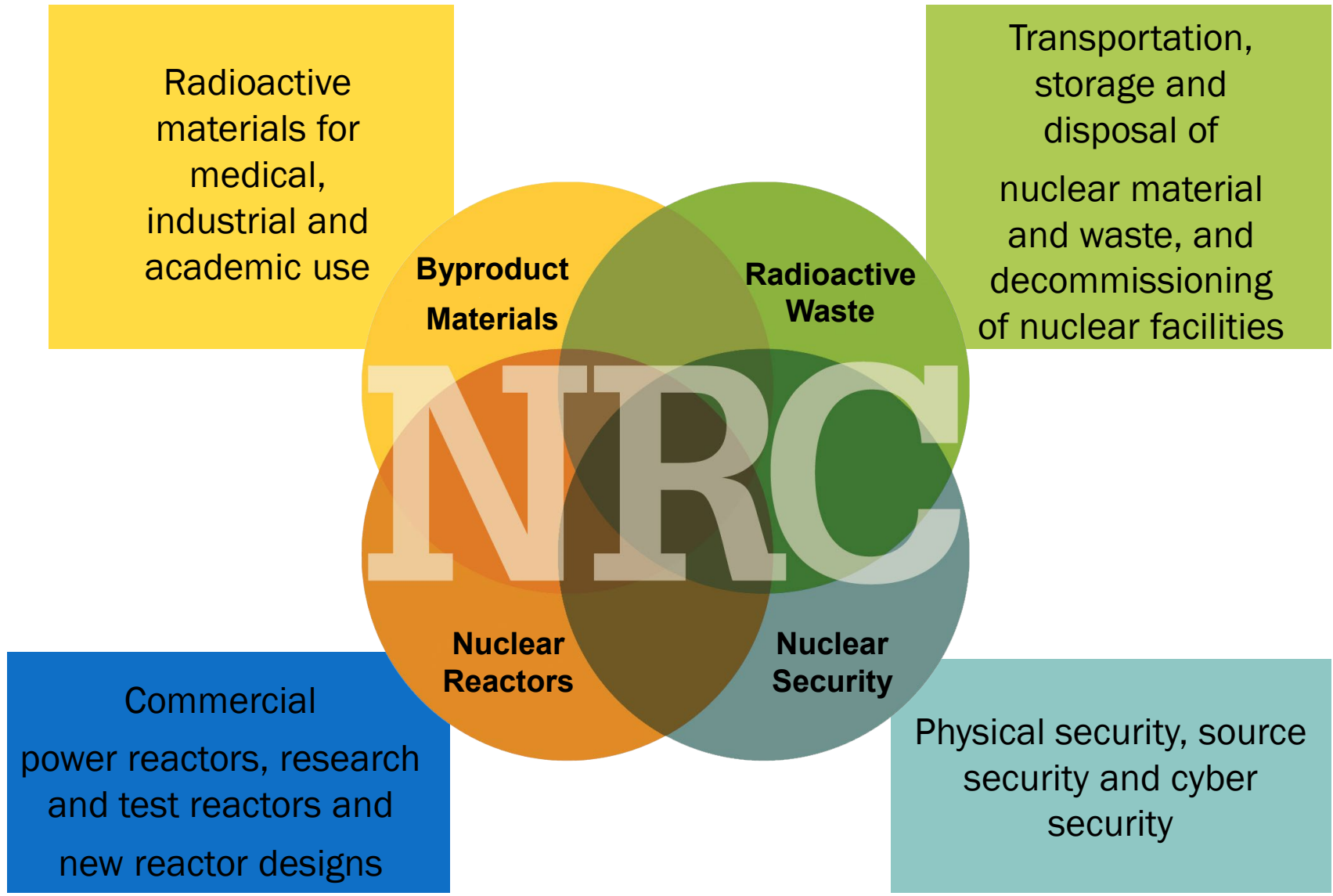
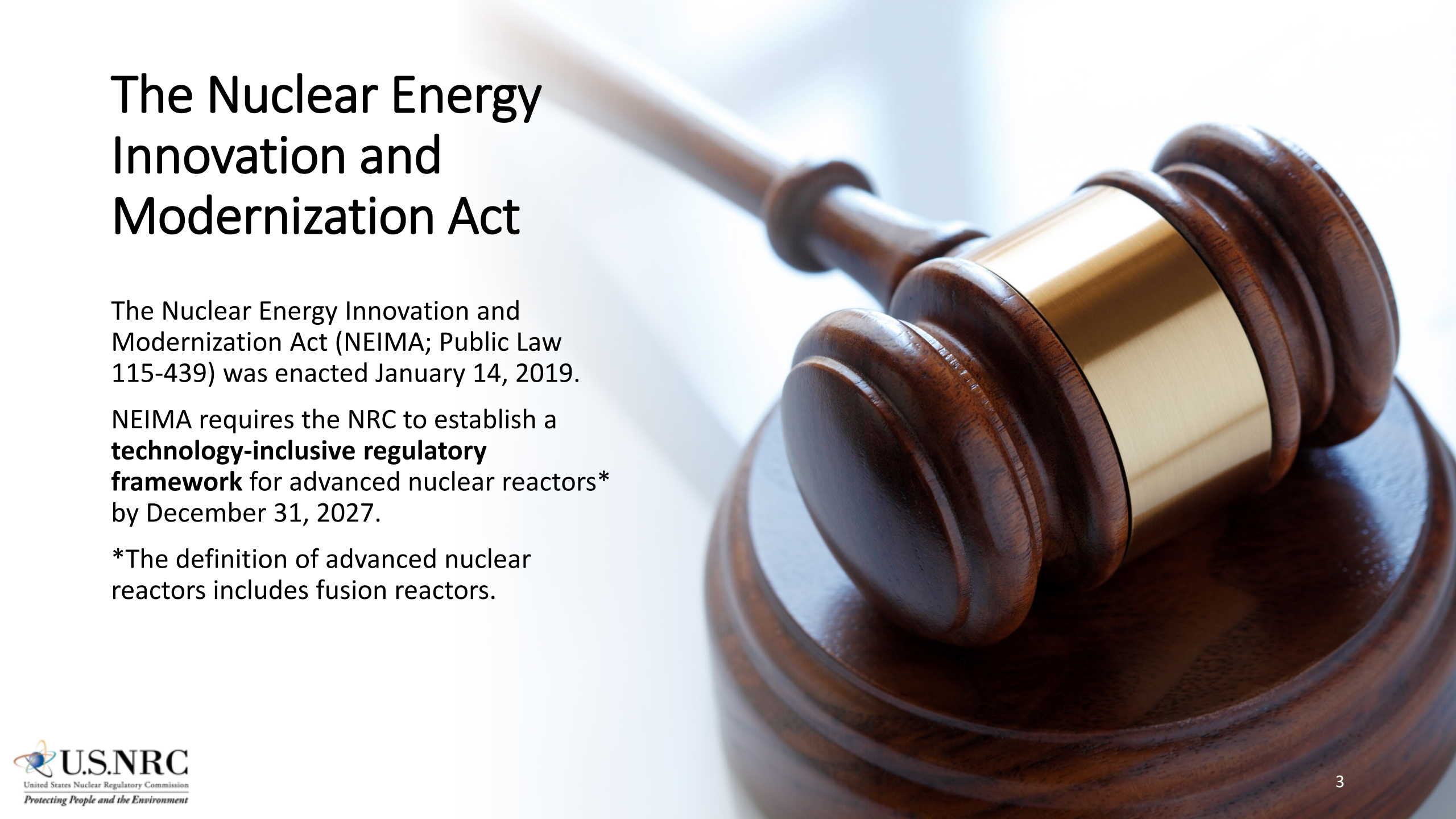


# U.S. Regulatory Framework for Emerging Fusion Technologies

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Duncan White & Allyce Bolger  
U.S. Nuclear Regulatory Commission  
Office of Nuclear Material Safety and Safeguards





# The Nuclear Energy Innovation and Modernization Act

The Nuclear Energy Innovation and Modernization Act (NEIMA; Public Law 115-439) was enacted January 14, 2019.

NEIMA requires the NRC to establish a **technology-inclusive regulatory framework** for advanced nuclear reactors\* by December 31, 2027.

\*The definition of advanced nuclear reactors includes fusion reactors.

# Proposed Regulatory Approaches

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On January 3, 2023, the NRC staff submitted SECY-23-001, “Options for Licensing and Regulating Fusion Energy Systems” (ML22273A163).

The Commission paper proposed three options for establishing a framework for fusion systems.

Utilization Facility

Byproduct Material

Hybrid

# Commission Directive

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On April 13, 2023, the Commission issued SRM-SECY-23-0001 (ML23103A449), directing the staff to implement a byproduct material regulatory approach to near-term fusion energy systems:

- Modify existing 10 CFR Part 30, “Rules of General Applicability to Domestic Licensing of Byproduct Material,” to include a fusion energy systems framework
- Develop a new volume of NUREG-1556, “Consolidated Guidance About Materials Licenses,” dedicated to fusion energy systems
- Notify the Commission if an anticipated fusion design presents hazards sufficiently beyond those of near-term fusion technologies and make recommendations for taking appropriate action as needed



# Byproduct Materials Framework

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Limit access and use of radioactive material

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Provide flexibility – requirements based on quantity, form, and use of material

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Permit use of radioactive material by qualified individuals

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Ensure adequate level of safety and security

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# Agreement State Programs

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## Assumption of Regulatory Authority

The NRC discontinues and the Agreement State assumes regulatory authority

Not a delegated program

88% of specific licenses are under Agreement State purview



## Adequacy of Program

Provides reasonable assurance of protection of public health and safety in regulating the use of agreement material



## Compatible Program

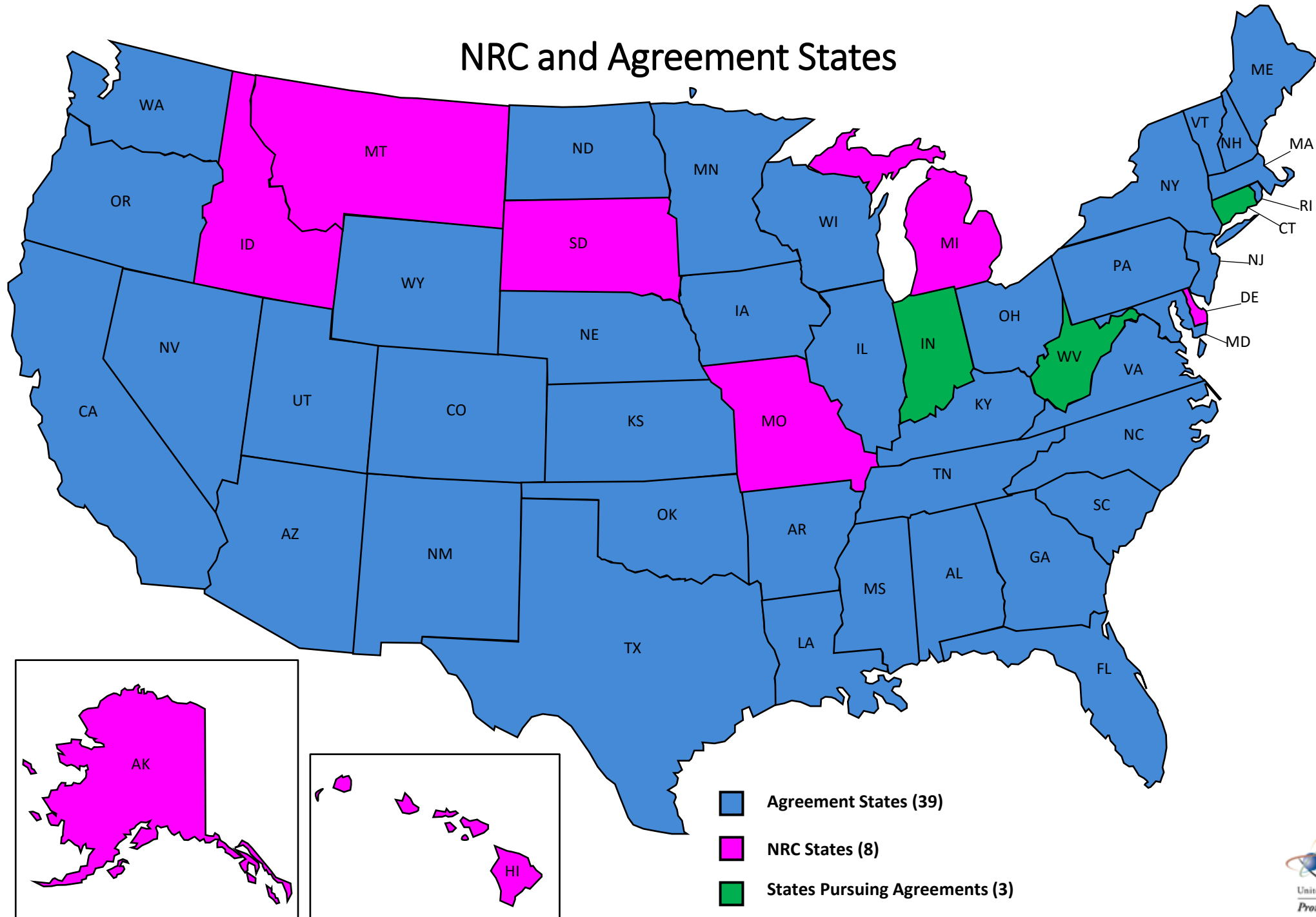
Compatible regulations, procedures, and guidance  
Cohesive national program



## Agreement State Oversight

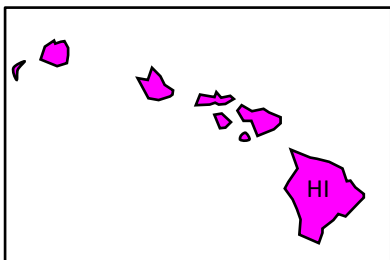
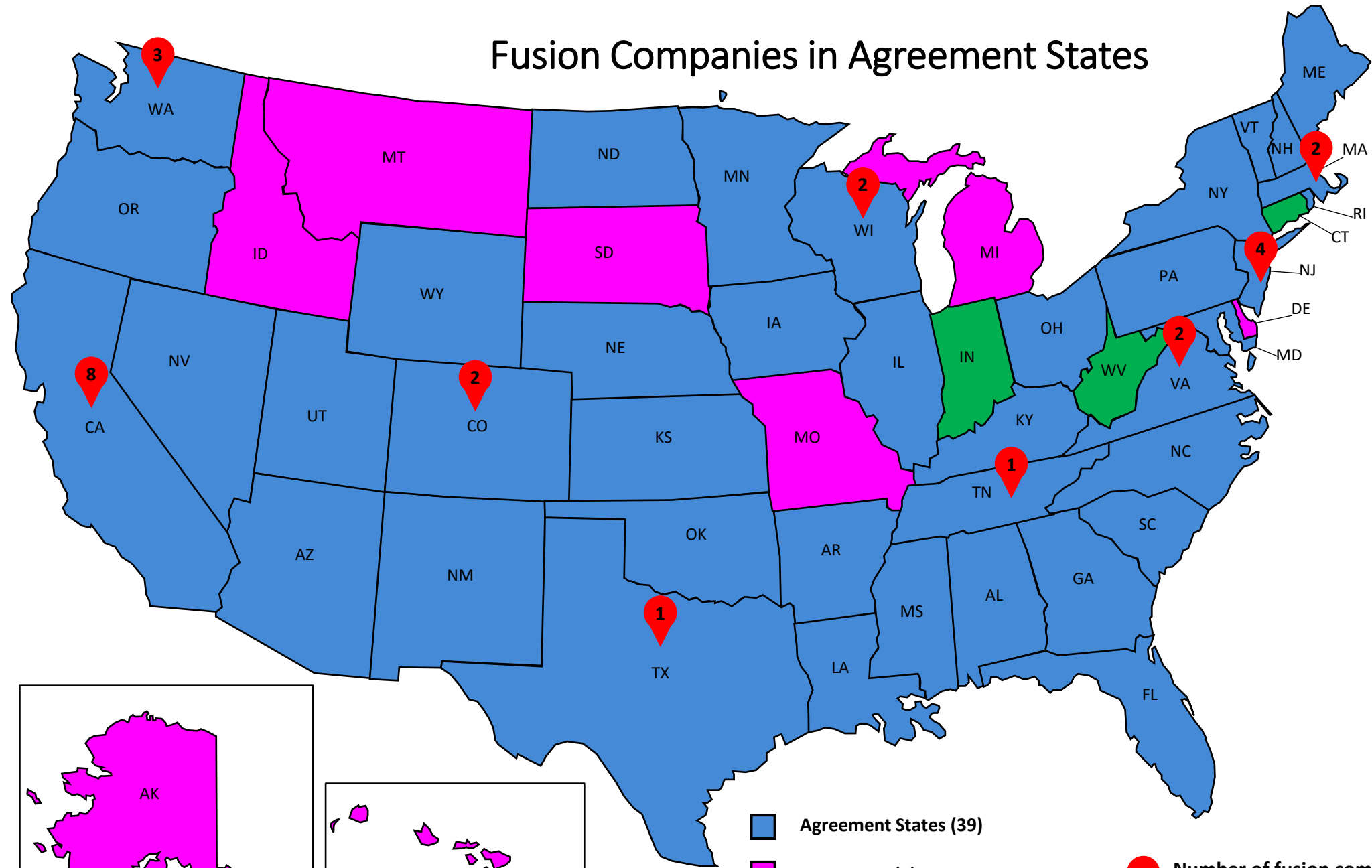
Integrated Materials Performance Evaluation Program (IMPEP)  
Regulation reviews

# NRC and Agreement States





# Fusion Companies in Agreement States



- Agreement States (39)
- NRC States (8)
- States Pursuing Agreements (3)

Number of fusion company headquarters by State

Source: Location Data from Fusion Industry Association 2023 Global Fusion Industry Report



# Fusion Systems Rulemaking

- Designing a Framework
  - Diversity of fusion technologies
  - Identifying radiological hazards
  - Design and programmatic elements
- NRC & Agreement State Participation
- Stakeholder Engagement

# Revisions to NRC Regulations

New definition for fusion system and revision to the definition of particle accelerator



Revise part 20 “Standards for protection against radiation” to add new paragraph regarding disposal of low-level waste from fusion



Revise part 30 “Rules of general applicability to domestic licensing of byproduct material” to add new paragraph under “Application for specific licenses”

General description of fusion system

Operating and emergency procedures

Organization structure related to radiation safety

Training

Inspection and maintenance

Material inventory

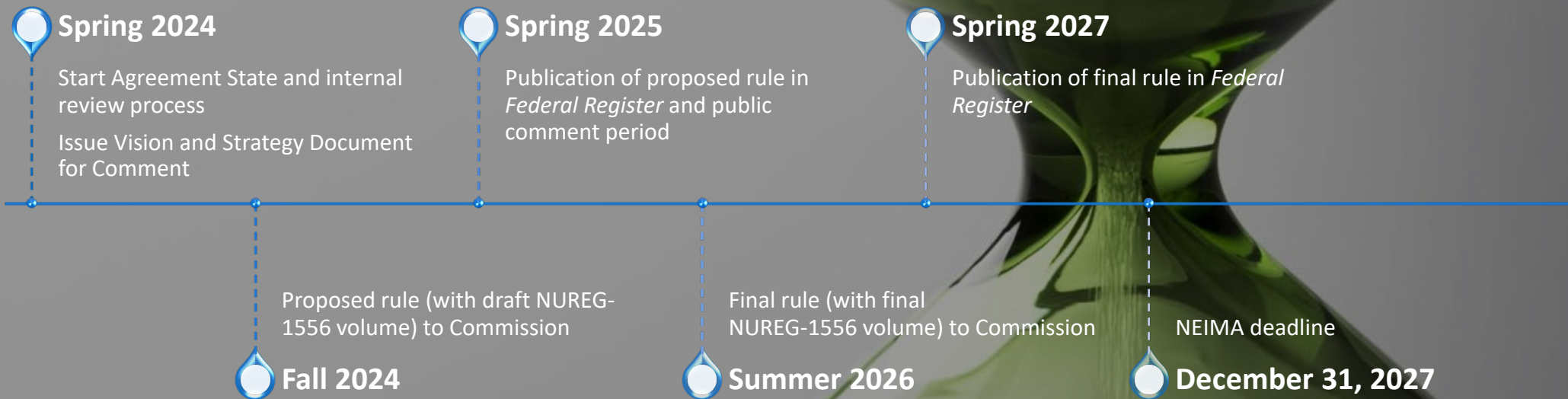
# Guidance Development

## NUREG-1556, Volume 22

- Cover contents of application and licensing process
- Apply to fusion systems for research and development or commercial deployment
- Ensure technology neutrality
- Focus on byproduct material and associated radiation
- Emphasize containing, processing, or controlling radiation and radioactive materials.
- Limit to specific components—not facility-wide
- Potentially identify additional changes to the preliminary draft guidance during the rulemaking process



# Upcoming Milestones



# Thank you

## Contacts

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NRC Fusion Website



Rulemaking