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NRC Implementation Action Plan for Technical Readiness

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Introduction & Background

- The "Implementation Action Plan" (IAP) for RES code and tool development was produced as part of the strategic plan for advanced non-LWR licensing.
- The NRO Strategic Plan is documented in:
 - ✓ Volume 1 – Executive Information: [ADAMS ML16264A023](#)
 - ✓ Volume 2 – Detailed Information: [ADAMS ML16270A217](#)



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Implementation Strategies

- The overall Strategic Plan addresses 6 specific areas:
 - **Strategy 1:** Acquire/develop sufficient knowledge, technical skills, and capacity to perform non-LWR regulatory reviews
 - **Strategy 2:** Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews
 - **Strategy 3:** Establish a more flexible, risk-informed, performance-based, non-LWR regulatory review process within the bounds of existing regulations, including the use of conceptual design reviews and staged-review processes
 - **Strategy 4:** Facilitate industry codes and standards needed to support the non-LWR life cycle (including fuels and materials)
 - **Strategy 5:** Identify and resolve technology-inclusive policy issues that impact the regulatory reviews, siting, permitting, and/or licensing of non-LWR nuclear power plants (NPPs)
 - **Strategy 6:** Develop and implement a structured, integrated strategy to communicate with internal and external stakeholders having interests in non-LWR technologies

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"Strategy 2"

- Strategy 2 is designed to "Acquire/develop sufficient computer codes and tools to perform non-LWR regulatory reviews"
 - Enables the staff to perform independent confirmatory analysis of safety significant design basis and beyond design basis accidents.
 - Identifies experimental information necessary for regulatory decisions.
 - Supports rulemaking and regulatory guidance.

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Functional Areas & Prioritization

- Reactor Kinetics and Criticality
- Fuel Performance
- Thermal-Fluid Phenomena
- Severe Accident Phenomena
- Probabilistic Risk Assessment
- Materials and Component Integrity

Primary Focus
FY17-FY18

- Offsite Consequence Analysis
- Instrumentation & Controls
- Security
- Human Factors

Secondary Focus
FY-17-FY18

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Technical Challenges

- Staff Familiarity of New Designs
 - Understanding physical processes for numerous designs; GCR, SFR, MSR.
- Fuel Performance
 - UO₂ fuel well established, but gaps exist for non-LWR fuels.
- Neutronics
 - Fast spectrum systems require analysis of more energy groups.
 - Benchmarks for > 5% enrichment.
- Severe Accident Phenomena
 - Identification of any new phenomena, Fission Product transport.
- Materials
 - High temperature material behavior.

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Technical "Benefits"

- **Previous Efforts for NGNP**
 - Path forward relatively well known, with technical issues identified.
 - Analysis codes selected and development started for GCR.
- **Single Phase Coolants**
 - Lack the complication of two-phase flow, thermal non-equilibrium.
 - Amenable to analysis with CFD.
- **Significant Safety Margin**
 - May allow for large modeling and simulation uncertainties.
- **Fission Product Capture**
 - Sodium and molten salt coolants may be very effective at capturing FP.

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Initial Efforts

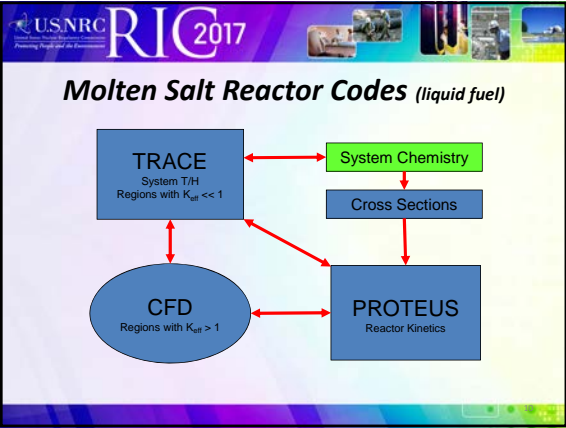
- **Phenomena, Scenario, and Issue Identification**
 - To be generic when possible, but more specific as design information is made available. Goal is to facilitate planning of future development.
- **Selection of Computer Codes for Confirmatory Analysis**
 - Much tighter coupling between fuel performance, neutronics, thermal-hydraulics than in most conventional LWR analysis.
 - May involve NRC developed codes, or adoption of codes developed by DOE (CASL and/or NEAMS developed, ANL codes for sodium fast reactors)
- **Identification of Experimental Data Needs**
 - Qualification of fuel behavior; analytical methods & data for assessment
 - Material performance at prototypical conditions
- **Participation in Codes and Standards Activities**

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Sodium Fast Reactor Codes (Option 2)

```

graph TD
    TRACE[TRACE  
System T/H] <--> PARCS[PARCS  
Reactor Kinetics]
    TRACE <--> CTF[CTF  
Subchannel T/H]
    TRACE <--> BISON[BISON  
Fuel Performance]
    CTF <--> PARCS
    CTF <--> BISON
    PARCS <--> BISON
  
```



Summary

- The NRC has developed a plan to address the technical issues expected in reviews of advanced non-LWRs.
- The initial thrust is directed at familiarization with new designs, and identification of technical issues and challenges.
- An objective of the initial planning is to “think out of the box” in order to gain efficiency and speed upcoming reviews.
