Advanced Reactor Program
Overview

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Implementation Action Plan

**Strategy 1**
Knowledge, Skills and Capability
- ONRL Molten Salt Reactor Training
- HTGR Training
- Fast Reactor Training
- Competency Modeling
- Knowledge Management

**Strategy 2**
Computer Codes & Review Tools
- Identification & Assessment of Available Codes
- Code Development/V&V

**Strategy 3**
Flexible Review Processes
- Regulatory Roadmap
- Prototype Guidance
- Non-LWR Design Criteria
- Environmental Review ISG
- Licensing Modernization Project (LMP)
- Technology Inclusive Content Applications Project (TICAP)
- Licensing Project Plans

**Strategy 4**
Consensus Codes and Standards
- ASME BPVC Section III Division 5
- ANS Standards 20.1, 20.2 30.2, 54.1
- Non-LWR PRA Standard

**Strategy 5**
Policy and Key Technical Issues
- Consequence Based Security (SECY-18-0076)
- EP for SMRs and ONTs (SECY-18-0103)
- Functional Containment (SECY-18-0096)
- Siting near densely populated areas
- Micro Reactor Policy issues
- Environmental policy issues
- Insurance and Liability

**Strategy 6**
Communication
- NRC DOE Workshops
- NRC DOE DOD Micro Reactor MOU
- NRC/DOE GAIN MOU
- NRC/DOE NEICA MOU
- WGSAR
- Memorandum of Cooperation with CNSC
- Periodic Stakeholder Meetings
STRATEGY 1 - Training

• Technology Training Courses
  – Molten Salt Reactors
  – Fast Reactors
  – High-Temperature Gas-Cooled Reactors

(https://www.nrc.gov/reactors/new-reactors/advanced.html#training)
STRATEGY 2 – Computer Codes

Overview of code development approach,

• Volume 1: DBA Information Gaps and Development
• Volume 2: Fuel Performance Code Development Plans
• Volume 3: BDBA Information Gaps and Development Plans.
• **Volume 4: Licensing and Siting Dose Assessment Codes (RAMP)**
STRATEGY 3 – Guidance Development

• Regulatory Review Roadmap

• Advanced Reactor Design Criteria (RG-1.232)
Licensing Modernization Project (LMP)

- Technology-Inclusive Risk-Informed Performance-Based Licensing Approach (NEI-18-04 and DG-1353)
  - Licensing Basis Event Selection
  - Frequency-Consequence Curve
  - Safety Classification of Systems, Structures, and Components
  - Defense in Depth Assessment
- “Part 53” will build off the LMP foundation
Technology-Inclusive Content of Applications Project (TICAP)
STRATEGY 4 – Codes and Standards

• ASME BPVC, Section III, Division 5 for High Temperature Materials

• ASME/ANS Non-LWR Probabilistic Risk Assessment Standard

• ANS Standards
  – 20.1, 20.2, 30.2, 54.1
STRATEGY 5 – Resolving Policy Issues

Consequence oriented approaches to resolving policy issues:

• Emergency Preparedness
• Physical Security
• Environmental Reviews
• Siting in Densely Populated Areas
STRATEGY 6 – Effective Communication

• Periodic Stakeholder Meetings

• NRC-DOE Memoranda of Understanding
  – Gateway for Accelerating Innovation in Nuclear
  – Versatile Test Reactor Program
  – Nuclear Energy Innovation Capabilities Act of 2017
International Cooperation on Advanced Reactors

- IAEA Small Modular Reactor Regulators Forum
- NEA Working Group on the Safety of Advanced Reactors
- NEA Gen IV Forum

NRC Chairman Kristine Svinicki and CNSC President and CEO Rumina Velshi signing a memorandum of cooperation aimed at enhancing technical reviews of advanced and small modular reactor technologies
Broad Landscape

- Micro Reactors
  - Oklo
  - Others
  - Stationary
  - Westinghouse
  - Others
  - Transportable

- Liquid Metal Cooled Fast Reactors (LMFR)
  - GE-H (VTR)
  - TerraPower
  - ARC
  - Sodium-Cooled
  - Westinghouse
  - Columbia Basin
  - Hydromine
  - Lead-Cooled

- High-Temperature Gas-Cooled Reactors (HTGR)
  - X-energy
  - General Atomics
  - Framatome
  - StarCore
  - TRISO Fuel
  - Kairos

- Molten Salt Reactors (MSR)
  - Terrestrial
  - TerraPower
  - Elysium
  - Thorcon
  - Muons
  - Flibe
  - Alpha Tech

Developers that have submitted a RIS response
Addressing Challenges

- Planning for the broad range of designs under development
- Expanding NRC staff organizational capacity
- Developing an integrated licensing approach
- Engaging with designers during pre-application
- Cooperating with DOE
References

• NRC Vision and Strategy (ML16356A670)
• Implementation Action Plans (IAPs) (ML17165A069 and ML17164A173)
• Regulatory Review Roadmap including prototype guidance (ML17312B567)
• RG 1.232, "Guidance for Developing Principal Design Criteria for Non-Light Water Reactors" (ML17325A611)
• SECY-18-0011, “Advanced Reactor Program Status” (ML17334B217)
• SECY-19-0009, “Advanced Reactor Program Status” (ML18346A075)
• SECY-18-0076, “Option and Recommendations for Physical Security for Advanced Reactors” (ML18052B032)
• SECY-18-0096, “Functional Containment Performance” (ML18114A546)
• DG 1353, “Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Approach to Inform the Content of Applications,” (ML18312A242)