



Exceptional service in the national interest

AN OVERVIEW OF SNL ENERGY CAPABILITIES

Sandia National Laboratories

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U.S. DEPARTMENT
of ENERGY



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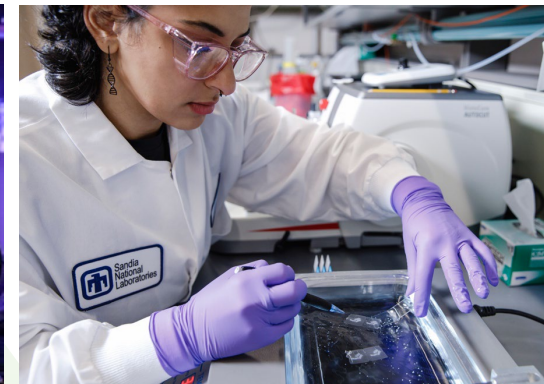


SANDIA'S DETERRENCE, SCIENCE & ENERGY DIVISION



Secure the homeland against threats and assure the nation's abundant energy future by performing world-class research and development

- Enable the full potential of renewable energy and subsurface resources
- Ensure the safety, security and resilience of **nuclear power**, the electric grid, and the **safe management and disposal of radioactive wastes**
- Advance affordable, available and efficient energy use for America's energy future
- Reduce the nation's vulnerability to chemical, biological, radiological and **nuclear threats**
- Increase our nation's digital and physical critical infrastructure security and resilience to natural and human-made threats



MOLTEN SALTS AT THE NATIONAL SOLAR THERMAL TEST FACILITY (NSTTF)



- Molten salt coupled CSP facilities date back to 1990s
- CSP work overlaps with molten salt reactors (MSRs) and molten salt cooled fusion reactors.
- The NSTTF has multiple molten salt testing capabilities for temperature ranges 500-1000 °C
- Can test chemistries including fluoride, chloride, and nitrate salts
- Major test capabilities include material compatibility and corrosion analysis, salt loops, and accident simulation

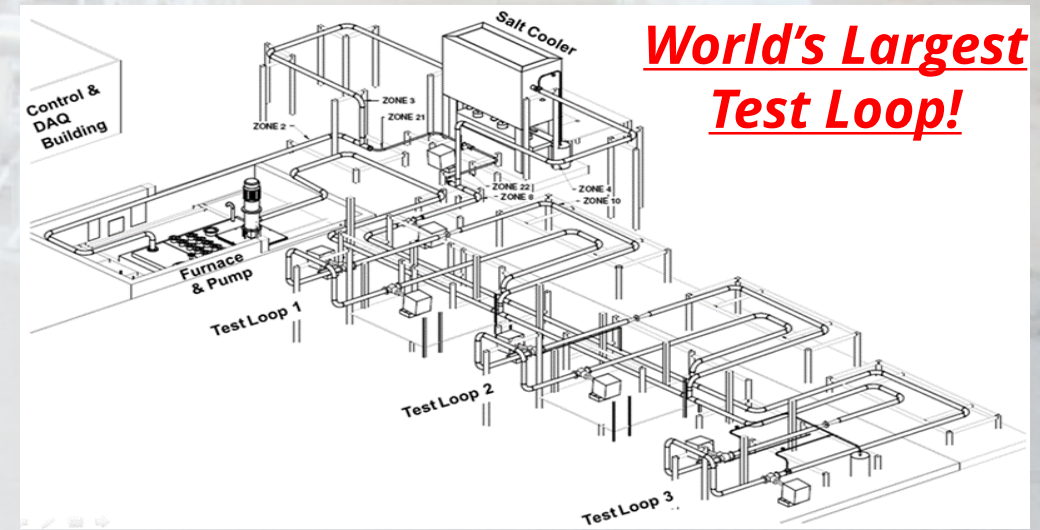


MSTL TECHNICAL CHARACTERISTICS (KEN ARMIJO)



- MSTL developed to allow industrial customers and researchers to test molten salts over range of temps/flow rates for various components & heated systems.
- Although small test loops are used to prove concepts, they are not necessarily scalable to commercial plant sizes.
- Since September 2017, MSTL has been offline. Capability is actively being restored with plans for commissioning in Spring 2026
- Construction of MSTL today would cost 1.5-2 times (~\$21M) more than original 2010 costs.

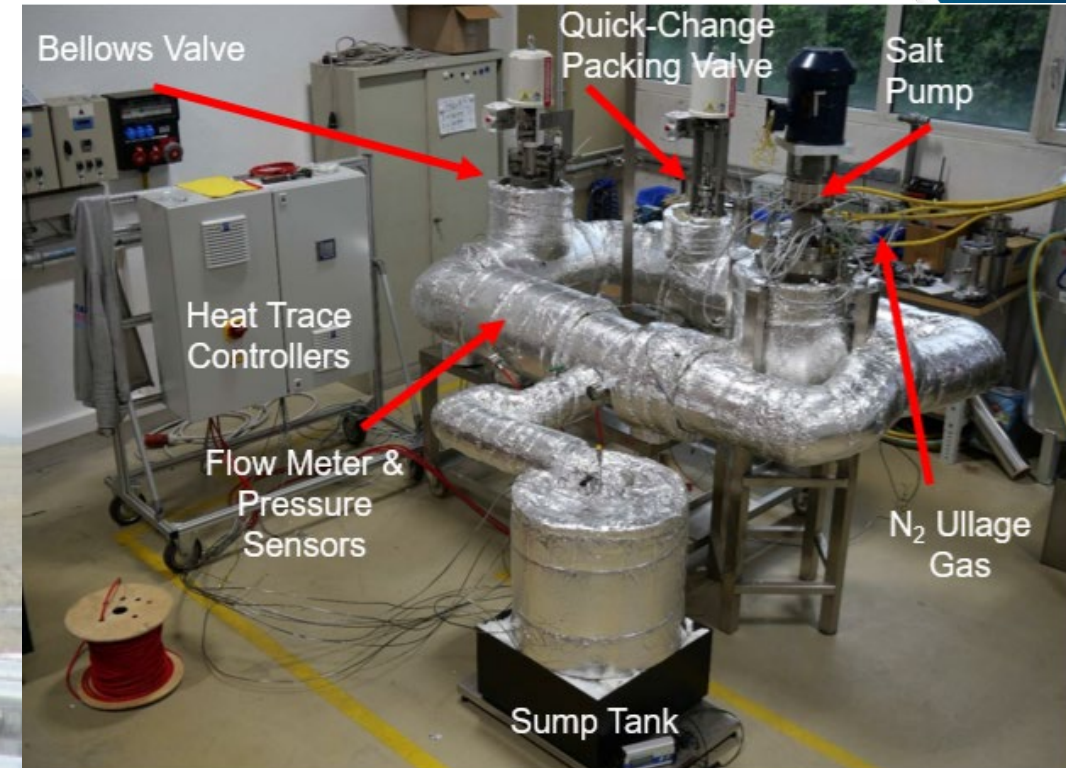
Ken Armijo (kmarmij@sandia.gov)



750 °C CHLORIDE/FLOURIDE SALT TEST LOOP



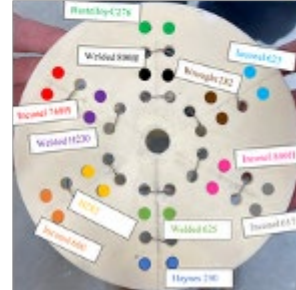
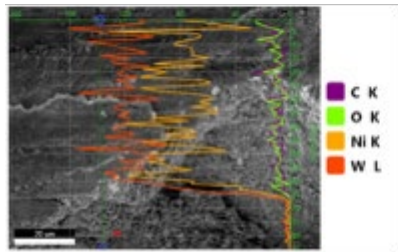
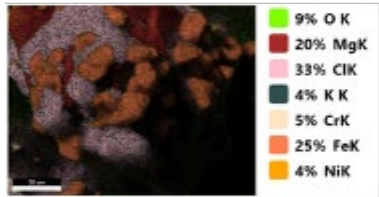
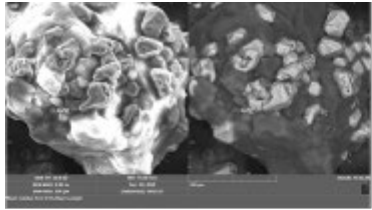
- Test Loop development in collaboration with Flowserve Corp., led by Sandia National Labs.
- 750 °C Salt Test Loop commissioned in 2023, now loaned to Sandia
- Test system for assessing high-temperature molten salt valves and sensors under flow conditions.
- Inconel 625 and Stainless Steel 316 construction
- 5 – 10 gpm flow rate from Inconel 625 pump



Dimitri Madden (damadde@sandia.gov)

MATERIALS CHARACTERIZATION

Corrosion Analysis



Coupon testing

World Record
(~1,000°C)



Salt pot testing



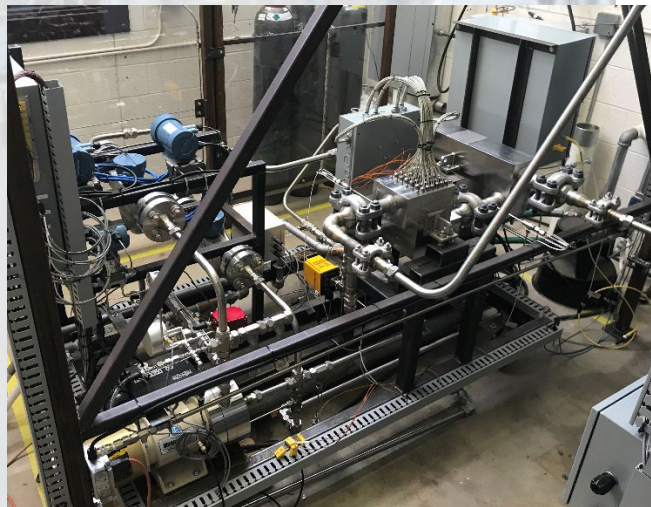
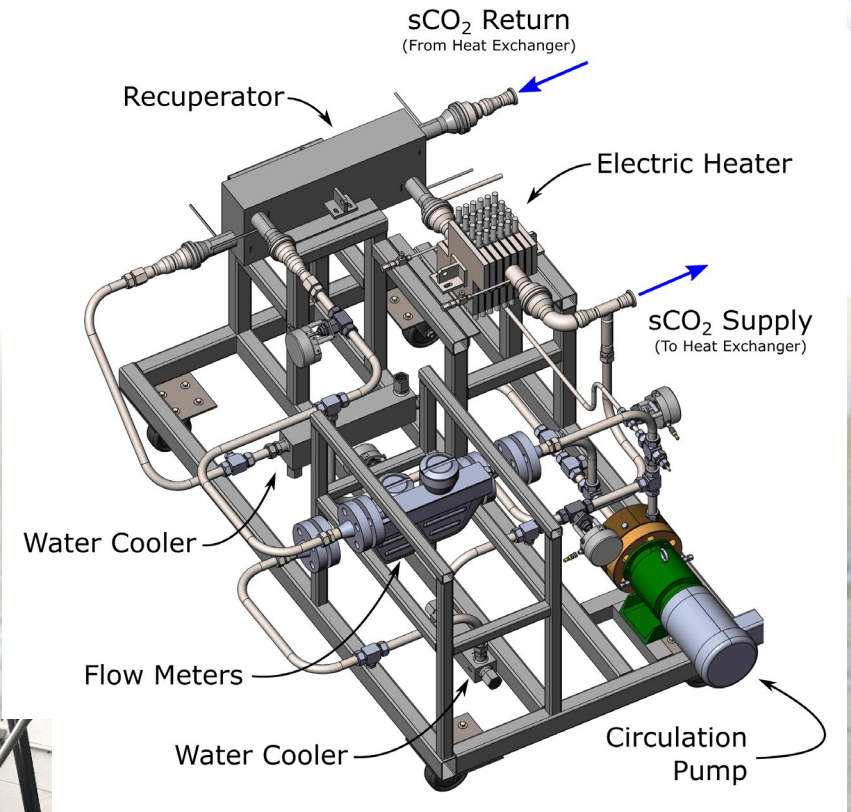
Dendrite growth on mica and graphite rings compressed between Inconel 625

- X-ray crystallography
- SEM
- EDS



OTHER CAPABILITIES: SUPERCRITICAL CO2 LOOPS

- The NSTTF houses three supercritical CO2 loops
- The molten salt team owns and operates a 20 kW loop designed for hardware demonstration and testing of up to 60 kW/800 °C heat exchangers
- Modular 20 kW loop is placed on a skid for easy configuration with many systems and heat sources.
- The loop is installed with a pump, heater, variable control valves, temperature sensors, Coriolis flow and density meters, pressure transducers, and multiple air and glycol coolers.



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Parameter	Specification	Unit
sCO ₂ Heating Capacity	20	kW
Heat exchanger sizing	20-60	kW
Pressure	20	MPa
sCO ₂ Flow Rate	250	g/s
Max sCO ₂ Op. Temp.	600	°C

SCO2 RESEARCH AT SANDIA



Rodney Keith
(rlkeith@sandia.gov)



Heat Exchanger Testing



Pressure Fatigue Testing



Turbomachinery Testing



Bearings Testing



Seals Testing

MELCOR

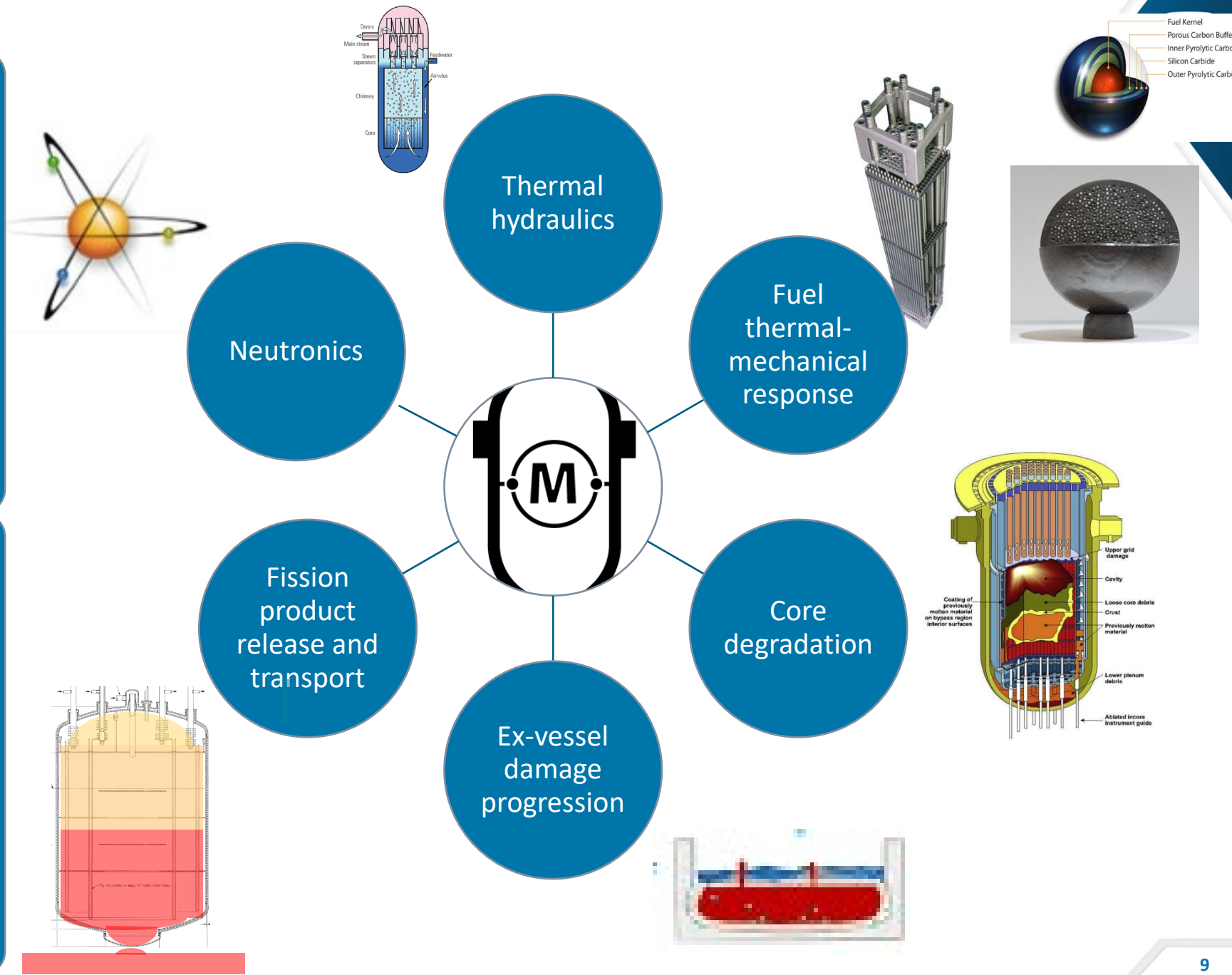
Integrated Accident and Source Term Modeling

- Hydrodynamics for range of working fluids
- Accident response of plant structures, systems and components
- Generalized fission product transport modeling inside facilities

MACCS

Consequence Assessment

- Near- and far-field atmospheric transport and deposition
- Assessment of health and economic impacts of radiological accidents



NUCLEAR WASTE STORAGE & TRANSPORTATION R&D



- Large scale testing capabilities at Sandia used for nuclear waste and transportation testing



The **Lurance Canyon Burn Site** offers controlled fire environments to simulate transportation and handling accidents



The **Cylindrical Boiling Facility (CyBL)** designed for thermal hydraulic investigations and fire ignition related to nuclear power plant safety.



The 185-foot **Drop Tower Facility** provides a controlled environment for testing small and large test items.



The **Surtsey Testing Facility** simulates nuclear detonation effects and includes large testing areas, three spent fuel canisters, and a 1/10th scale nuclear power plant containment vessel



The **Mobile Instrumentation Data Acquisition System (MIDAS)** is a versatile platform designed for real-time data collection and monitoring in various mobile experimental environments



Package and transport capabilities for multiple delivery avenues

DISPOSAL R&D



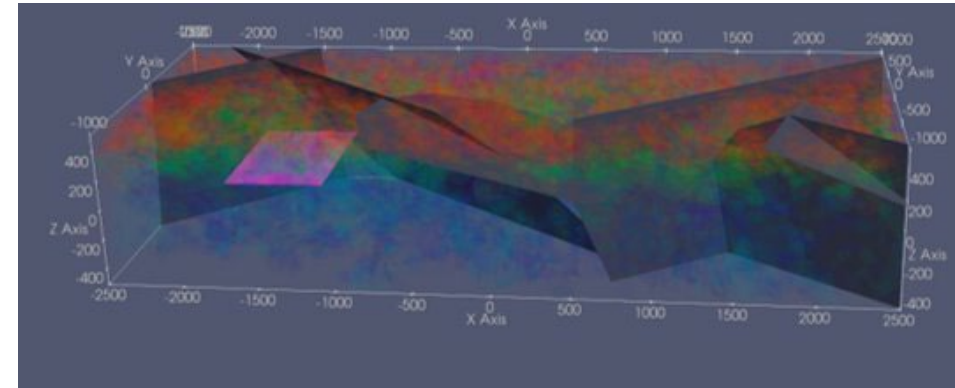
Provide a **sound technical basis for multiple** viable disposal options in the US

- Spent nuclear fuel (SNF)
 - Commercial
 - DOE-managed
- High-level nuclear waste (HLW) glass

Increase confidence in the robustness of generic disposal concepts

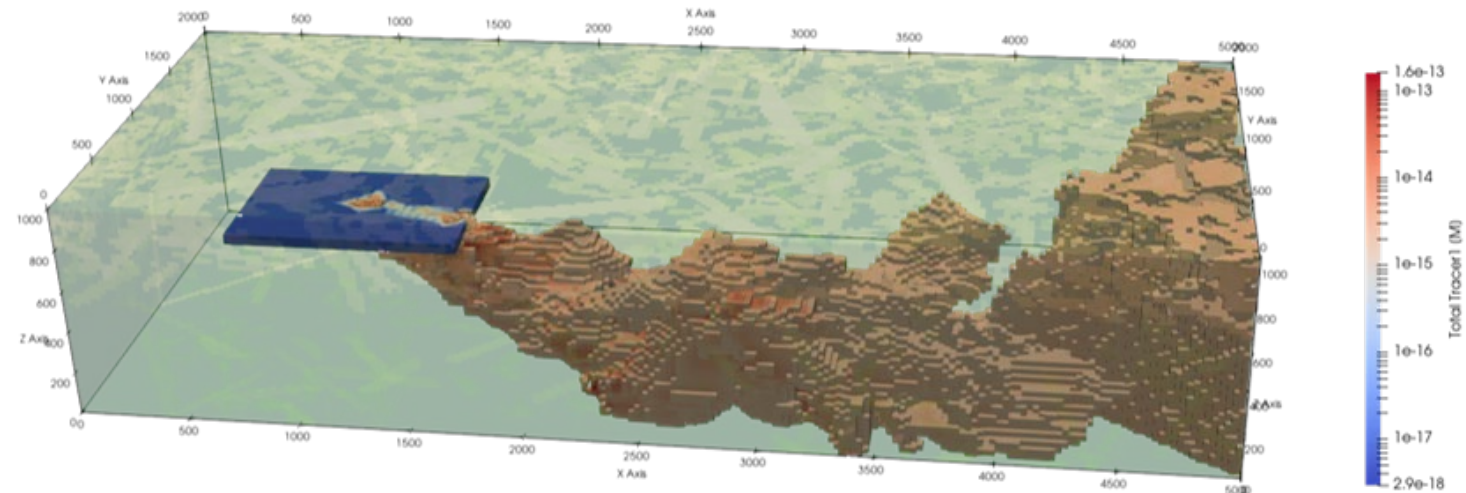
Develop the science and engineering tools needed to support disposal concept implementation

Created performance assessments for nuclear repositories, including the Waste Isolation Pilot Plant (WIPP)



Fracture network and repository

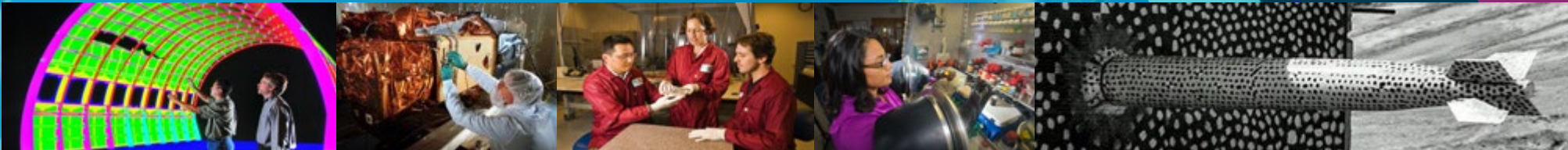
Tracer plume at 100,000 years
for 2500 canisters





THANK YOU

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