NRIC National Reactor Innovation Center

Advanced Reactor Demonstration Facilities

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October 13, 2020

NRIC is a new DOE program, launched in FY'2020

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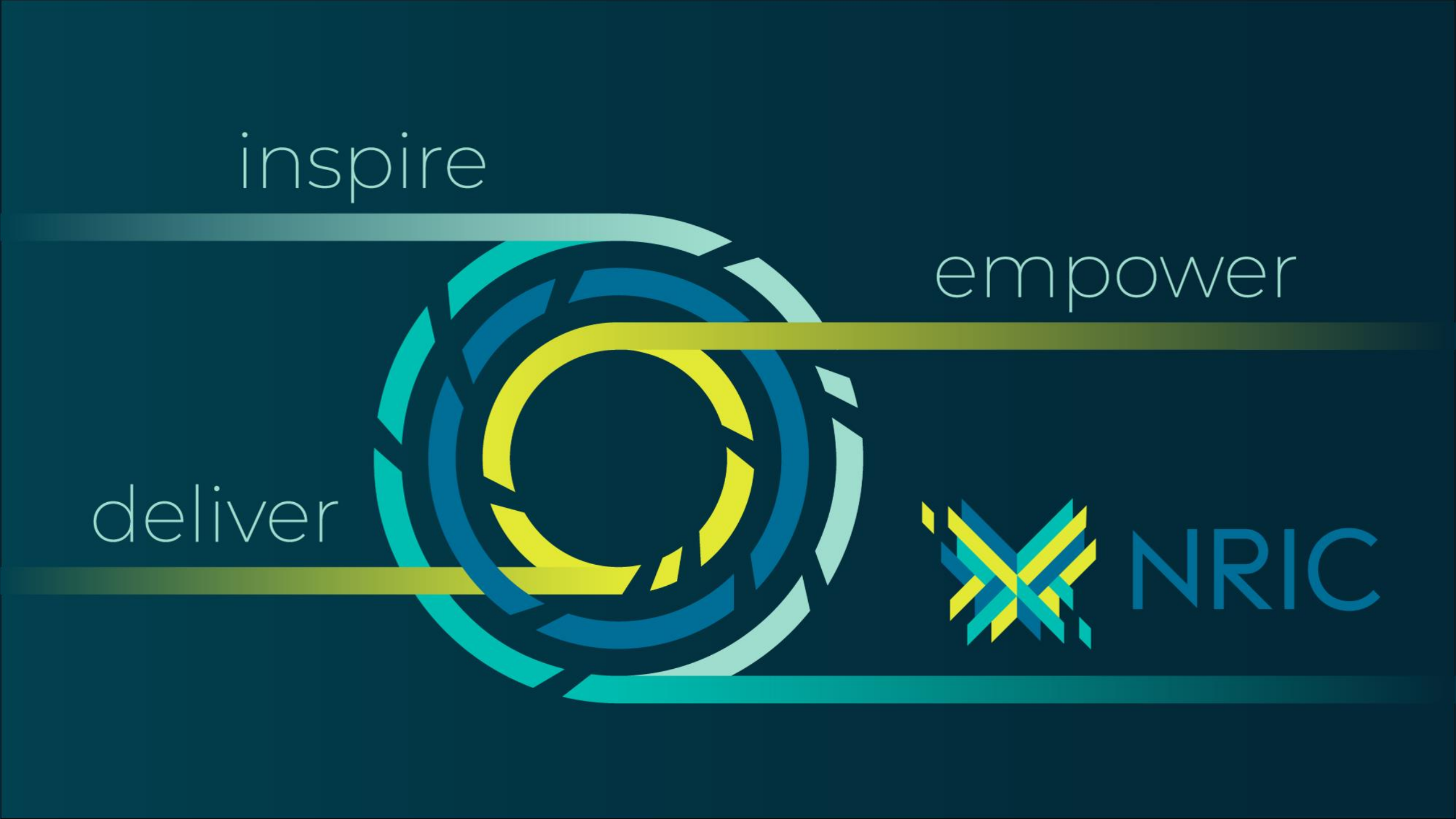
National Reactor Innovation Center

NRIC Enables Nuclear Reactor Demonstrations

- Authorized by the Nuclear Energy Innovation Capabilities Act (NEICA)
- Led by Dr. Ashley Finan, Director out of INL in coordination with other national labs


inspire
empower
deliver
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NRIC projects are focused on enabling demonstration of industry reactor designs.

- Establish trust and predictable collaboration across multi-year projects
- Understand the details of industry designs and development challenges
- Create infrastructure and capabilities needed by multiple reactor designers
- Solve specific problems in the context of reactor demonstration
  - Not general topic area research

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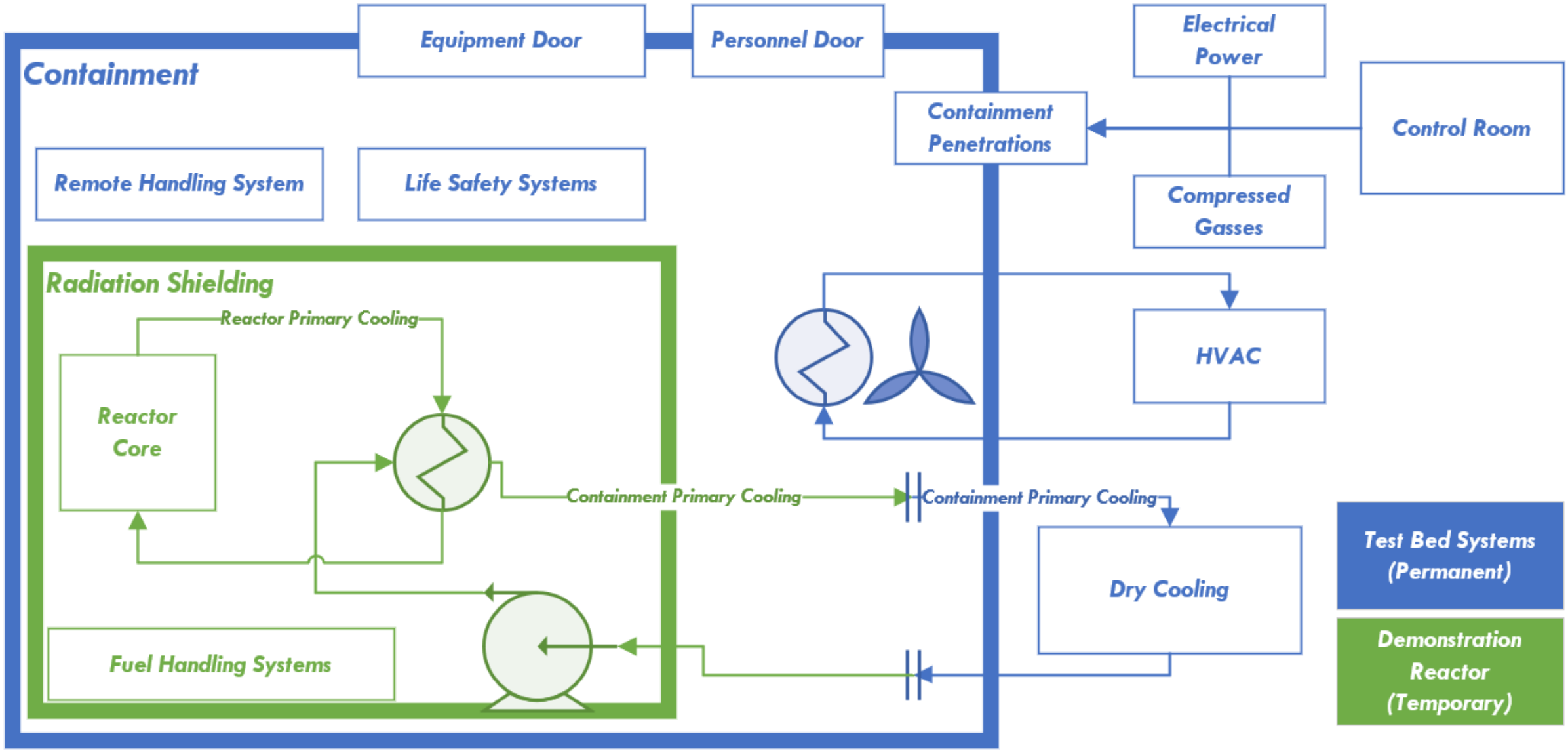
NRIC Demonstration Reactor Test Bed



Pre-Conceptual Design
ZPPR Cell Demonstration Reactor Test Bed (ZTB)

- Reactors producing less than 500kWt power
- Use of Safeguards Category I fuels
- Modifications to enable efficient personnel access during construction
- Modifications to enable installation and removal of reactor systems
- Electrical power system including safety class battery backup
- Ventilation system upgrades
- Control Room for ZTB operations

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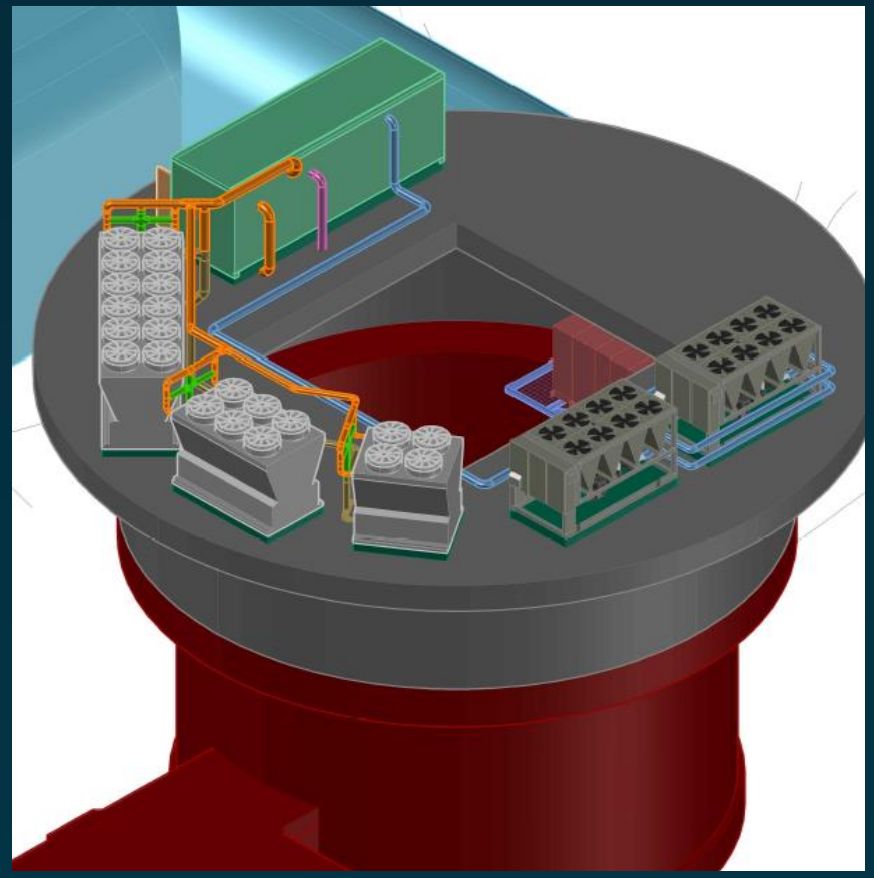
Pre-Conceptual Design of ZTB Key Modifications

- Demolition of existing roof structure
- New 30’ x 30’ equipment hatch
- Roof mounted pump house and heat rejection systems
- 500kW Dowtherm Q closed loop reactor cooling system
- 492kW (140 Tons) chilled water/glycol air cooling system
- Seismic Design Category 3 (SDC-3)



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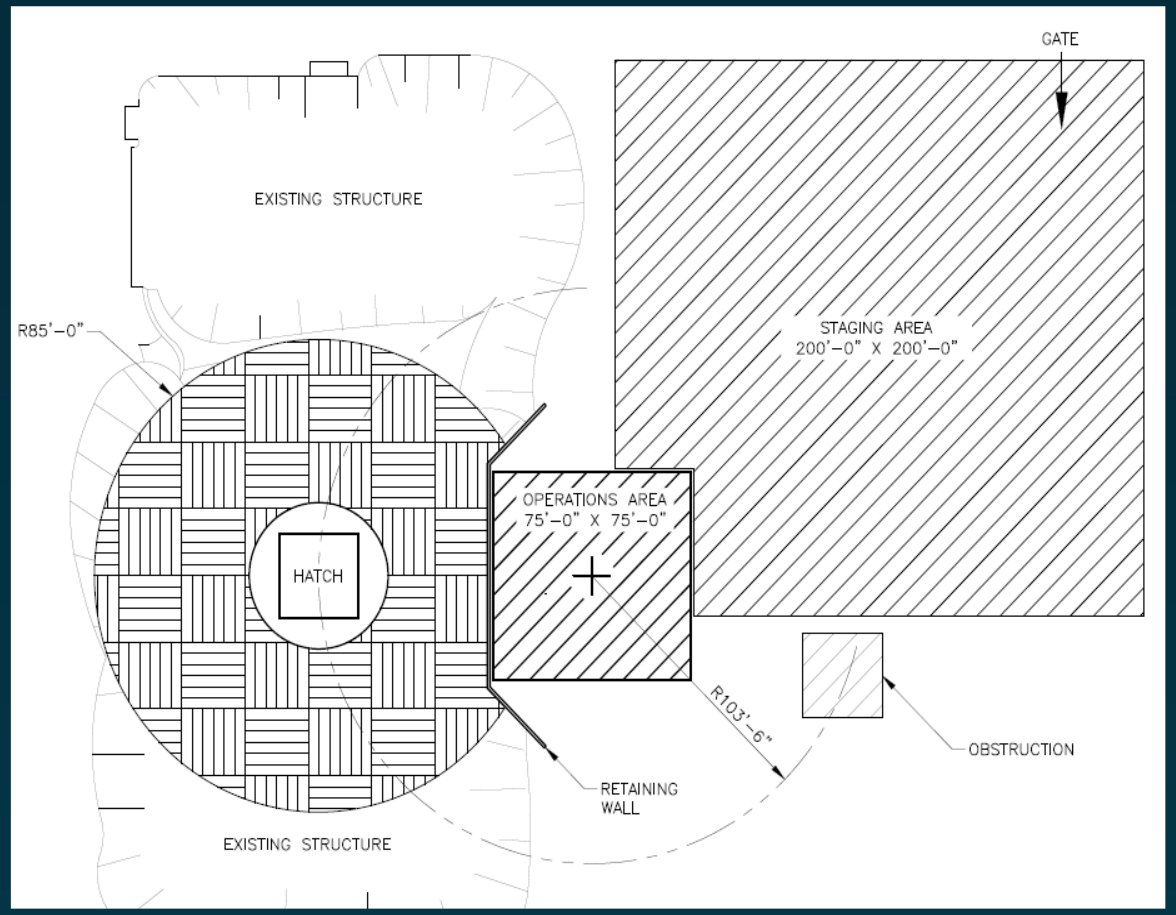
FY'21 Plans
Resolution of ZTB Technical Risks

- Heaviest demonstration reactor Component
- Radioactive material sampling during operations
- Required I&C signals
- Compatibility and rigor of I&C signals
- Structural integrity of ZPPR Control Room
- Overpressure protection capability
- Stand-alone cell ventilation



Pre-Conceptual Design
EBR-II Dome Demonstration Reactor Test Bed (ETB)

- Reactors producing less than 10MWt power
- Use of Safeguards Category IV fuels
- Modifications to equipment door to enable loading of Conex containers
- Cooling, electrical, ventilation, process fluid penetrations
- Ventilation system upgrades
- Electrical power system including safety class battery backup
- Control Room for ETB operations

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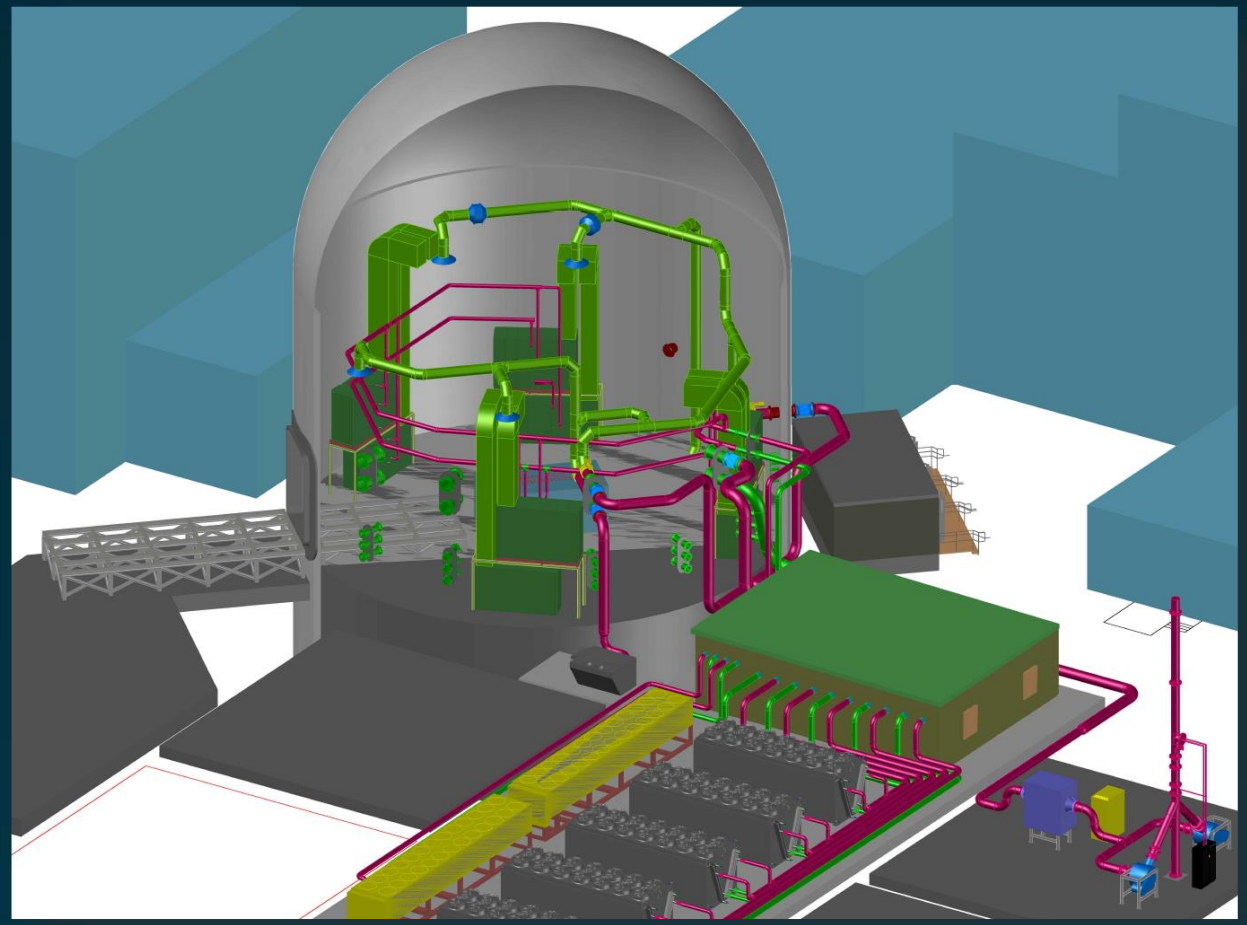
Pre-Conceptual Design of ETB Key Modifications

- Expand equipment hatch to 13’ x 15.5’
- 10MW Dowtherm Q closed loop reactor cooling system
- 2MW chilled water/glycol air cooling system
- (33) New Penetrations
  - (4) 24” Ø Pen- Demonstrator
  - (2) 20” Ø Pen- Ventilation
  - (2) 24” Ø Pen- Heat Removal
  - (15) 12” Ø Pen- Electrical
  - (2) 10” Ø Pen- Cooling
  - (8) 1-4” Ø Pen- Mechanical
- New 2000kVA substation



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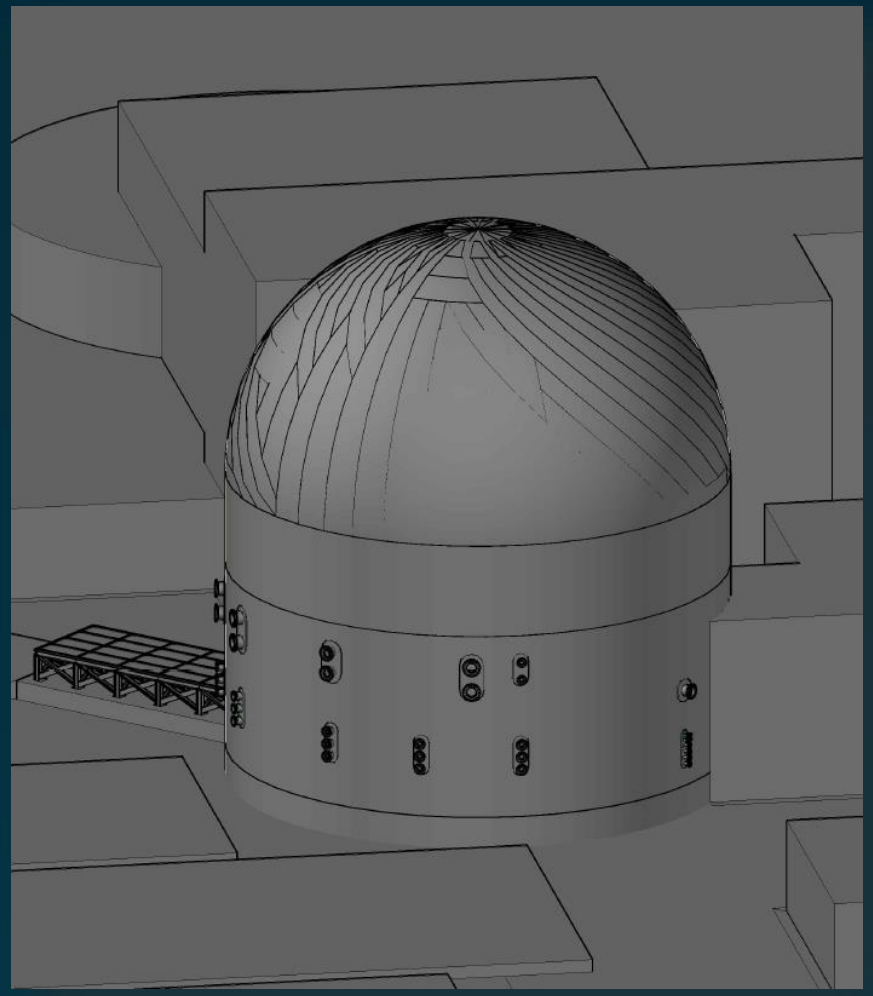
FY'21 Plans
Resolution of ETB Technical Risks

- Number and spacing of containment penetrations
- Surface area and thickness of concrete pads
- Size of equipment hatch
- Cooling system capacity
- Piping arrangement
- Reactor module handling strategy
- I&C system considerations



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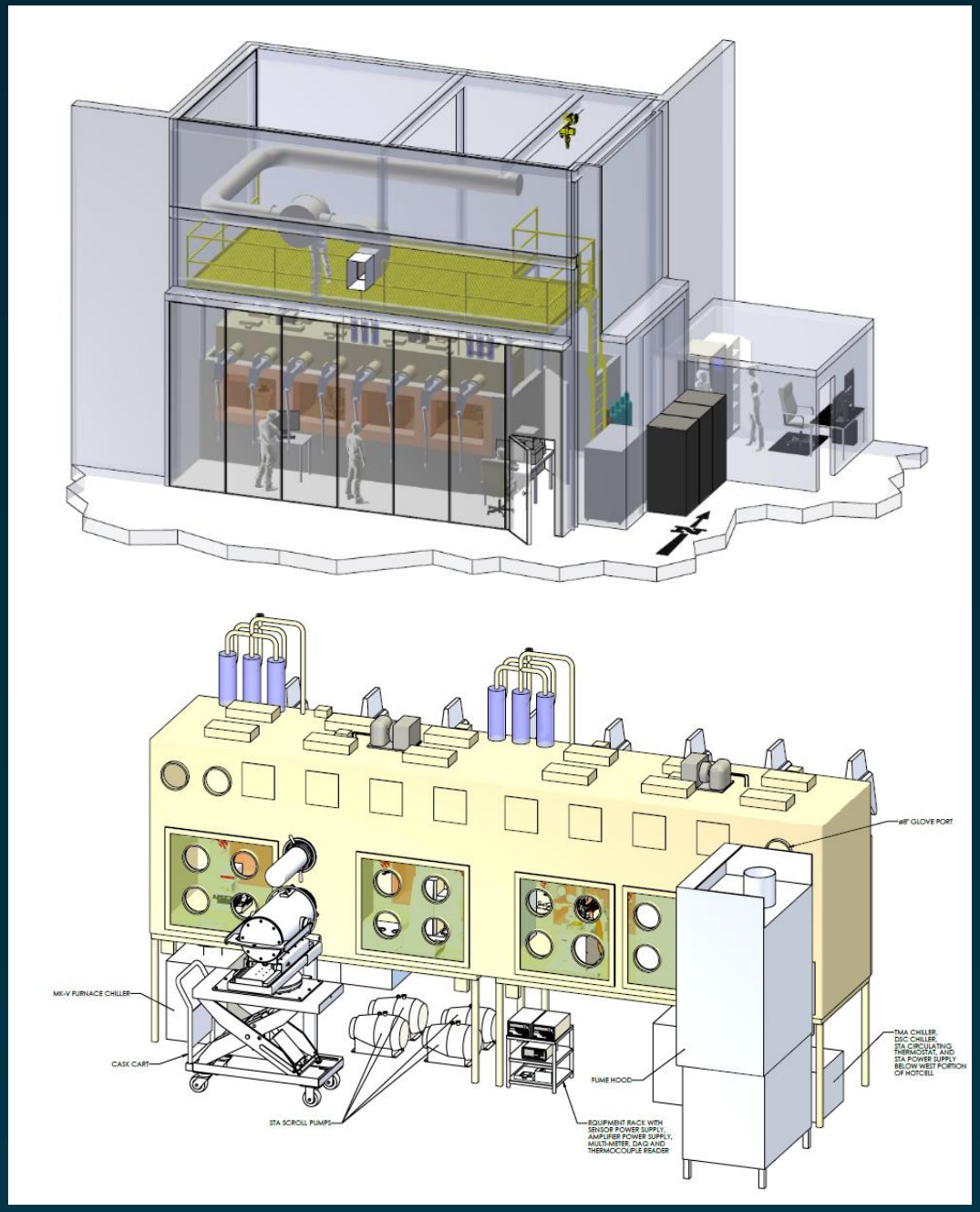
Molten Salt Thermophysical Examination Capability (MSTEC)

- Numerous MSR designers planning reactor demonstrations
- Currently no infrastructure to characterize irradiated molten salt fuel samples
- Validation of liquid fuel performance and safety
- Comparable to existing solid fuel capabilities
- Salt synthesis, irradiation, thermal characterization, and isotopic analysis in one location



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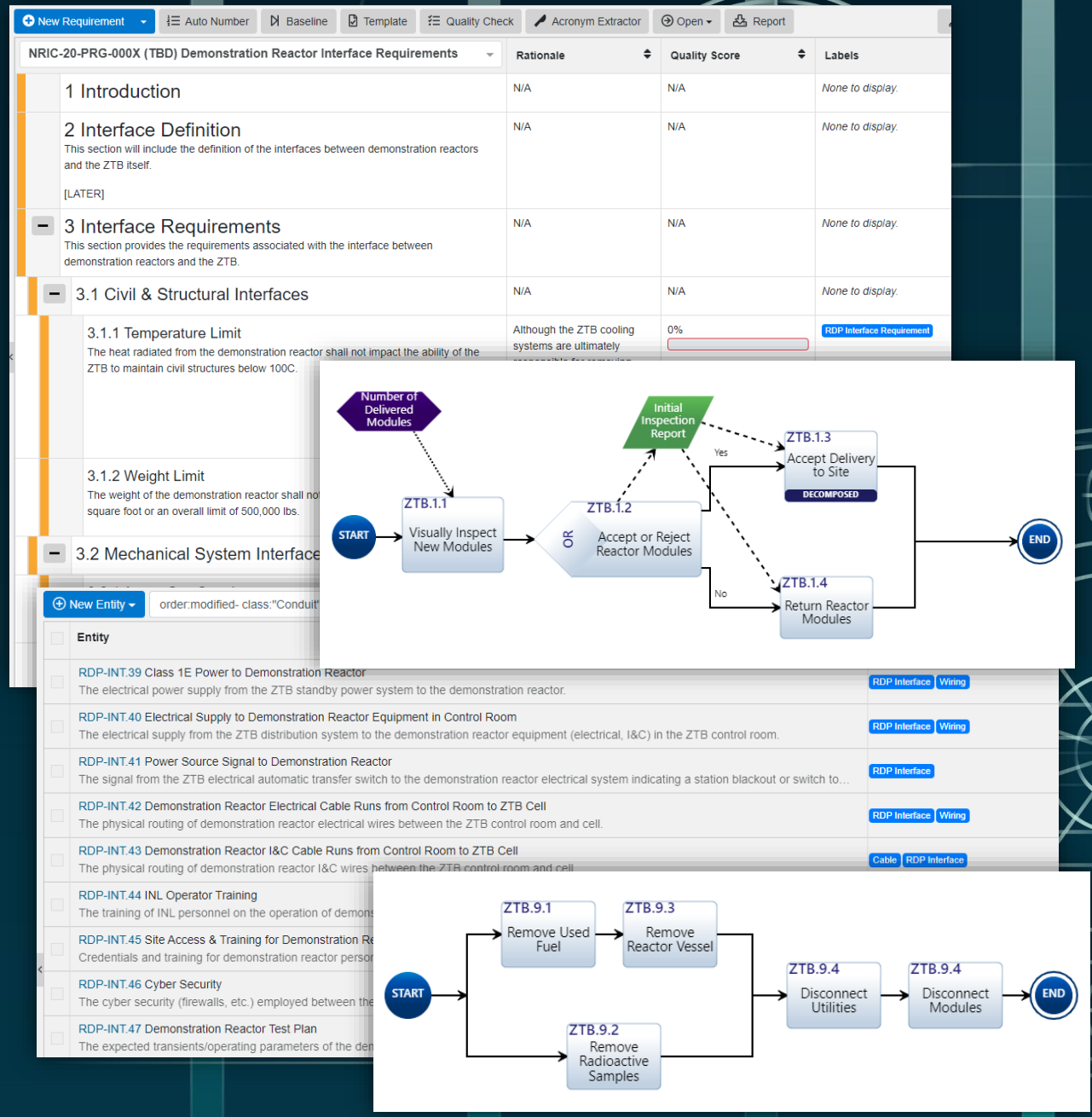
Digital Engineering Framework

- Digital approach to integrate information across project lifecycle
- Requirements and Configuration Management
- Model-Based Systems Engineering (MBSE)
- Bi-directional traceability between requirements, system elements, interfaces, and verification



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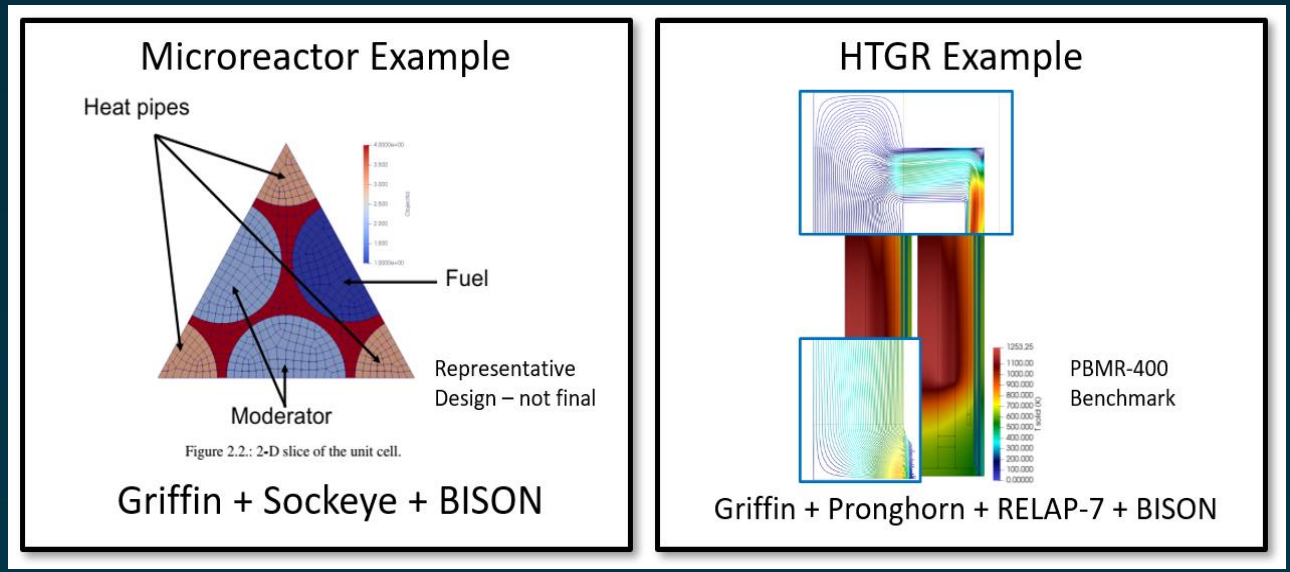
NRIC & NEAMS
Virtual Test Bed (VTB)

- Establish reference plant infrastructure using NEAMS capabilities through targeted modeling and simulation applications
- Enables reactor demonstrations by verifying compatibility of proposed industry designs in context of test beds
- PBMR-400 Benchmark complete
- MSR and FHR planned for FY'21



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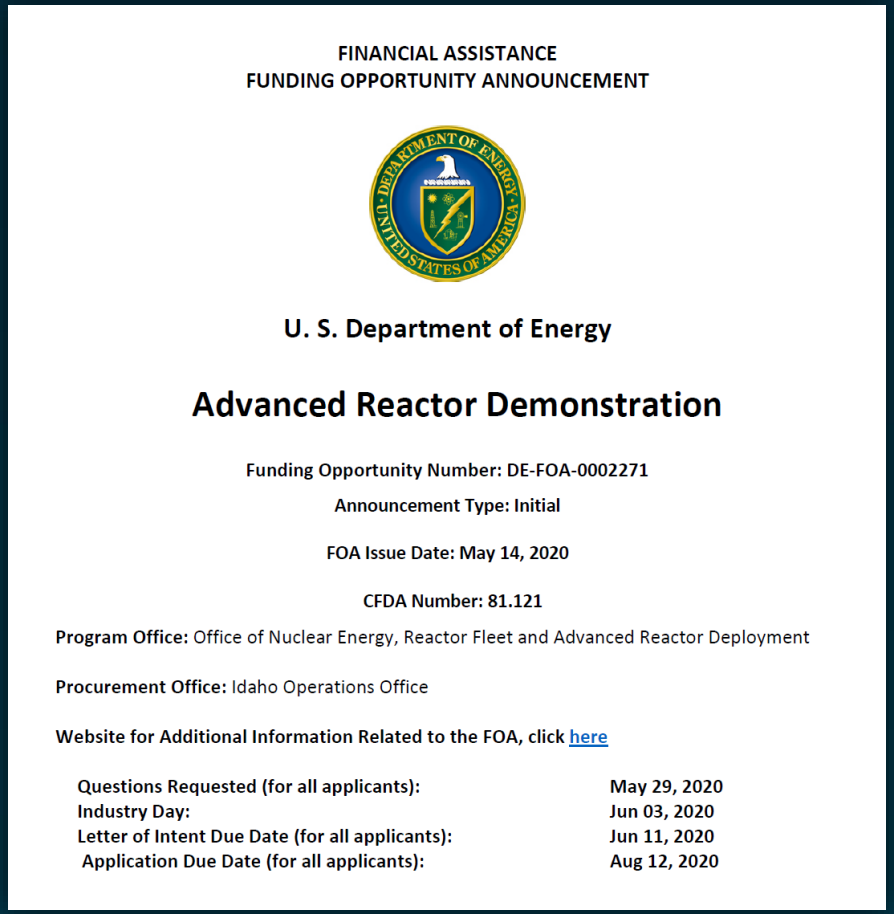
DE-FOA-0002271
Advanced Reactor Demonstration

- Initial funding of $160M for up to 9 projects
- Intended to focus DOE and non-federal resources, through cost shared agreements with industry, on the construction of demonstration reactors
- The FOA has three separate award pathways:
  - Advanced Reactor Demonstrations (Demos)
    - ***$400M - $4B***
  - Risk Reduction for Future Demonstrations (Risk Reduction)
    - ***$40M - $400M***
  - Advanced Reactor Concepts – 20 (ARC-20)
    - ***$10M - $40M***
- NRIC coordinating proposal response for 18 potential projects with industry



FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U. S. Department of Energy

Advanced Reactor Demonstration

Funding Opportunity Number: DE-FOA-0002271

Announcement Type: Initial

FOA Issue Date: May 14, 2020

CFDA Number: 81.121

Program Office: Office of Nuclear Energy, Reactor Fleet and Advanced Reactor Deployment

Procurement Office: Idaho Operations Office

Website for Additional Information Related to the FOA, click here

Questions Requested (for all applicants):	May 29, 2020
Industry Day:	Jun 03, 2020
Letter of Intent Due Date (for all applicants):	Jun 11, 2020
Application Due Date (for all applicants):	Aug 12, 2020

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Additional Topic Areas NRIC is engaged on include:

- HALEU supply for demonstration reactors
- Back-end of reactor demonstrations
  - Deactivation & Decommissioning
  - Used fuel disposition
- Advanced Construction Technologies Initiative to reduce cost and schedule risk for nuclear projects
- NEPA preparedness for demonstration projects

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Thank You

Additional information can be found on the NRIC Website:

https://inl.gov/nric/

nric@inl.gov

Questions?

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