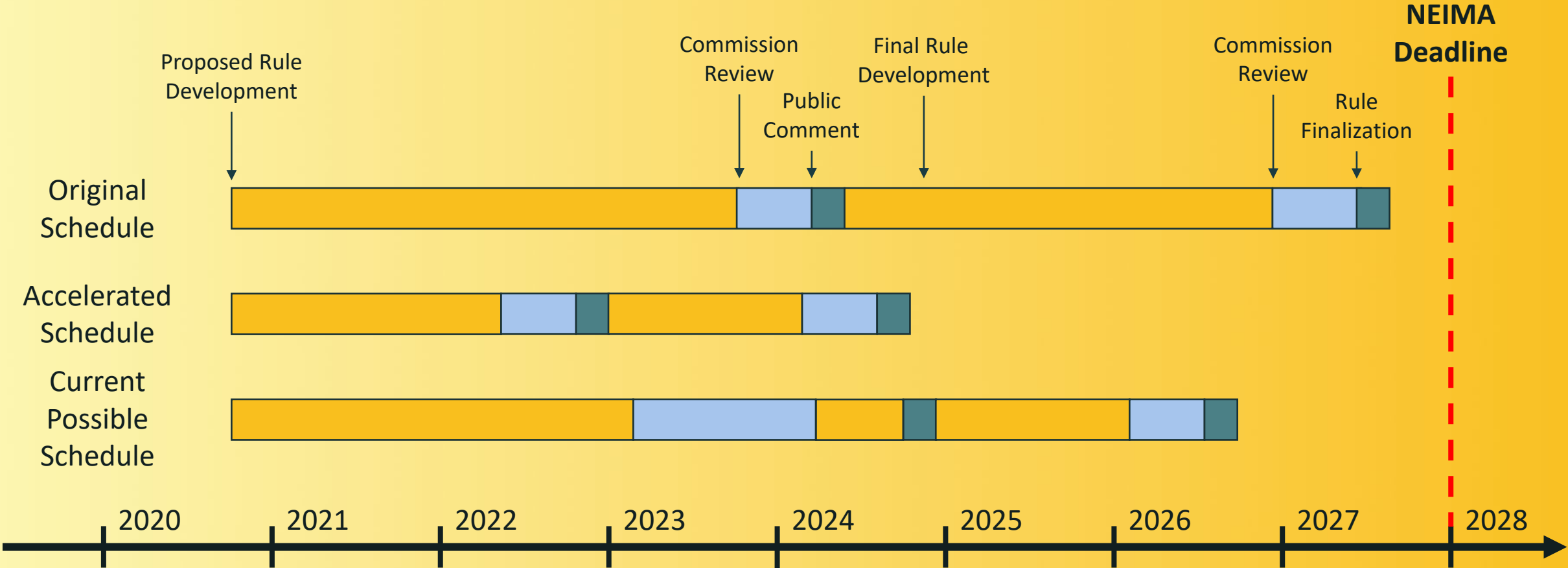


Greater rule emphasis on flexibility

NRC staff have six months to incorporate Commission direction and prepare revised rule for public comment



Commission revisions on Part 53 still allow NRC to meet NEIMA deadline to complete rulemaking in 2027



Next steps on Part 53 focus on staff implementation of Commission direction and addressing open policy questions

Staff implementation of Commission SRM

- Supporting and engaging with staff on implementation of Commission direction in SRM

Comprehensive Risk Metrics (CRM)

- Collaboratively developing technical and policy basis for CRM for advanced reactor licensing

New security requirements

- Understanding Commission direction and staff implementation of updated security requirements

Expectations for application PRA

- Understanding Commission direction and staff implementation of application PRA expectations

Continued stakeholder engagement on Part 53 is critical to creating a transformative rule for advanced reactors



Effective, efficient, and predictable licensing of advanced nuclear energy in the 2020s and beyond