

Designing a Flexible, Resilient Regulatory Framework for Emerging Fusion Technologies

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Adapting to a Changing Landscape
#nrcric2024

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

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

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

Limit access and use of radioactive material

Permit use of radioactive material by qualified individuals

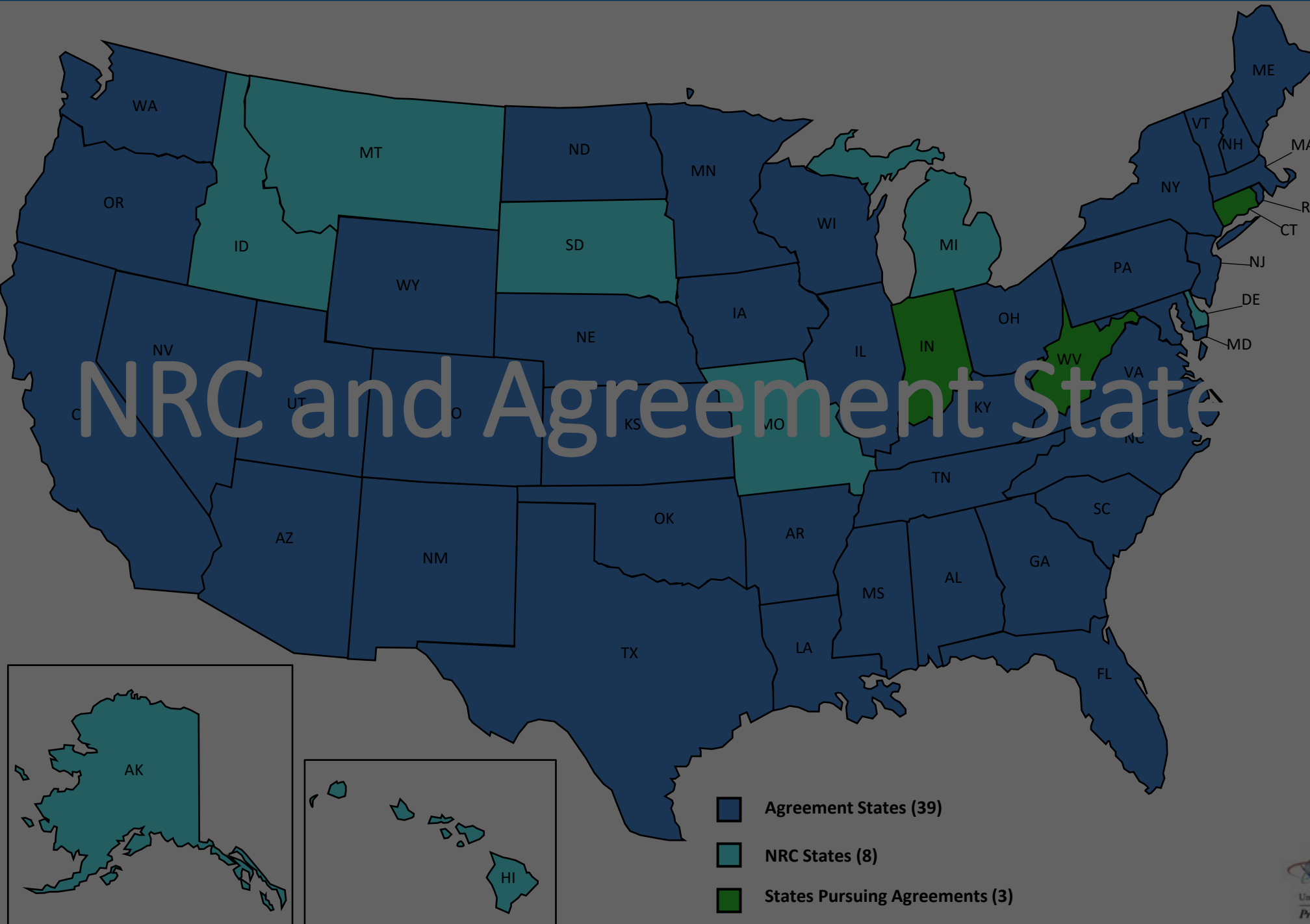
Ensure adequate level of safety and security

Provide flexibility

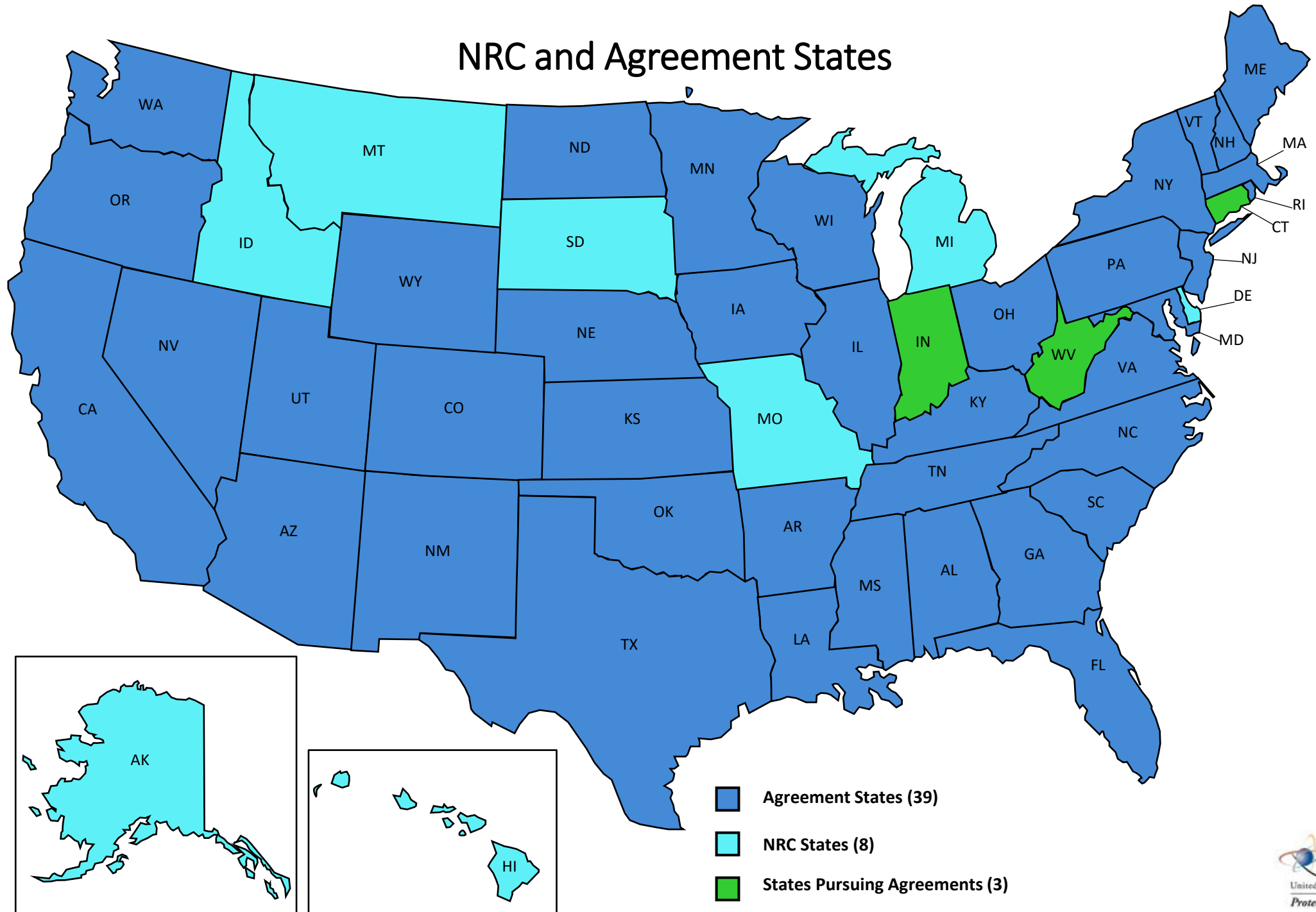
Impose reasonable restrictions



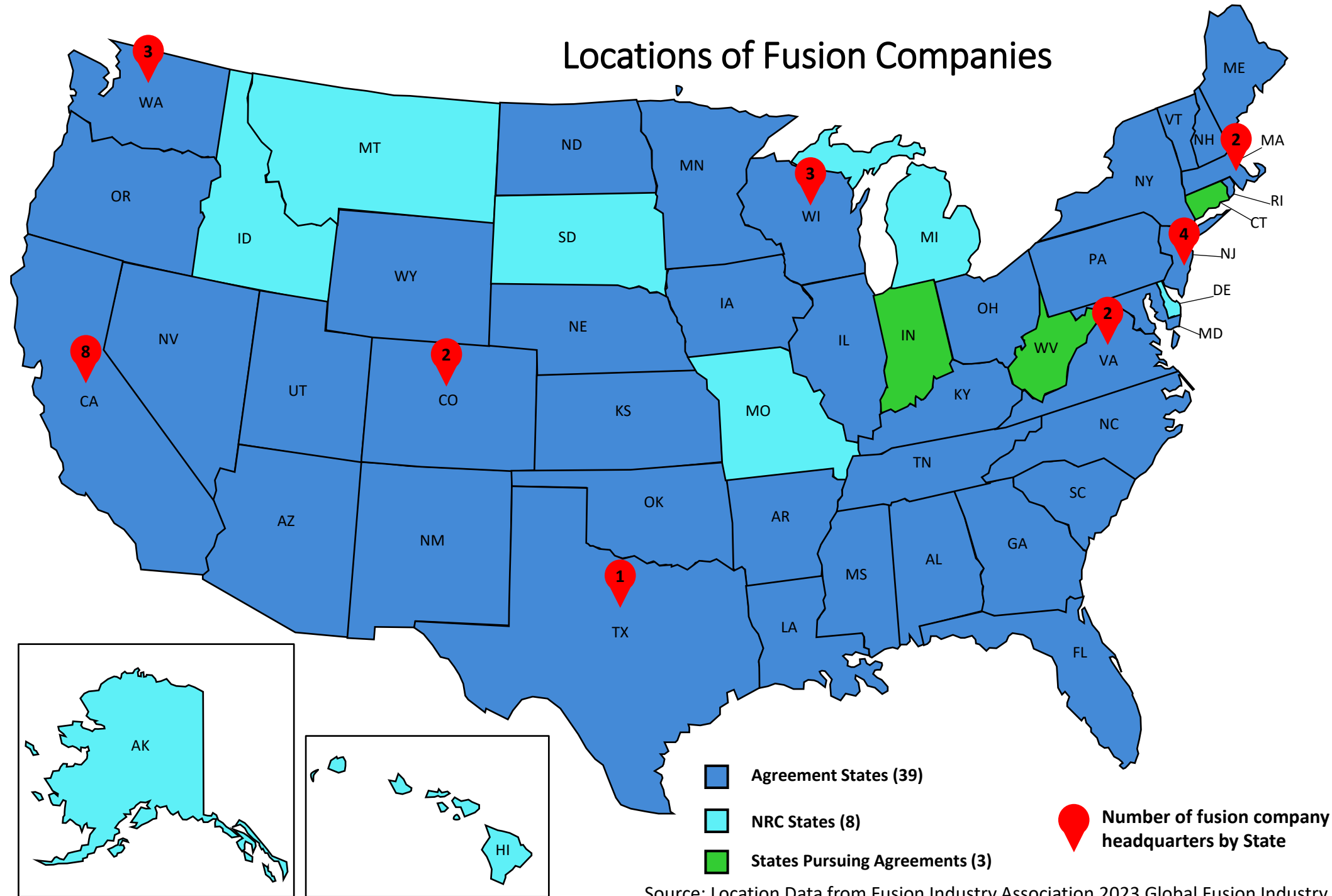
NRC and Agreement State



NRC and Agreement States



Locations of Fusion Companies



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

Agreement State Programs



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

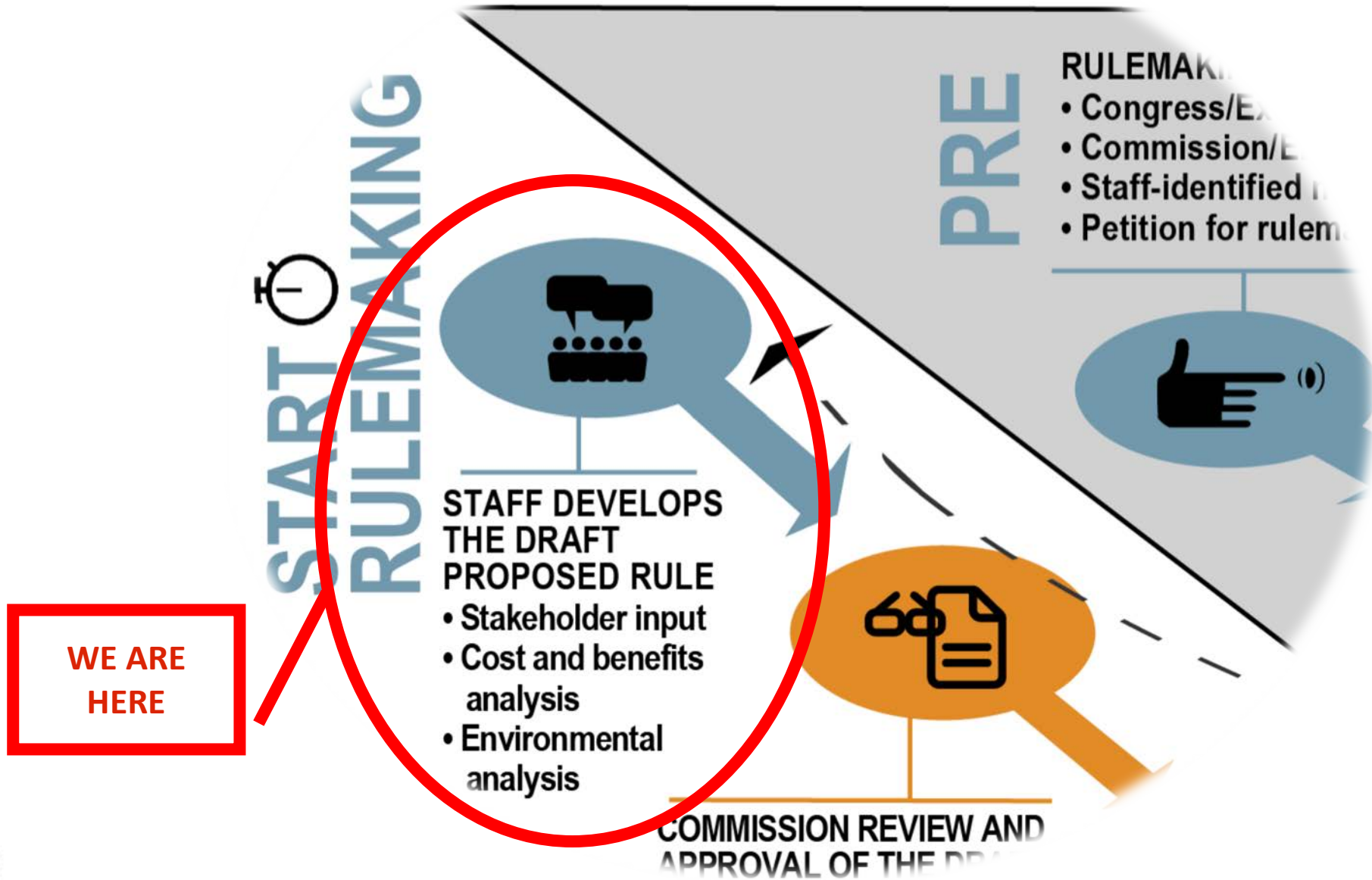
Compatible regulations, procedures, and guidance
Cohesive national program



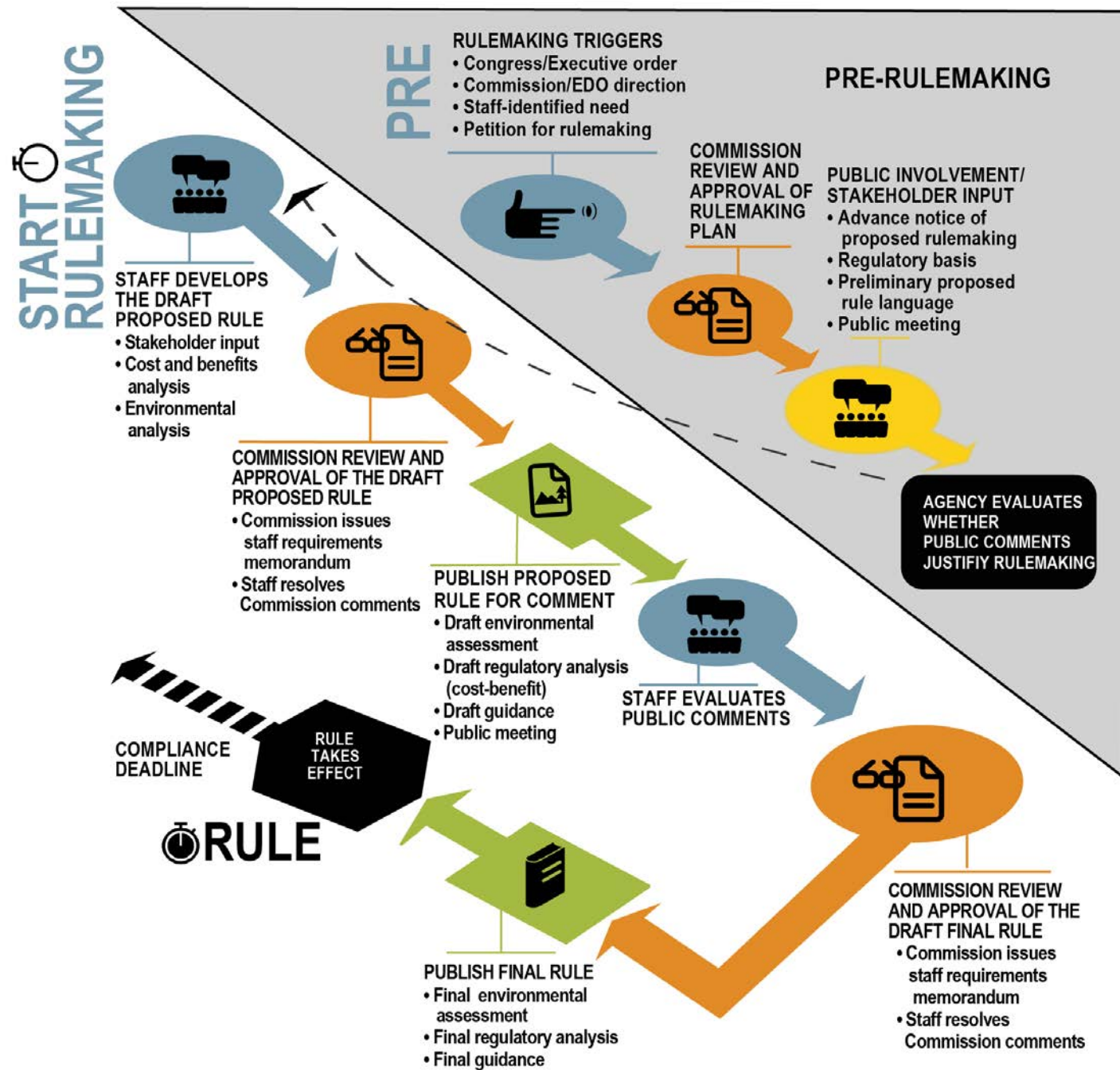
Agreement State Oversight

Integrated Materials Performance Evaluation Program (IMPEP)
Regulation reviews

Rulemaking Process



Rulemaking Process



As of February 2023

Regulatory Framework for Fusion Systems Rulemaking Working Group

- NRC & Agreement State Participation
- Stakeholder Engagement
 - Diverse organizations
 - Building capabilities and knowledge
 - Leveraging existing regulatory experience
- Designing a Flexible, Resilient Regulatory Framework for Emerging Fusion Technologies
 - Diversity of fusion technologies
 - Identifying radiological hazards
 - Design and programmatic elements



Revisions to Title 10 of the *Code of Federal Regulations*

- New definition for fusion system
- New 10 CFR 30.32(k) 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
- New 10 CFR 20.2008(c) regarding disposal of low-level waste from fusion waste



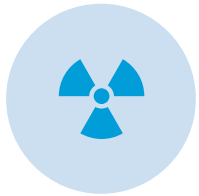


Guidance Development

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

Contents of the Application



Types and form of
radioactive material



Purpose(s) for which
licensed material will
be used



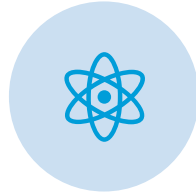
Individual(s)
responsible for
radiation safety
program and their
training and experience



Training for individuals
working in or
frequenting restricted
areas



Facilities and
equipment



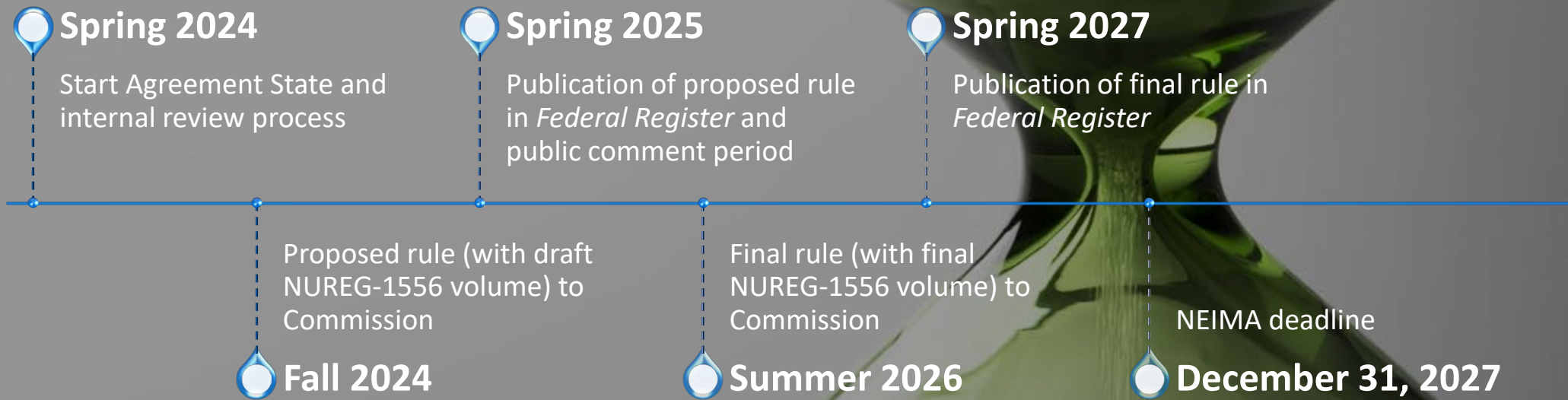
Radiation protection
program



Waste management



Upcoming Milestones



Thank you

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NRC Fusion Website



Docket ID