



NRIC

National
Reactor
Innovation
Center

Advanced Reactor Demonstration Facilities

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



NRIC

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



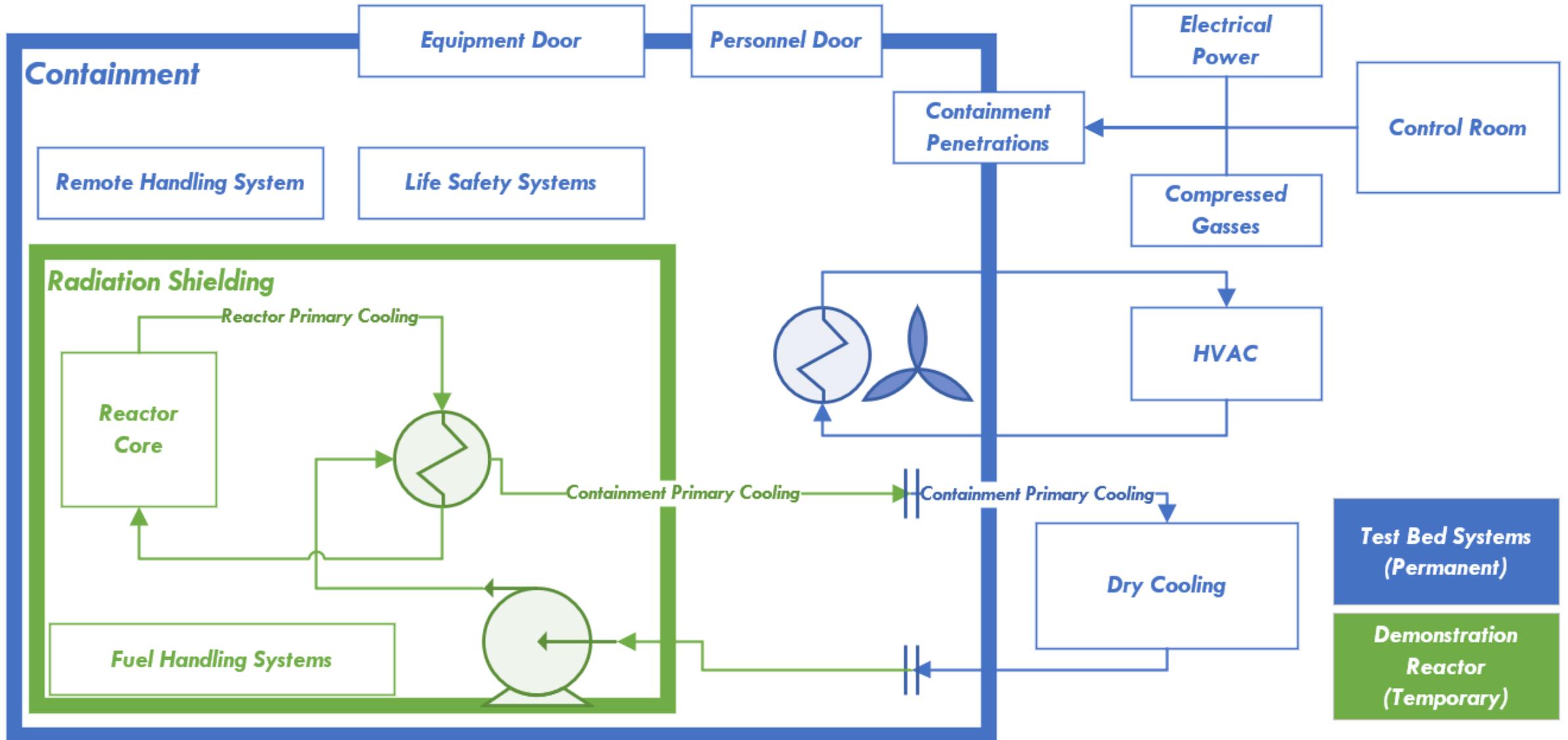
NRIC

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



NRIC Demonstration Reactor Test Bed



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

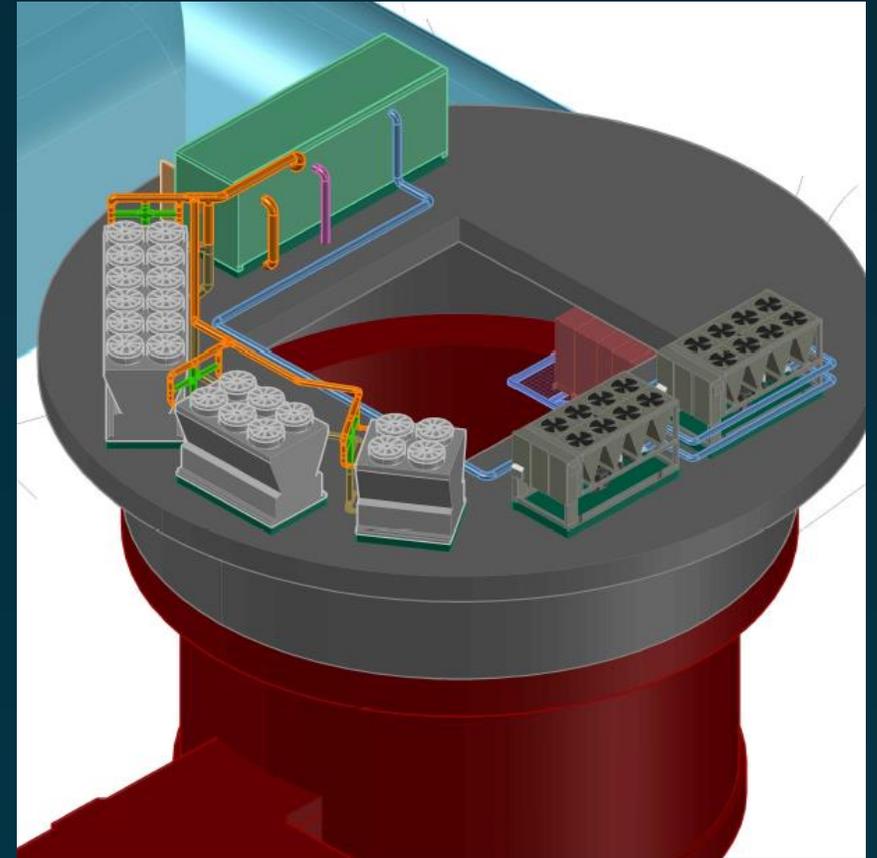
- Reactors producing less than 500kWt power
- Use of Safeguards Category I fuels
- Modifications to enable efficient personnel access during construction
- Modifications to enable installation and removal of reactor systems
- Electrical power system including safety class battery backup
- Ventilation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



Pre-Conceptual Design of ZTB

Key Modifications

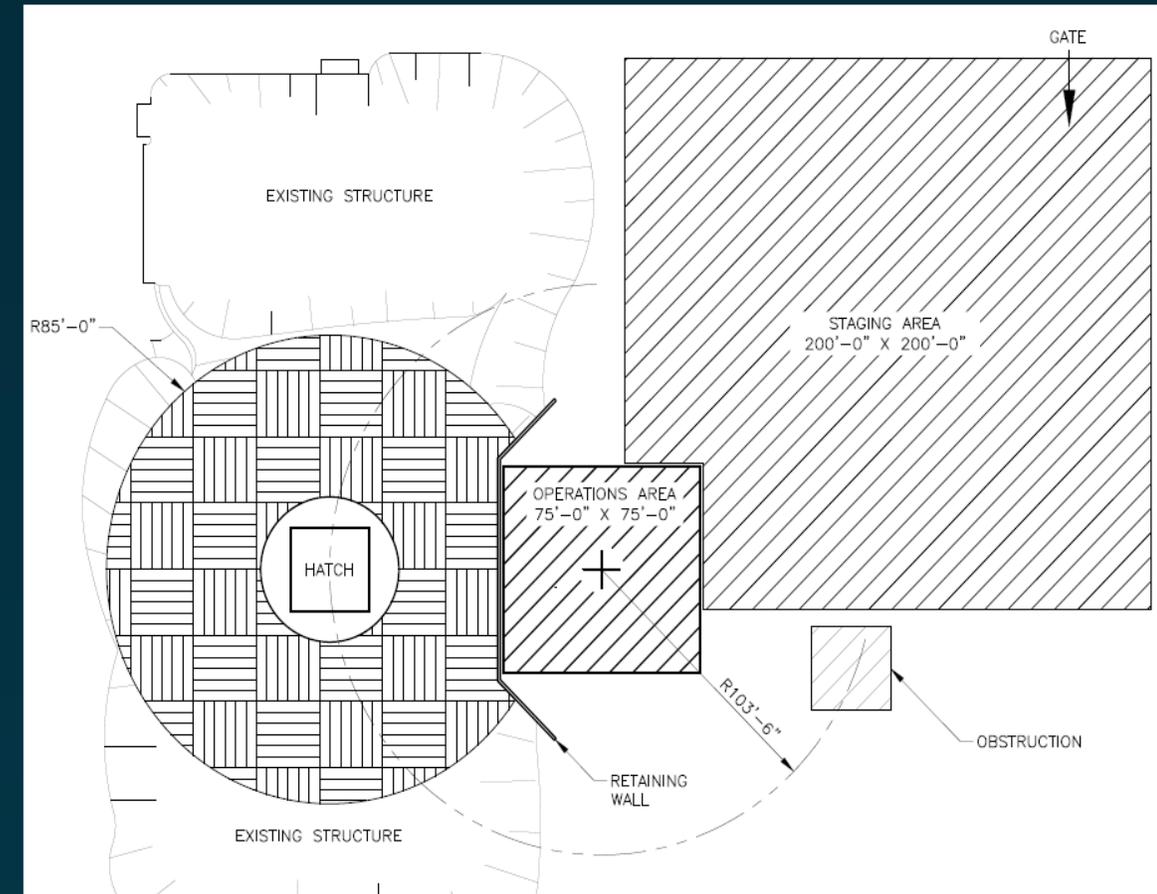
- Demolition of existing roof structure
- New 30' x 30' equipment hatch
- Roof mounted pump house and heat rejection systems
- 500kW Dowtherm Q closed loop reactor cooling system
- 492kW (140 Tons) chilled water/glycol air cooling system
- Seismic Design Category 3 (SDC-3)



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)

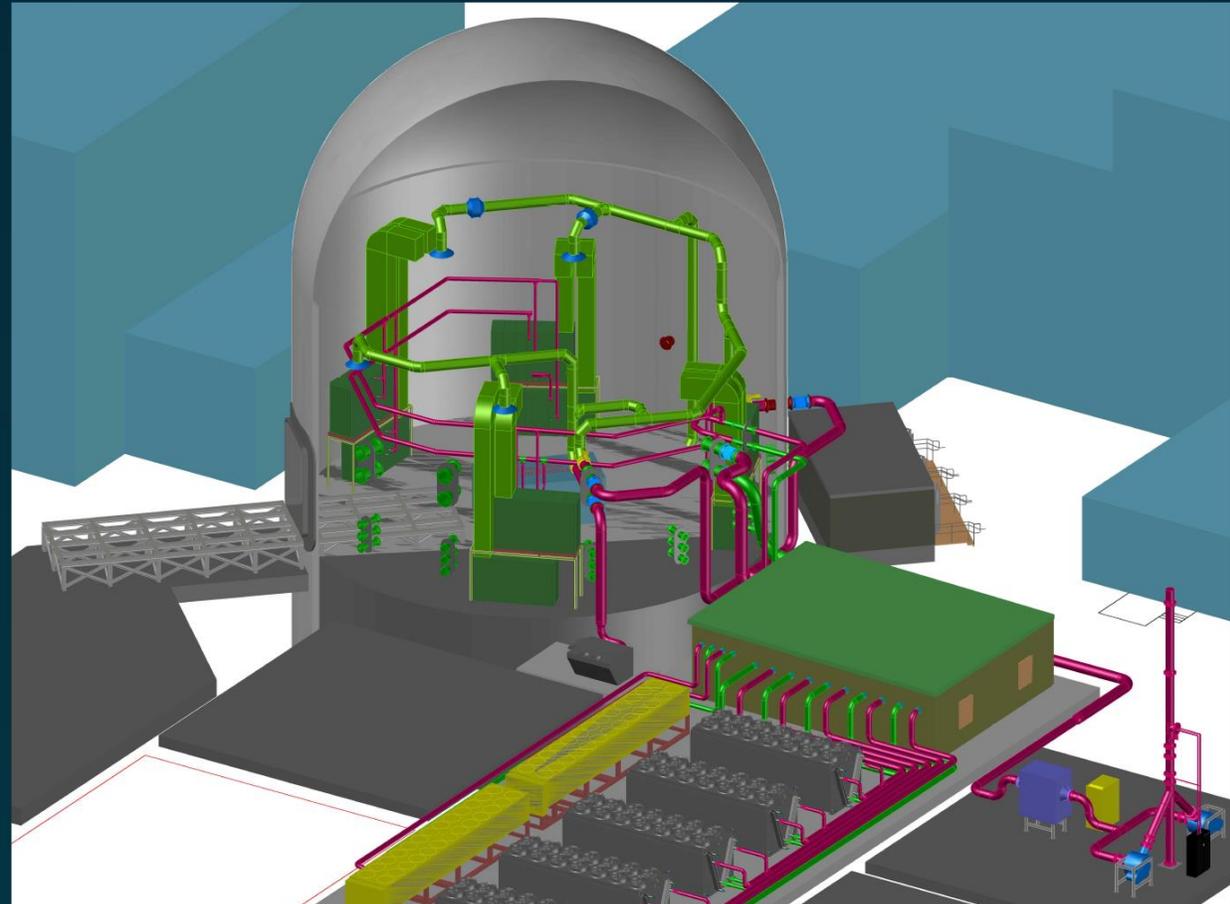
- Reactors producing less than 10MWt power
- Use of Safeguards Category IV fuels
- Modifications to equipment door to enable loading of Conex containers
- Cooling, electrical, ventilation, process fluid penetrations
- Ventilation system upgrades
- Electrical power system including safety class battery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



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



FY'21 Plans

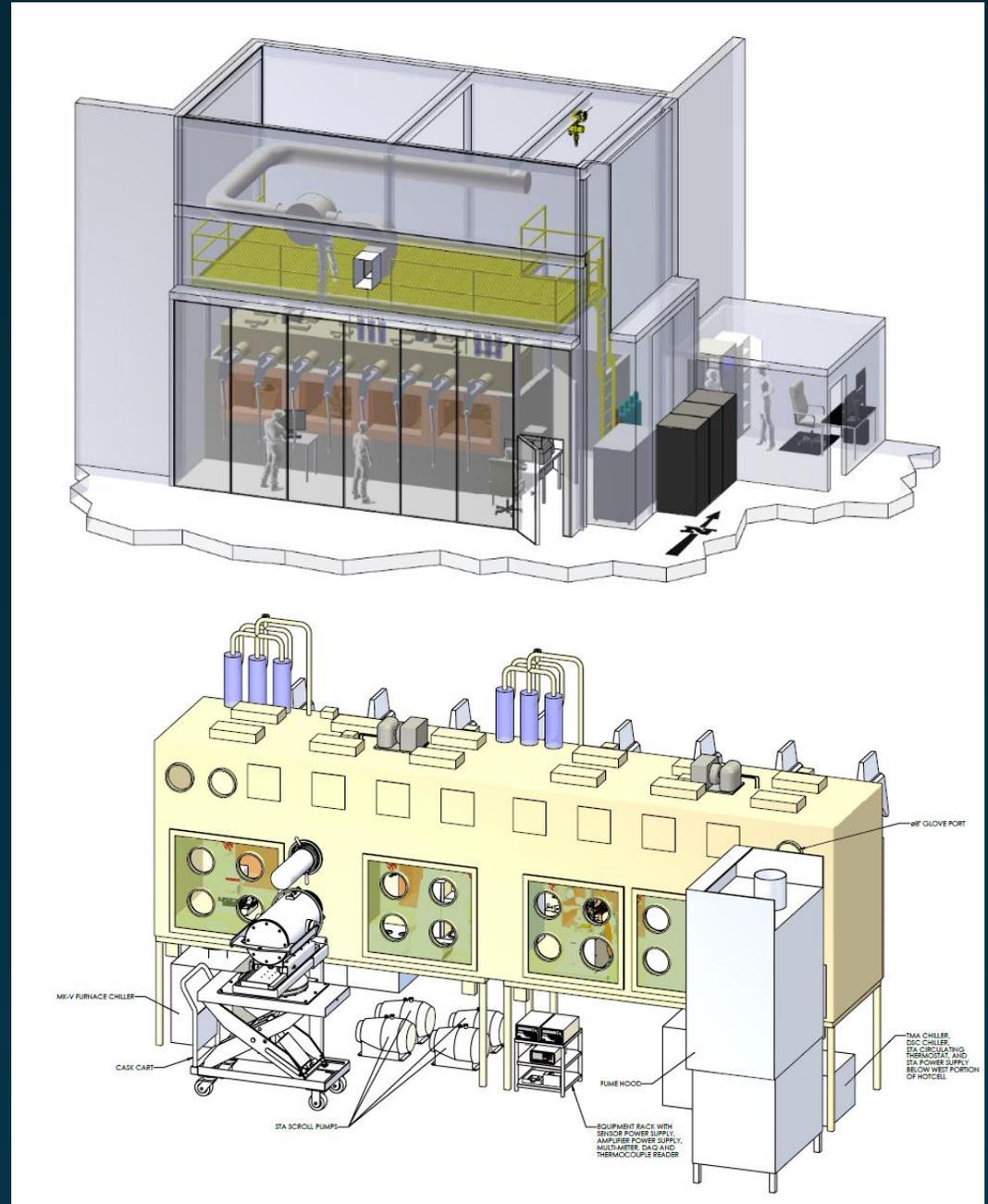
Resolution of ETB Technical Risks

- 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



Molten Salt Thermophysical Examination Capability (MSTEC)

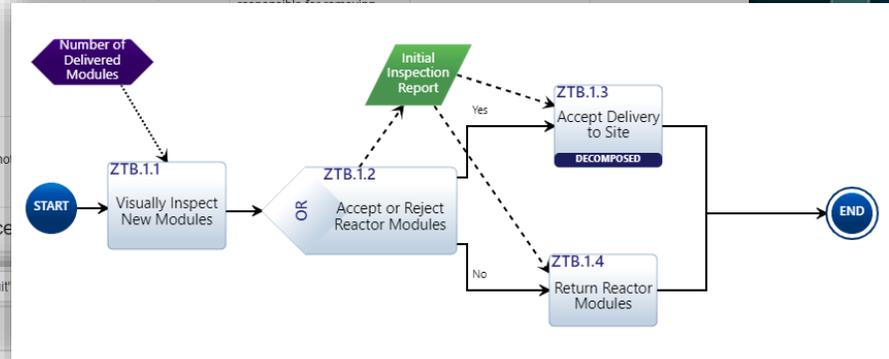
- Numerous MSR designers planning reactor demonstrations
- Currently no infrastructure to characterize irradiated molten salt fuel samples
- Validation of liquid fuel performance and safety
- Comparable to existing solid fuel capabilities
- Salt synthesis, irradiation, thermal characterization, and isotopic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



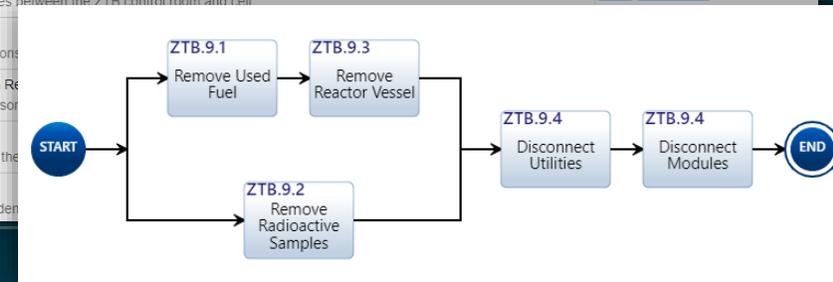
Digital Engineering Framework

- 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

NRIC-20-PRG-000X (TBD) Demonstration Reactor Interface Requirements	Rationale	Quality Score	Labels
1 Introduction	N/A	N/A	None to display.
2 Interface Definition This section will include the definition of the interfaces between demonstration reactors and the ZTB itself. [LATER]	N/A	N/A	None to display.
3 Interface Requirements This section provides the requirements associated with the interface between demonstration reactors and the ZTB.	N/A	N/A	None to display.
3.1 Civil & Structural Interfaces	N/A	N/A	None to display.
3.1.1 Temperature Limit The heat radiated from the demonstration reactor shall not impact the ability of the ZTB to maintain civil structures below 100C.	Although the ZTB cooling systems are ultimately	0%	RDP Interface Requirement
3.1.2 Weight Limit The weight of the demonstration reactor shall not exceed 500,000 lbs. or an overall limit of 500,000 lbs.			
3.2 Mechanical System Interface			

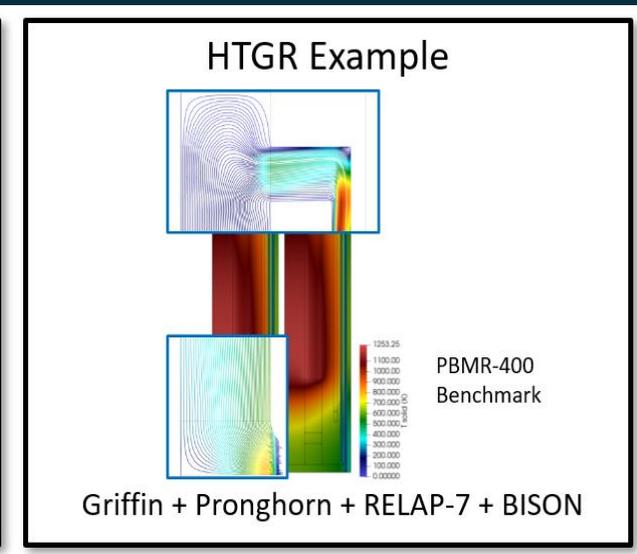
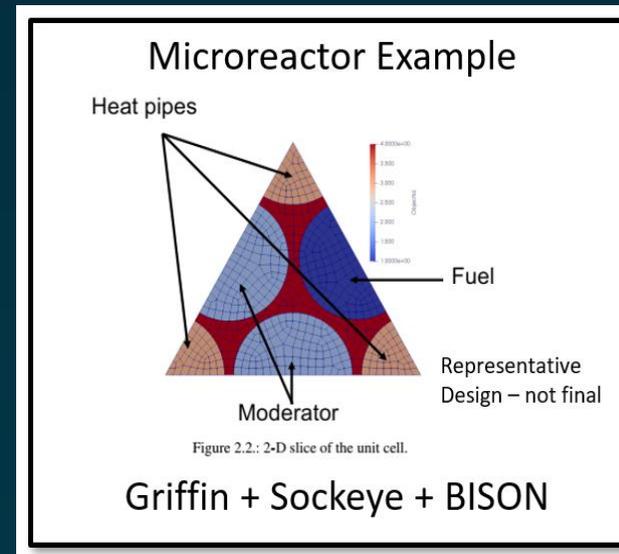


Entity	Labels
RDP-INT.39 Class 1E Power to Demonstration Reactor The electrical power supply from the ZTB standby power system to the demonstration reactor.	RDP Interface Wiring
RDP-INT.40 Electrical Supply to Demonstration Reactor Equipment in Control Room The electrical supply from the ZTB distribution system to the demonstration reactor equipment (electrical, I&C) in the ZTB control room.	RDP Interface Wiring
RDP-INT.41 Power Source Signal to Demonstration Reactor The signal from the ZTB electrical automatic transfer switch to the demonstration reactor electrical system indicating a station blackout or switch to...	RDP Interface
RDP-INT.42 Demonstration Reactor Electrical Cable Runs from Control Room to ZTB Cell The physical routing of demonstration reactor electrical wires between the ZTB control room and cell.	RDP Interface Wiring
RDP-INT.43 Demonstration Reactor I&C Cable Runs from Control Room to ZTB Cell The physical routing of demonstration reactor I&C wires between the ZTB control room and cell.	Cable RDP Interface
RDP-INT.44 INL Operator Training The training of INL personnel on the operation of demonstration reactor.	
RDP-INT.45 Site Access & Training for Demonstration Reactor Credentials and training for demonstration reactor personnel.	
RDP-INT.46 Cyber Security The cyber security (firewalls, etc.) employed between the demonstration reactor and the ZTB.	
RDP-INT.47 Demonstration Reactor Test Plan The expected transients/operating parameters of the demonstration reactor.	



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



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

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



Thank You

Additional information can be found on the NRIC Website:

<https://inl.gov/nric/>
nric@inl.gov

Questions?