

Nuclear Energy University Program (NEUP) Fiscal Year (FY) 20 Annual Planning Webinar

RC-3 Liquid Metal-cooled Fast Reactor Technology Development and Demonstration to Support Deployment

Tom Sowinski
Office of Nuclear Energy
Department of Energy

August 6, 2019

Federal POC – Thomas Sowinski:
Thomas.Sowinski@nuclear.energy.gov

Technical POC – Chris Grandy:
cgrandy@anl.gov

Program Mission and Objectives

Mission:

- Perform targeted research and create sustained testing infrastructure to support demonstration of U.S. fast reactor technologies and to enable subsequent commercial deployments

Objectives:

- Research, development, and demonstration of innovative cost reduction and performance enhancing technologies (e.g., new configurations, materials, energy conversion, etc.)
- Developing and sustaining a flexible domestic infrastructure and knowledge base for research, development, and demonstration of fast spectrum systems
- Clarifying fast reactor licensing frameworks and developing science-based approaches for regulatory compliance (e.g., NRC engagement and resolution of outstanding fast reactor regulatory issues)



METL Facility - ANL

Major Program R&D Areas

For the commercial deployment of fast reactors, stakeholders have identified two recurring challenges:

- Capital investment in fast reactors is a dominant cost (cost reduction is vital for competitiveness)
- A pathway must be established for non-LWR licensing

To address these challenges, the program uses input from key stakeholders such as the industry-led Fast Reactor Technology Working Group to focus its efforts on the following high-priority R&D areas:

- Preserving, streamlining access to, and qualifying legacy DOE fast reactor R&D and operational data for use in industry design and licensing cases
- **Researching more effective fast reactor primary component, sensor, and reliability monitoring technology options identified by fast reactor designers**
- **Operating the Mechanisms Engineering Test Loop (METL) facility to demonstrate innovative fast reactor components and instrumentation in a prototypic in-sodium environment**
- Improving, sustaining, benchmarking, and validating existing fast reactor design and safety analysis code suites for use in vendor design optimization and licensing cases
- Providing the technical basis to support ASME qualification of advanced structural materials for use in fast reactors

RC-3 Scope (Slide 1 of 2)

Seeking proposals to develop experiments, instrumentation, control strategies, and performance enhancing technologies for the METL facility that have the potential to subsequently be deployed in U.S. liquid metal fast reactor concepts

Focus on technology enhancements and experimental work that can offer potentially significant benefits in reactor capital or operating cost reductions

Examples of potentially beneficial work areas include:

- Development of test articles for METL. Test articles can be used to demonstrate innovative sub-components (sensors, seals, mechanisms, etc.) or validate key fast reactor behaviors under prototypic conditions
- Enhancement of advanced sensors and instrumentation required to operate in the primary liquid metal coolant (e.g., leak detection, sodium impurity measurement, level measurement)
- Testing components for innovative liquid metal-cooled reactor self-actuated control and shutdown systems (e.g., curie point magnets, fusible linkages)
- Experiments for in-service repair technologies. These systems include visualization sensors for immersed coolant applications and technologies for the welding and repair of structures in contact with the primary coolant



RC-3 Scope (Slide 2 of 2)

Examples continued:

- Improving performance of METL sodium technologies including rugged high temperature resistance heating systems, improved insulation technology, improved sodium leak detection and identification technologies, vessel support technologies that reduce heat losses, improved clamp on flow meters, thermal monitoring, etc.
- Development of deployable sensors and prognostic techniques for demonstration in METL that can be used to monitor and quantify materials degradation in liquid metal-cooled fast reactor primary systems

NOTE: Though proposals are not limited to the example work areas above, applicants should indicate how their proposed work will support current DOE, national laboratory, and/or U.S. nuclear industry liquid metal-cooled fast reactor deployment and commercialization R&D initiatives.

Further information on METL available at:

<https://www.anl.gov/nse/mechanisms-engineering-test-loop-facility>

