



NRIC

National
Reactor
Innovation
Center

NRIC Program Overview

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INL Industry Engagement Series
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NRIC Enables Nuclear Reactor Demonstrations

- Authorized by the Nuclear Energy Innovation Capabilities Act (NEICA)
- 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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DE-FOA-0002271

“Advanced Reactor Demonstration “

- FOA has three separate award pathways:
 - **Demos** Advanced Reactor Demonstrations
 - Initial funding of \$160M for 2 awards
 - \$400M - \$4B total per project across 7 years
 - [TerraPower Sodium and X-energy Xe-100 Selected for Award](#)
 - **Risk Reduction** Risk Reduction for Future Demonstrations
 - Initial funding of \$30M for 2-5 awards
 - \$40M - \$400M total per project across 5 years
 - **ARC-20** Advanced Reactor Concepts – 2020
 - Initial funding of \$20M for 2 awards
 - \$10M - \$40M total per project across 5 years
- NRIC coordination with INL on responses for 18 potential projects with industry

DOD SCO RFS:

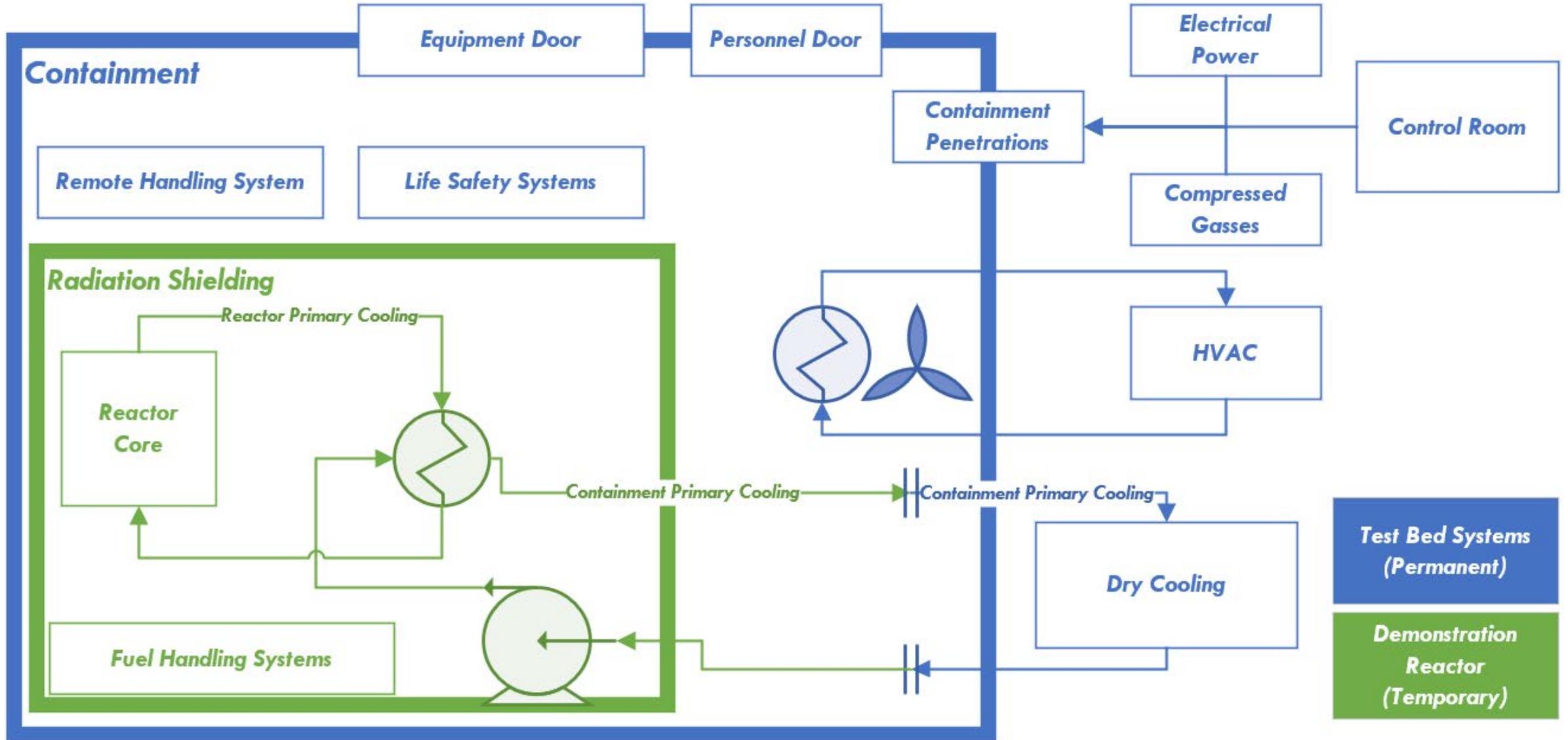
Pele Program Phase I

“Mobile Nuclear Reactor”

- [BWXT, WEC, and X-energy Selected for Award](#)
- 1-5 MWe for >3 Years Before Refuel
- Utilize TRISO Fuel Form
- CONEX Box Mounted Reactor System
- <40 Tons Total Weight
- Transportable by single C-17
- Minimal Staff needed to Operate and Maintain System
- NNSA Providing HALEU
- NRIC-DOME (potential) Site for Initial Demonstration in 2024



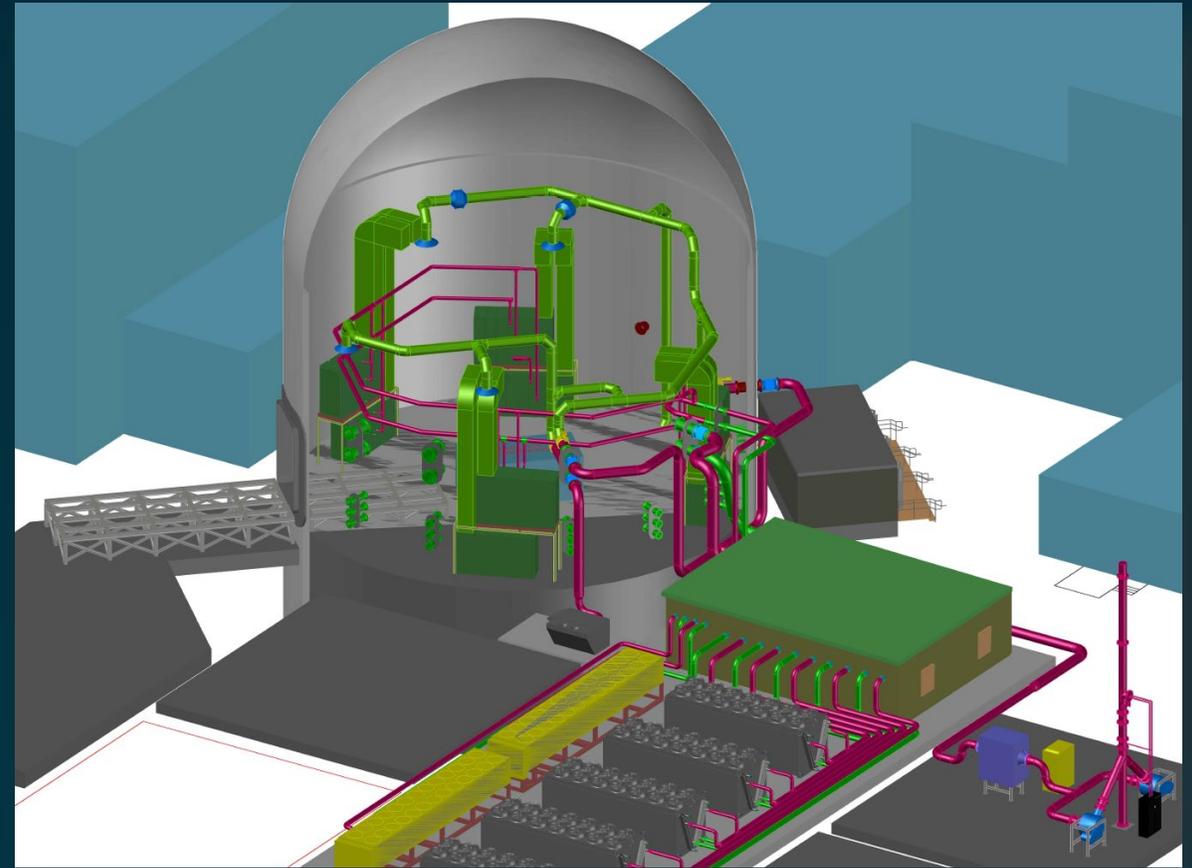
NRIC Demonstration Reactor Test Bed



NRIC-DOME

Demonstration and Operation of Microreactor Experiments

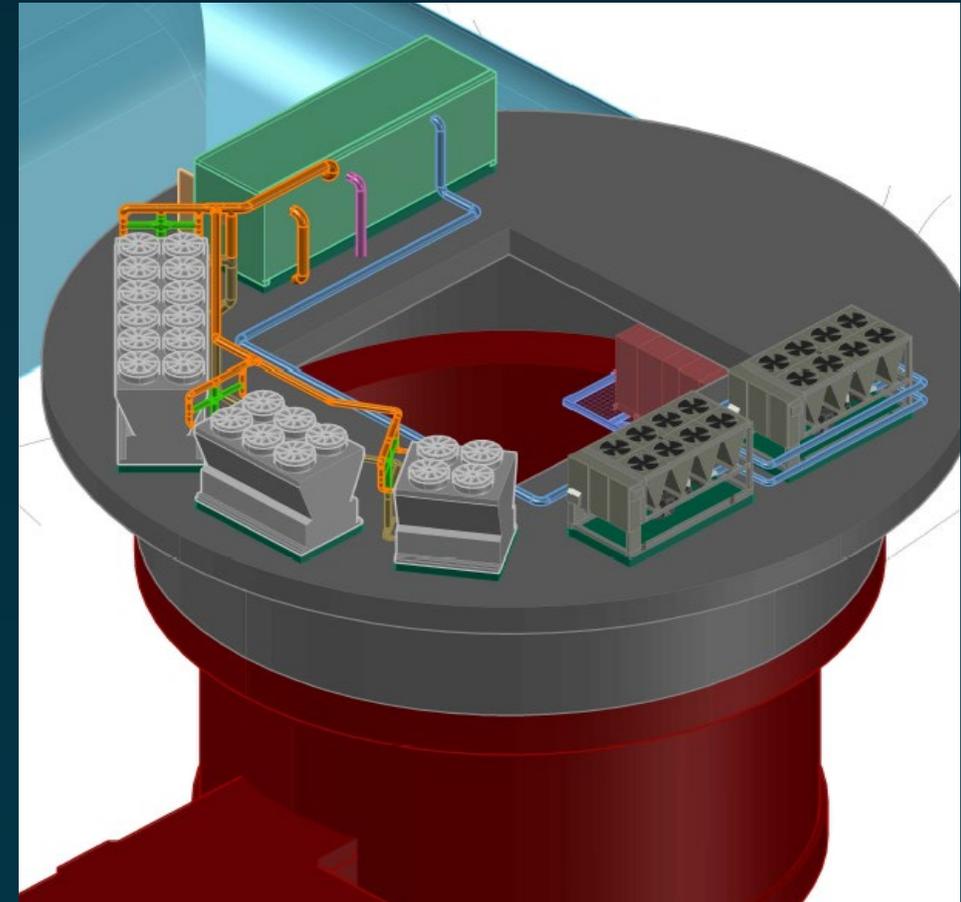
- Modifications to the EBR-II Dome
- Expand equipment hatch to 13' x 15.5'
- 10MW Dowtherm Q closed loop reactor cooling system
- 2MW chilled water/glycol air cooling system
- 33 New Containment Penetrations
 - (4) 24" Ø Pen- Demonstrator, (2) 20" Ø Pen- Ventilation, (2) 24" Ø Pen- Heat Removal, (15) 12" Ø Pen- Electrical, (2) 10" Ø Pen- Cooling, (8) 1-4" Ø Pen- Mechanical
- New 2,000 kVA substation
- Microreactor demonstrations that utilize Safeguards Category IV fuels
- Pre-Conceptual Design Summary Report:
 - <https://www.osti.gov/biblio/1690269-nric-eb-r-ii-test-bed-pre-conceptual-design-report>



NRIC-LOTUS

Laboratory for Operation and Testing in the U.S.

- Modifications to the ZPPR Cell
- 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
- Experimental or Pilot reactor demonstrations that utilize Safeguards Category I fuels
- Pre-Conceptual Design Summary Report:
 - <https://www.osti.gov/biblio/1691465-zppr-test-bed-ztb-pre-conceptual-design-report>



NRIC Digital Engineering Framework

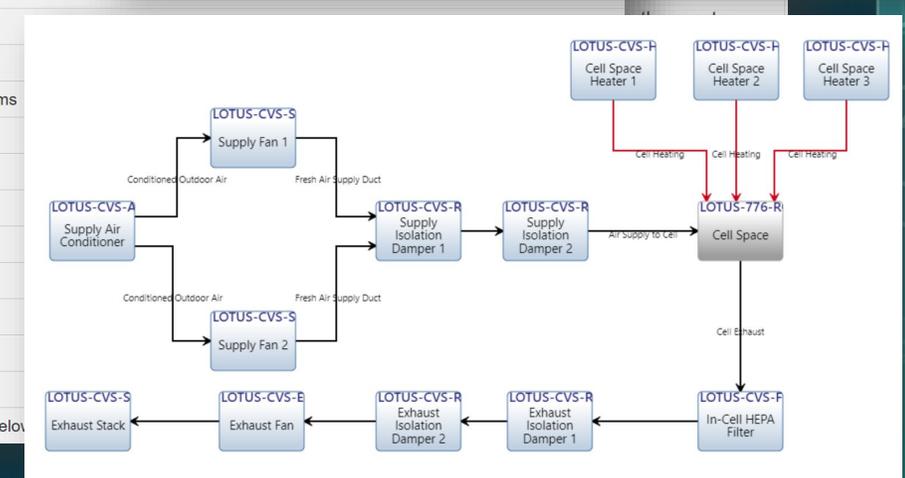
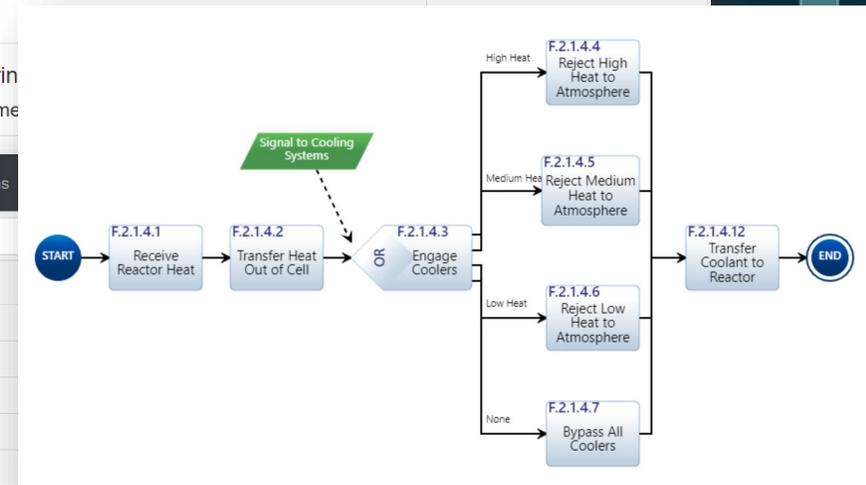
- Digital Requirements Management
- Functional Decomposition
- Configuration Management
- Model-Based Systems Engineering (MBSE)
- Bi-directional traceability between requirements, system elements, interfaces, and verification

FOR-538 ZPPR Modifications to Support Demonstration Reactors	Rationale
A means to test and quantify the leak rate of the confinement boundary shall be provided.	
3.1.4.8 Demonstration Reactor Effluent Collection A means to connect effluent from demonstration reactor filtering systems and delay tanks shall be provided.	S Filters and delay tanks are to be provided by the demonstration reactor project, but a facility connection needs to be
3.1.4.9 Standard for Emissions Monitoring Emissions monitoring shall meet the requireme	

MENU Dashboard Database Diagrams

order.modified- class:"Action" Search the Database...

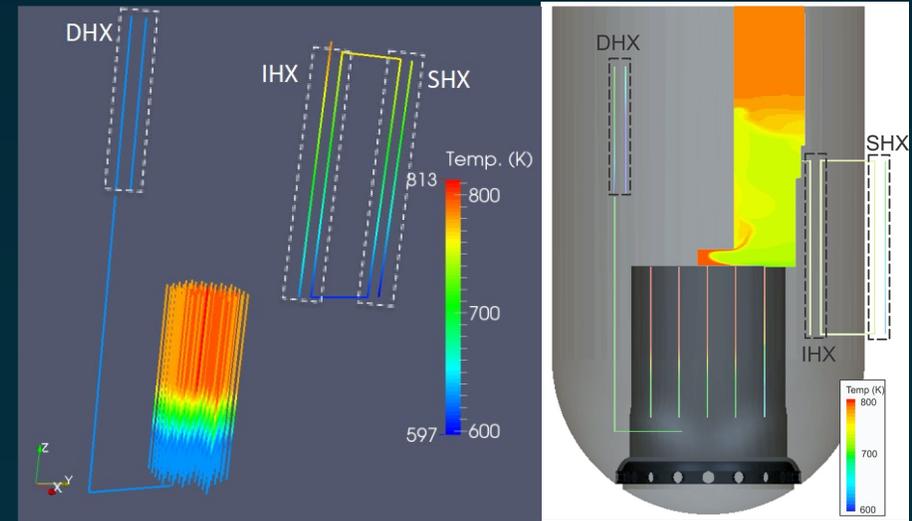
- Entity**
- F.2.7.5 Perform Logic Solving
 - F.2.1.4.6 Reject Low Heat to Atmosphere
 - F.2.1.4.7 Bypass All Coolers
 - F.2.1.4 Remove 50 - 500 kW Reactor Thermal Energy
 - F.2.1.4.5 Reject Medium Heat to Atmosphere
 - F.2.1.4.4 Reject High Heat to Atmosphere
 - F.2.1.4.3 Engage Coolers
 - F.2.7.3 Receive Operator Input
 - F.2.7 Monitor and Control Facility and Systems
 - F.2.7.4 Receive Data from Reactor I&C
 - F.2.7.7 Transmit Signals to LOTUS Systems
 - F.2.7.6 Transmit Data to Reactor I&C
 - F.2.7.9 Display System Status
 - F.2.7.8 Transmit Data to MFC
 - F.2.7.1 Receive Data from LOTUS Systems
 - F.2.1.1.1 Exchange Heat with Cell Air
 - F.2.7.2 Receive Signals from MFC
 - F.2.1.1 Actively Maintain Cell Temperature Below



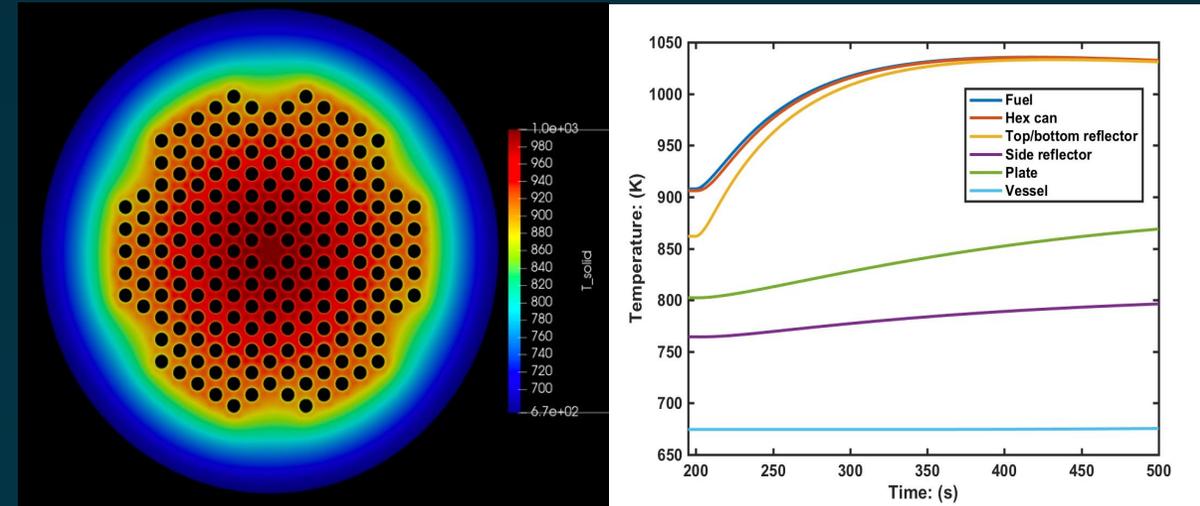
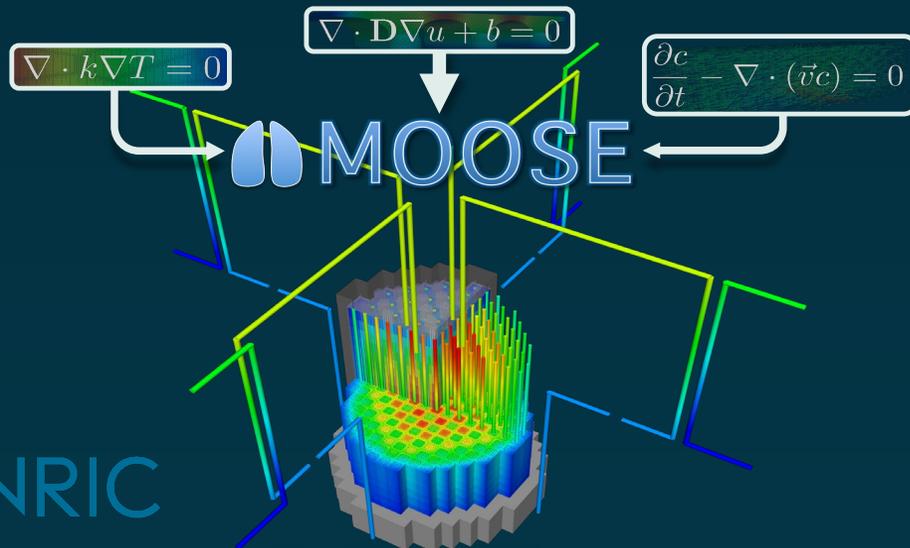
NRIC & NEAMS - VTB

Virtual Test Bed

- 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



Stand-alone and Coupled SAM and CFD code simulations of SFR



Transient multi-physics simulation of heat-pipe-cooled micro-reactor

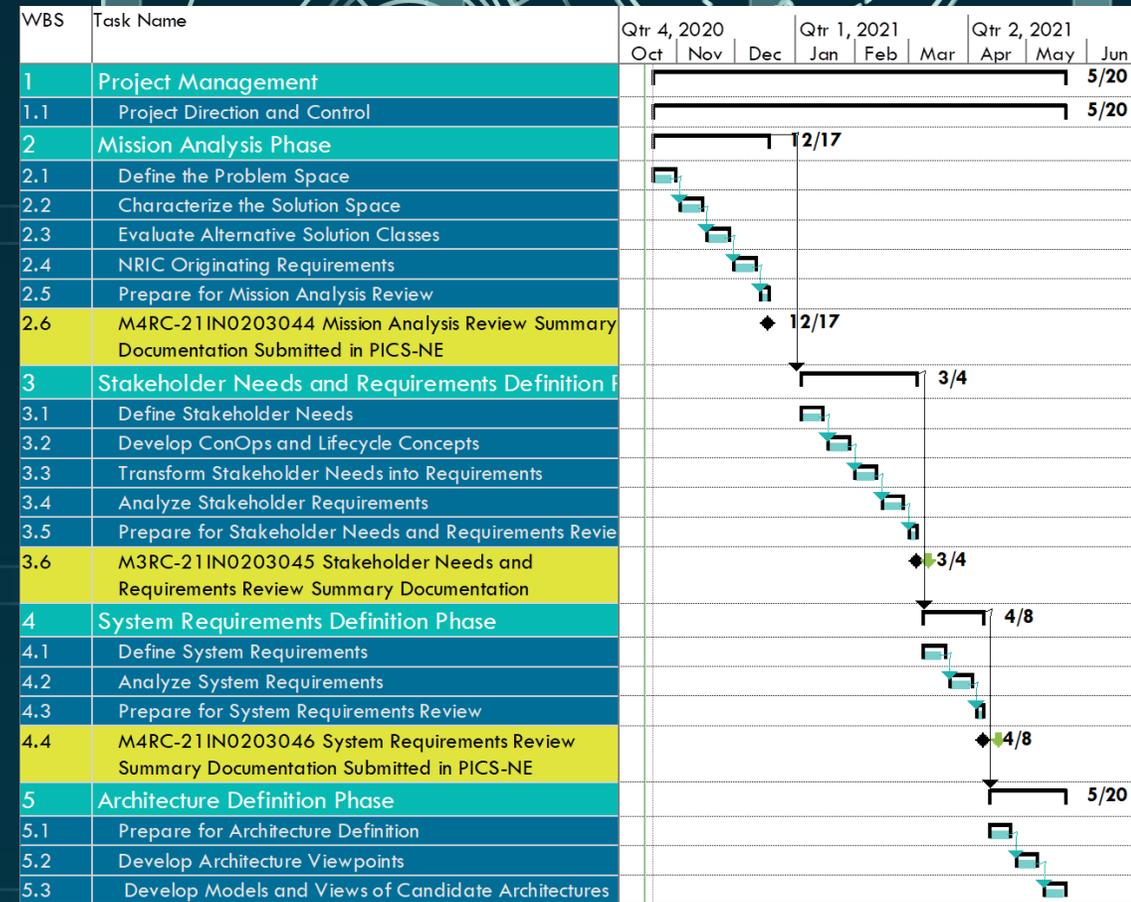
NRIC D&D Capability- Pre-Conceptual Design

Vision –

Enable timely and cost-effective execution of post-reactor operations for experimental reactor projects that make use of the NRIC Test Beds at INL.

Need –

A decommissioning and deactivation capability to support successful deployment of experimental advanced reactors at NRIC test beds is needed to continue use of the test beds and to protect human health and the environment at the end of those projects.



Thank You

Additional information can be found on the NRIC Website:

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

Questions?