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Protecting People and the Environment

NRC Perspectives on Nuclear Data Needs

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NRC Mission

The NRC licenses and regulates the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety and to promote the common defense and security and to protect the environment.

NRC's regulatory mission covers three main areas:

- Reactors – Commercial reactors for generating electric power and research and test reactors used for research, testing, and training
- Materials – Uses of nuclear materials in medical, industrial, and academic settings and facilities that produce nuclear fuel
- Waste – Transportation, storage, and disposal of nuclear materials and waste, and decommissioning of nuclear facilities from service

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NRC Uses of Nuclear Data

- Criticality safety
  - Spent Fuel Storage and Transportation
  - Fuel Cycle Facilities
- Radiation Shielding
  - Spent Fuel Storage and Transportation
  - Personnel dose
  - Control room
- Materials and component integrity
  - Neutron Embrittlement
- Confirmatory Analysis
  - Operating Reactor License Amendments
  - Accident Tolerant Fuel Licensing
  - New and Advanced Reactor Licensing

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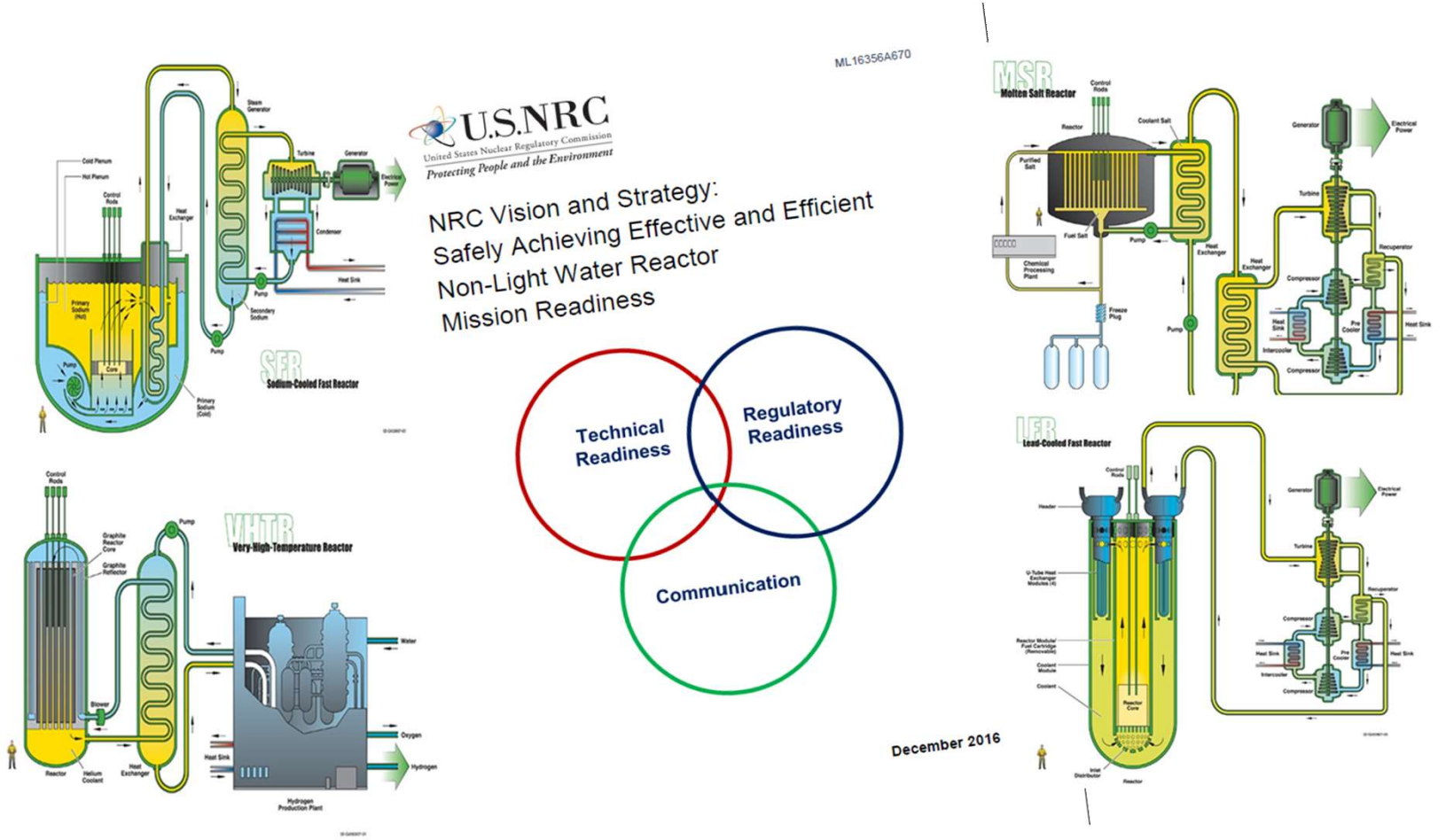
NRC Advanced Reactor Program Vision and Strategy



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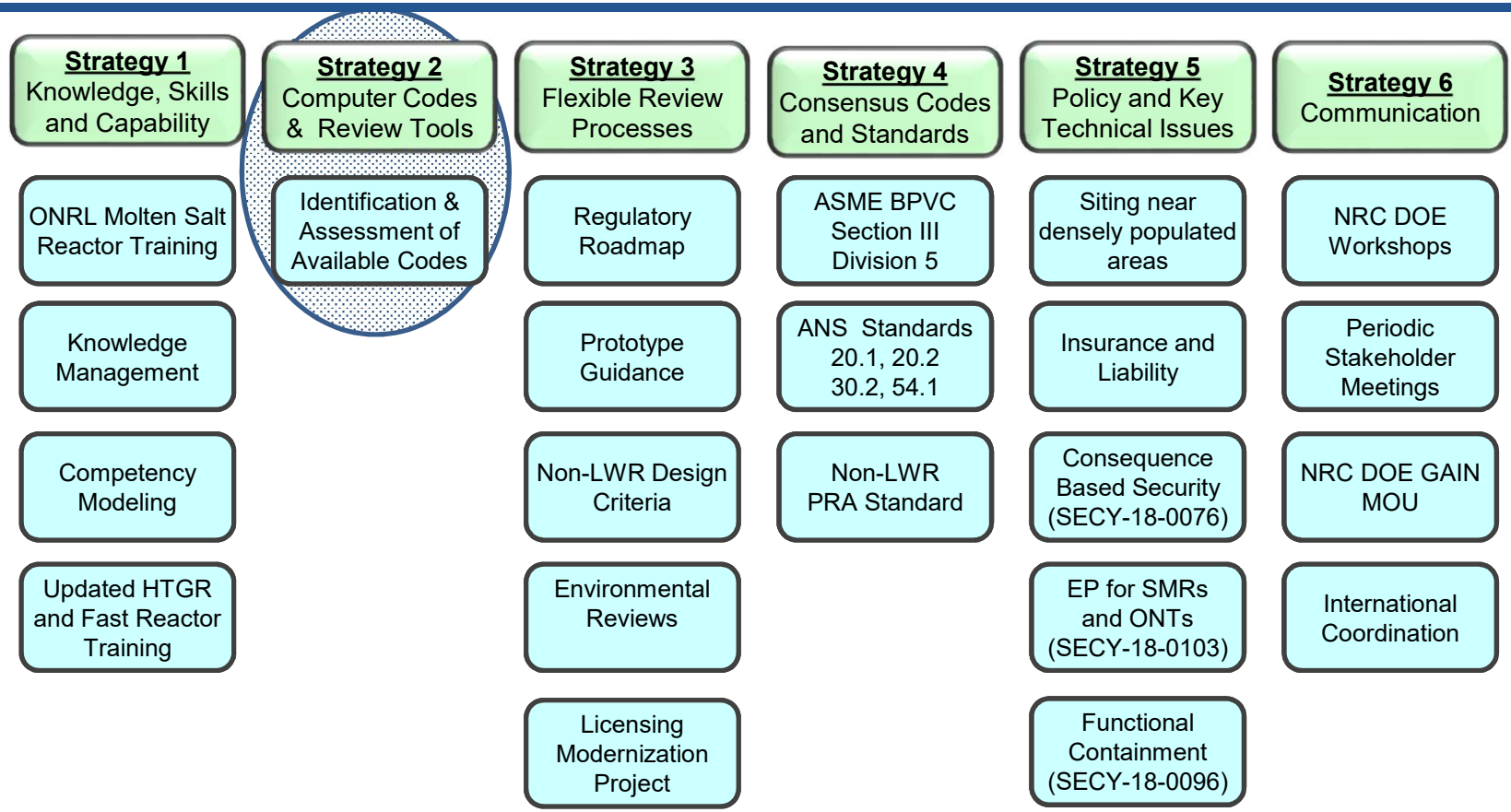
Implementation Action Plans



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NRC Confirmatory Analysis

- Confirmatory analysis is not required; however, NRC may conduct confirmatory analysis in support of a licensing review
- NRC confirmatory analysis may use NRC codes, DOE codes, applicant codes, or other codes
- NRC uses nuclear data to generate cross-sections for use in confirmatory analysis

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The Respective Role of Computer Codes by NRC and Applicants

NRC Responsibility

- Rulemakings
- Regulatory analysis
- Backfit analysis
- Reactor Oversight Process
- Safety studies
- Generic Issues Program

Applicant/Licensee Responsibility

- Technical/safety/compliance base for license applications and amendments
- Core reload analysis, design changes, methodology

The technical/safety basis to support a licensing decision must be demonstrated by the applicant. The applicant's analysis and models are part of the licensing basis and carry forward. NRC confirmatory analyses, if conducted, have a limited role in licensing applications.

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Challenges for Advanced Reactors

- Unlike LWRs, advanced reactors do not have the benefit of decades of operational experience and supporting infrastructure
  - Unique materials and neutron spectra
  - Very high burnup possible
  - High assay LEU fuel
  - Nontraditional fuel forms
- Wide variety of designs under development
- Uncertainty in timeline for data needs
- General lack of experienced analysts

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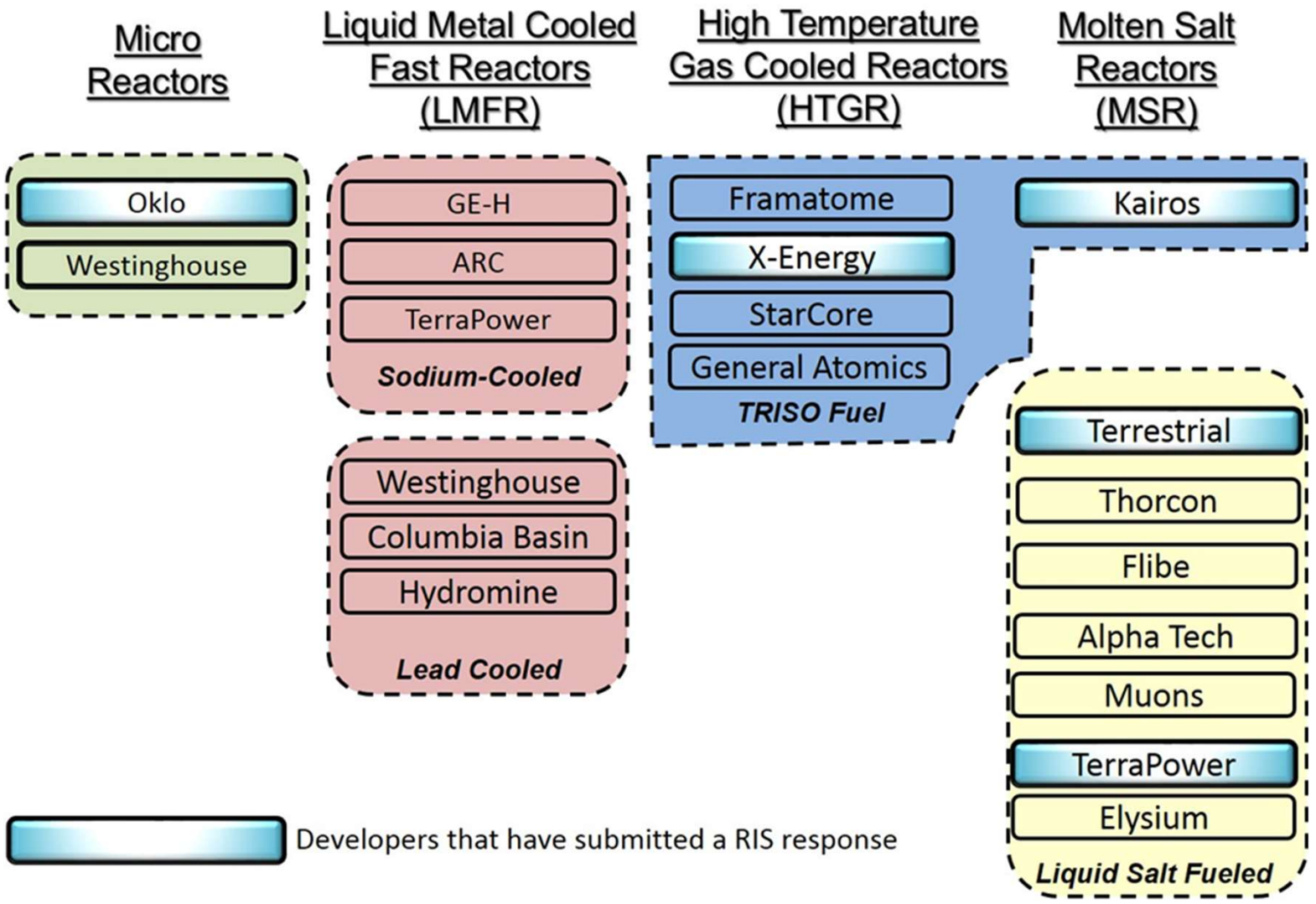
Non-LWR Landscape



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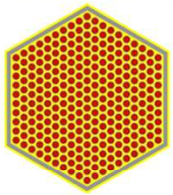
Consequence Assessment Tools

scale
Nuclear Systems Modeling & Simulation



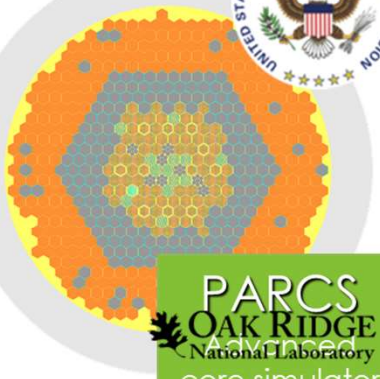
ENDF/B
Physics data
Thermal scattering law, resonance data, energy distributions, fission yields, decay constants, etc.

AMPX
Validated cross section libraries; depletion and decay data

TRITON / Polaris
Transport and depletion in 1D, 2D, and 3D for LWR, ATF, and nonLWR

ORIGEN / ORIGAMI
Depletion, activation and decay
Reactor-specific radioactive source term characterization

CAMP



PARCS
OAK RIDGE National Laboratory
Advanced core simulator
Neutron flux solver and depletion

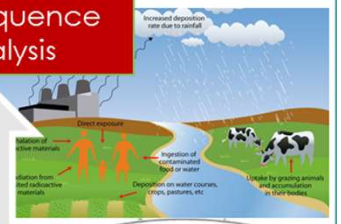
TRACE
System level temperature distributions and feedback

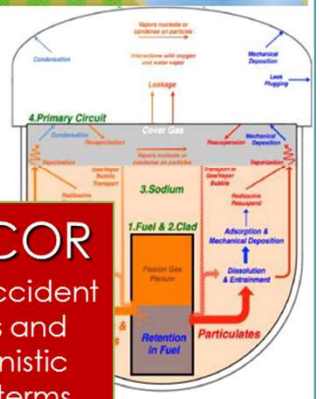
AGREE
Temperature distributions for gas reactors

FAST
Fuel performance

CSARP

MACCS
Offsite consequence analysis





MELCOR
Severe accident analysis and mechanistic source terms

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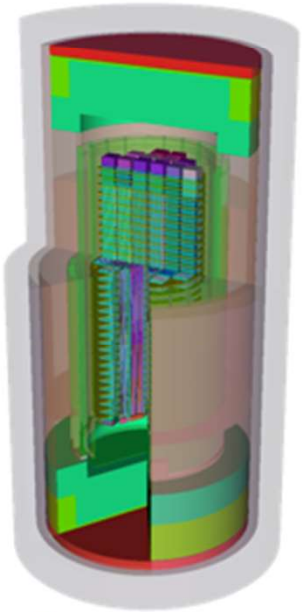
Criticality, Shielding, Structural and Thermal Analysis

scale
Nuclear Systems Modeling & Simulation



UNF-ST&DARDS
Used Nuclear Fuel-Storage, Transportation & Disposal Analysis Resource and Data System

ENDF/B
Physics data
Thermal scattering law, resonance data, energy distributions, fission yields, decay constants, etc.

AMPX
Validated cross section libraries in multigroup (O(100g)) or continuous-energy (O(100,000g); depletion and decay data

TRITON / Polaris
Transport and depletion in 1D, 2D, and 3D for LWR, ATF, and nonLWR

CSAS
3D criticality safety analysis

MAVRIC
3D shielding and dose rate analysis

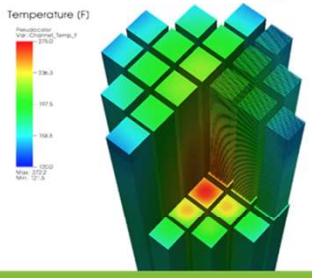
TSUNAMI
Sensitivity and uncertainty analysis and validation applicability

ORIGAMI
Depletion, activation and decay
Reactor-specific radioactive source term characterization

Structural analysis

ANSYS / LS-DYNA
Commercial finite element analysis

Thermal analysis



STAR-CCM+ / FLUENT
Commercial computational fluid dynamics codes

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Take Aways

- Nuclear data supports a variety of the NRC's regulatory decisions

- NRC is evaluating gaps in data to support advanced reactor licensing and developing strategies to account for uncertainties in the near term

- NRC participants will discuss specifics in areas of criticality safety, reactor safety, and materials integrity in Roadmapping Sessions 1A an 2A tomorrow

Thank you!