U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Developing a Regulatory Framework for Fusion Energy Systems

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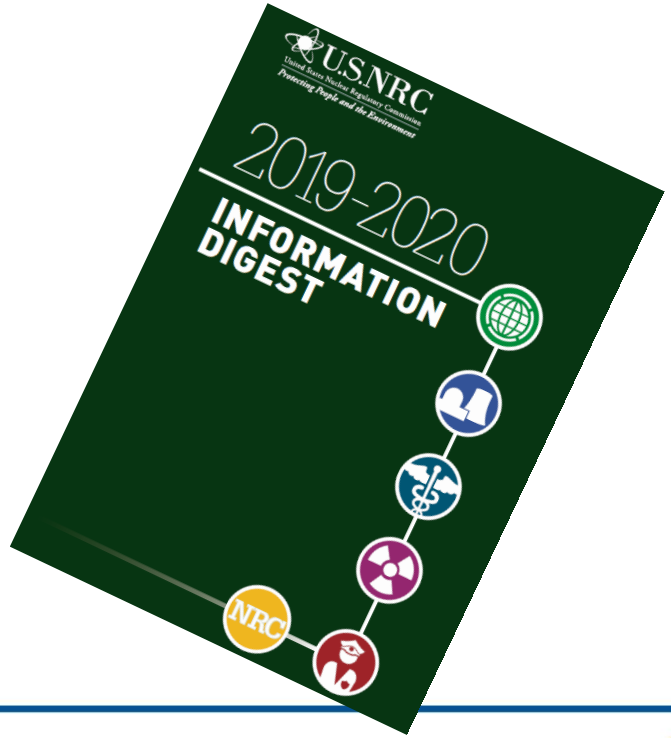
Nuclear Regulatory Commission

- The U.S. Nuclear Regulatory Commission (NRC) is an independent agency created by Congress. The NRC regulates the Nation's civilian commercial, industrial, academic, and medical uses of nuclear materials.
- Major Programs
  - Nuclear Reactors
    - Commercial
    - Research & Test
  - Materials & Waste
    - Materials
    - Nuclear Fuel Cycle



Background

- Nuclear Energy Innovation and Modernization Act (NEIMA) signed into law in January 2019 requires the NRC to complete a rulemaking to establish a technology-inclusive, regulatory framework for optional use for commercial advanced nuclear reactors no later than December 2027
  - (1) ADVANCED NUCLEAR REACTOR—The term "advanced nuclear reactor" means a nuclear fission or **fusion reactor,** including a prototype plant… with significant improvements compared to commercial nuclear reactors under construction as of the date of enactment of this Act, …

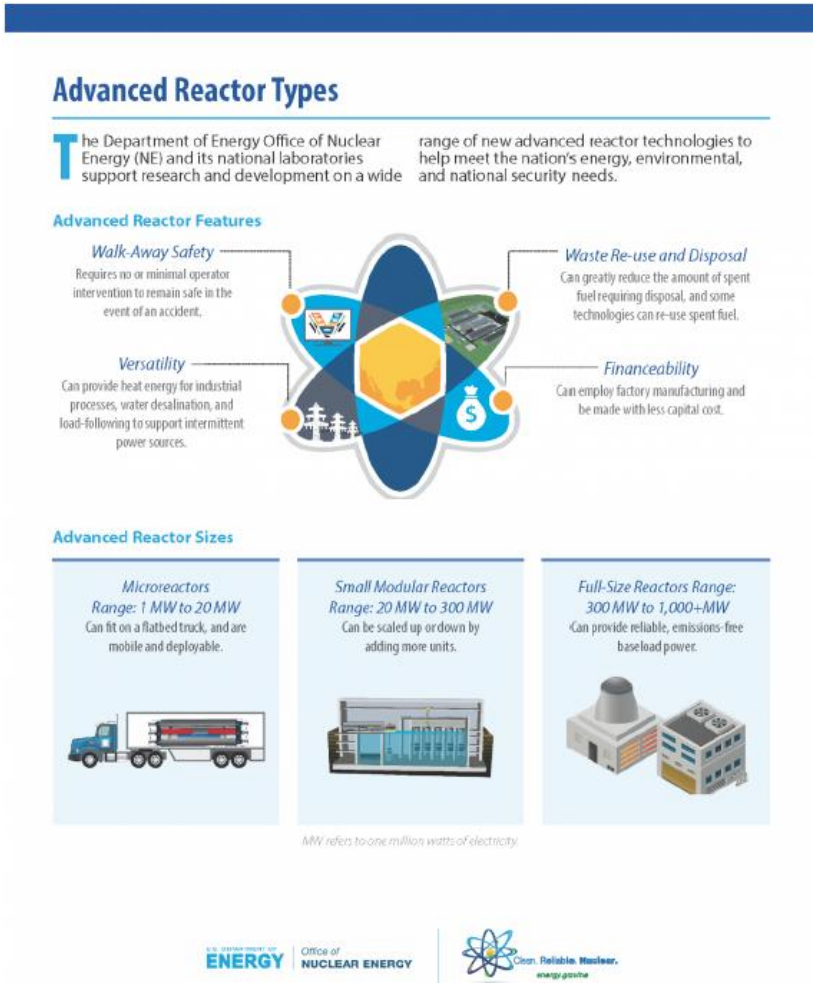
Commission Direction on Rulemaking Plan

- In SRM-SECY-20-0032, dated October 2, 2020 (ADAMS ML20276A293), the Commission:
  - Approved the staff's proposed approach for the rulemaking
  - Directed the staff to provide:
    - a schedule with milestones and resource requirements to achieve publication of the final Part 53 rule by October 2024
    - key uncertainties impacting publication of the final rule by that date
    - **options for Commission consideration on licensing and regulating fusion energy systems**
  - Directed the staff to develop and release preliminary proposed rule language intermittently, followed by public outreach and dialogue

Current Activities

- On November 2, 2020, staff submitted a Commission memorandum responding to the SRM direction to provide a schedule with milestones and resources to complete the final rule by October 2024 (ADAMS ML20288A251).
- Continuing interactions such as the public forum in October 2020 with an NRC public meeting scheduled for **January 26, 2021**
- Assess potential risks posed by possible commercial deployment of various fusion technologies and possible regulatory approaches for commercial fusion facilities
- Regulatory framework for advanced reactors (Part 53) being developed to accommodate fusion technologies as much as possible to maintain flexibility for future
- May recommend separate rulemaking for fusion facilities that would extend beyond 2024 but would be completed before 2027.

Advanced Reactor Concepts



- Light-Water Small Modular Reactors
- Non-Light-Water Reactors
  - Liquid Metal Cooled Fast Reactors
  - Gas Cooled Reactors
  - Molten Salt Cooled Reactors
  - Molten Salt Fueled Reactors
  - Heat Pipe Reactors
  - Microreactors
- *Accelerator Driven Systems*
- ***Fusion Reactors***

Regulatory Approaches

- Preliminary assessments left open the regulatory approach for commercial fusion reactors
- Possible approaches include treatment similar to:
  - Nuclear (fission) power plants

  - Materials (e.g., accelerator)

  - Hybrid or new approach ?

Challenge – Diversity of Designs and Hazards

Fusion Technologies

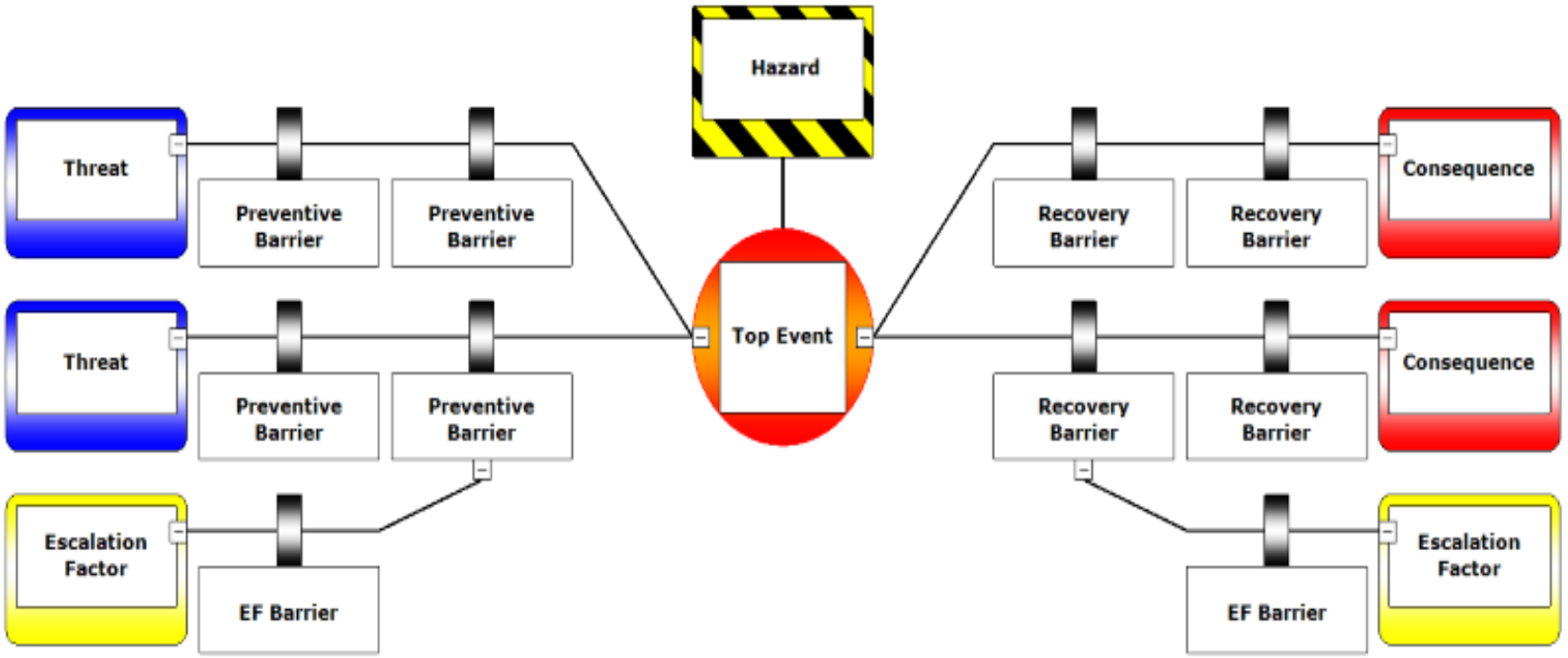
- Magnetic
- Magneto-Inertial
- Inertial

Fusion Reactions

- D-T
- P-^{11}B
- D-^{3}HE

Radiological Hazards
Chemical & Other Hazards

Integrated Approach (Background)



Bow-Tie Risk Management Figure

Questions & Discussion

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