

NEAMS Overview: Molten Salt Reactors

David Andersson, NEAMS National Technical Director, Los Alamos National Laboratory

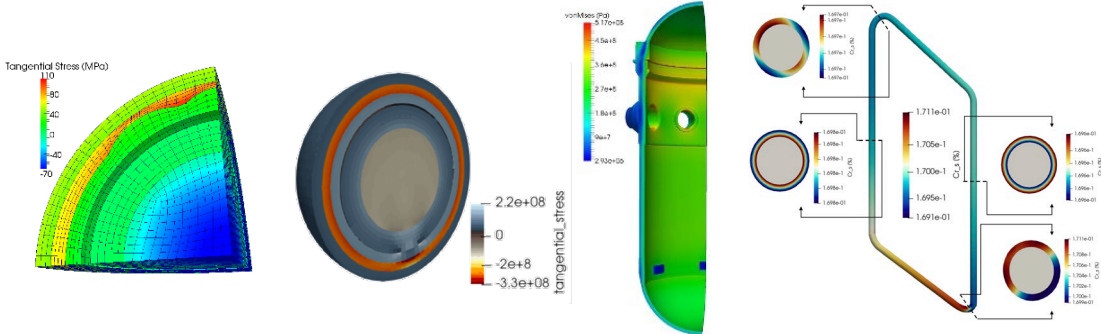


U.S. DEPARTMENT
of **ENERGY**

Office of
Nuclear Energy

NEAMS Technical Areas and Code Support

Fuel Performance

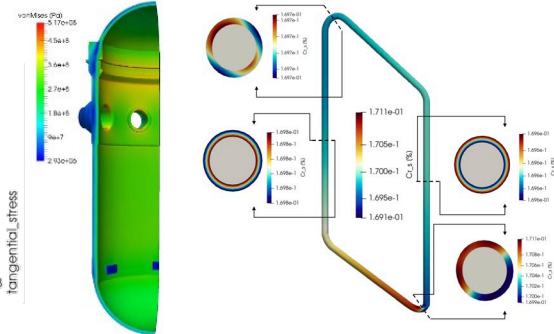


Competencies: Multi-scale fuel and cladding performance

Codes: Bison

Lower-length-scale capabilities: DFT, MD, phase field, crystal plasticity (LAPx), cluster dynamics, phase field

Structural Materials and Chemistry

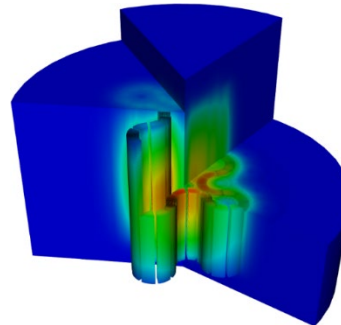


Competencies: Multi-scale modeling of materials degradation and chemistry (molten salts)

Codes: Grizzly/BlackBear, MSTDB-TC/TP, Mole, Saline, SWIFT, MOSCATO

Lower-length-scale capabilities: DFT, MD, phase field, crystal plasticity (LAPx), dislocation dynamics, cluster dynamics

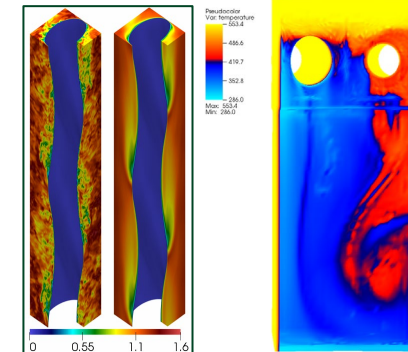
Reactor Physics



Competencies: Deterministic and stochastic methods for simulating neutron transport and nuclide depletion/decay

Codes: GRIFFIN, Shift, MPACT

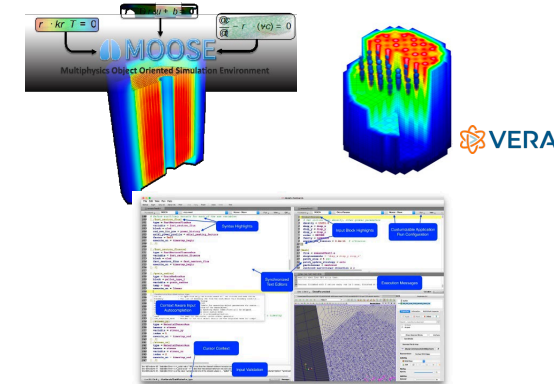
Thermal Fluids



Competencies: Multi-scale simulations of thermal fluids and heat transfer in reactor systems

Codes: CTF, SAM, PRONGHORN, Sockeye, Nek5000/NekRS, Cardinal

Multiphysics Applications



Competencies: Computational frameworks, multiphysics simulations, reactor specific applications, user interfaces and workflows.

Codes and frameworks: MOOSE, VERA, Workbench

Capabilities are developed for all major reactor types – Light Water Reactors, Gas-Cooled Reactors, Molten Salt Reactors, Metal Cooled Fast Reactors and Microreactors. The reactor specific applications cross-cut the technical areas.

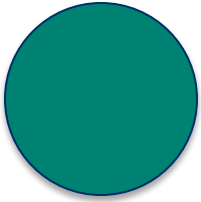
Key success metric: Use of NEAMS technology (either software or R&D) by stakeholder to improve how they “do business.”



U.S. DEPARTMENT
of **ENERGY** | Office of
Nuclear Energy

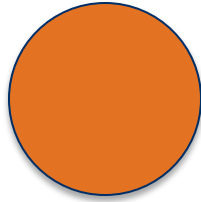
Molten-salt reactors: Five-year Plan and Major Achievements

FY26



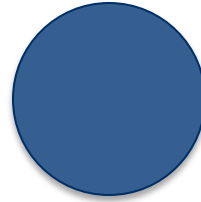
- Demonstrate enhanced electrochemical and noble-metal plating and deposition models using Pronghorn and MOSCATO.
- Supports MSR steady-state analyses.

FY27



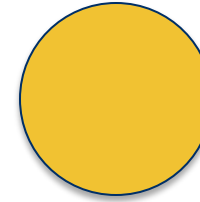
- Establish initial transient simulation capabilities for molten-salt reactors by integrating reactor physics, thermal fluids, and evolving chemistry.
- Supports MSR AOO and DBA analyses.

FY28



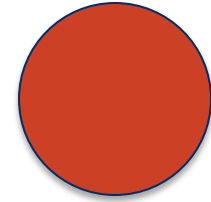
- Demonstrate modeling capability for salt-spill accidents involving fluoride- and chloride-based salts.
- Supports MSR BDBA analyses.

FY29



- Deliver reactor physics workflows, integrating online refueling, fission-product generation/management, fission gas behavior modeling, novel depletion methodologies, and high-fidelity delayed neutron precursor tracking.
- Supports MSR Steady-State analyses.

FY30



- Establish a mature simulation capability for operation of MSRs via coupled reactor physics, thermal-fluids, and chemistry models, including off-gas dynamics and its impact on reactor physics.
- Expansion of molten salt property database to include higher-order systems relevant to corrosion and fission products.
- Demonstrate the use of lower-length-scale thermal-fluids and materials techniques to improve mass transfer coefficient correlations and corrosion predictions in systems and engineering-scale MSR models.
- Supports MSR Steady-State analyses.

Collaboration with the MSR, AMMT, and AFC programs will be important for the broader impact of these achievements by, for example, providing application context, validation data, and M&S supporting experimental interpretation and design.



U.S. DEPARTMENT
of **ENERGY**

Office of
Nuclear Energy

Agenda

NEAMS – MSR Material and Chemistry		
2:10 PM	NEAMS Structural Materials & Chemistry Overview	Ted Besmann/USC
2:25 PM	Atomistic simulations for thermophysical properties of molten salts	Gaoxue Wang/LANL
2:40 PM	Reactive Multiphase Flow Modeling with MOSCATO	Nathaniel Hoyt/ANL
2:55 PM	Phase-field modeling of corrosion in alloys	Chaitanya Bhawe/INL
3:10 PM	BREAK	
NEAMS- Thermal Fluids		
3:15 PM	NEAMS - Thermal Fluids Overview	Elia Merzari/PSU&ANL
3:35 PM	Recent SAM enhancements for MSR applications	Travis Mui/ANL
3:55 PM	Pronghorn enhancements for MSR applications	Mauricio Tano/INL
NEAMS- Multiphysics Application		
4:00 PM	NEAMS Multiphysics Application Overview	Mauricio Tano/INL
4:20 PM	Comprehensive modeling of the L-MSR exercising current capabilities	Rodrigo de Oliveira/INL
4:45 PM	Multidomain multiphysics analysis of transients in the Molten Salt Reactor Experiment: Saline, Pronghorn, SAM, and Griffin	Ramiro Freile/INL
5:00 PM	Xenon Transport Simulation and Validation with MSRE Data	Ting Fei/ANL
5:15 PM	Noble metal transport in an MSR heat exchanger with Nek/MOSCATO	Kirk Yuan/ANL





U.S. DEPARTMENT
of **ENERGY**

Office of
Nuclear Energy