U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

Spent Fuel and Waste Science and Technology (SFWST)

SAND2021-7057PE

SFWST Storage and Transportation: What we are Doing, How it Fits Together, and Where we are Going.

FY21 ANS FCWMD Social and Game Night

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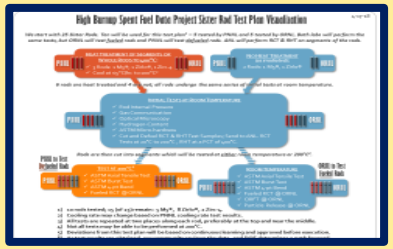
Project Synergy for the Technical Basis of Spent Fuel Integrity

We are testing fuel in hot cells and glove boxes. (ANL, ORNL & PNNL)

We completed nondestructive analysis are completing destructive analysis.

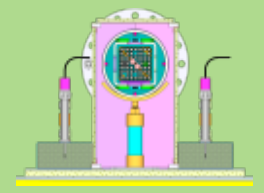


Results show stronger spent fuel than predicted. It is more ductile, harder to break and does not release as much when broken as predicted.

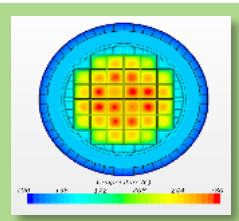
SISTER ROD MECHANICAL TESTING DATA

We got validation thermal data from the EPRI/DOE North Anna Nuclear Power Plant Cask

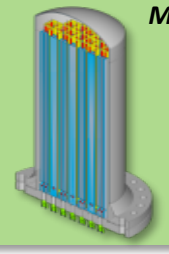
We are getting new thermal data from SNL Mockups at CYBL.



THERMAL BEHAVIOR



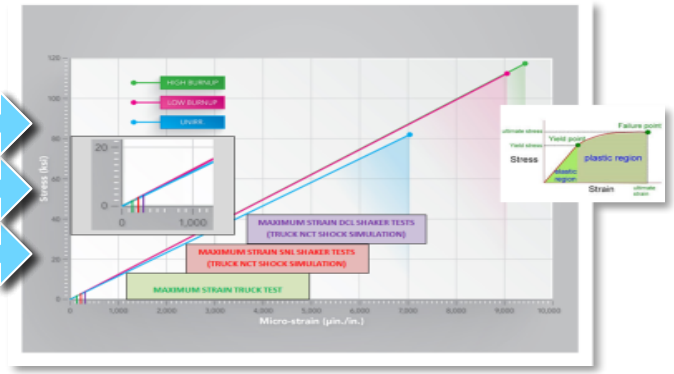
We are working to ID conservatisms & develop more realistic assumptions in Nuclear Fuel Thermal Models.



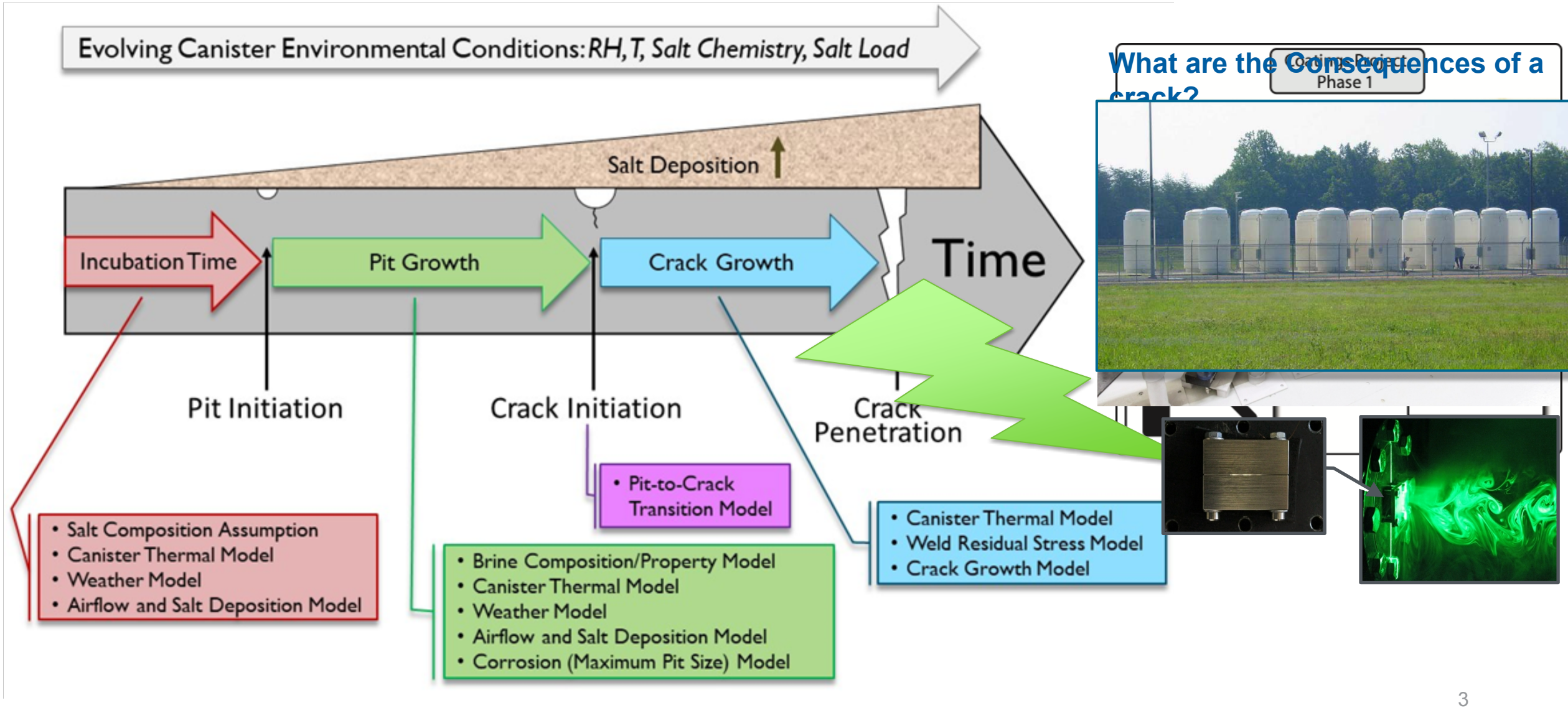
PROVIDES KNOWLEDGE ABOUT SPENT FUEL INTEGRITY

Spent Fuel Triathlon (2017) and 30-cm Drop (2020), then Seismic (2022): Fuel Experiences Low External Shocks and Vibrations

EXTERNAL LOAD QUANTIFICATION



Understanding Canister Corrosion Progression, Consequence, and Mitigation



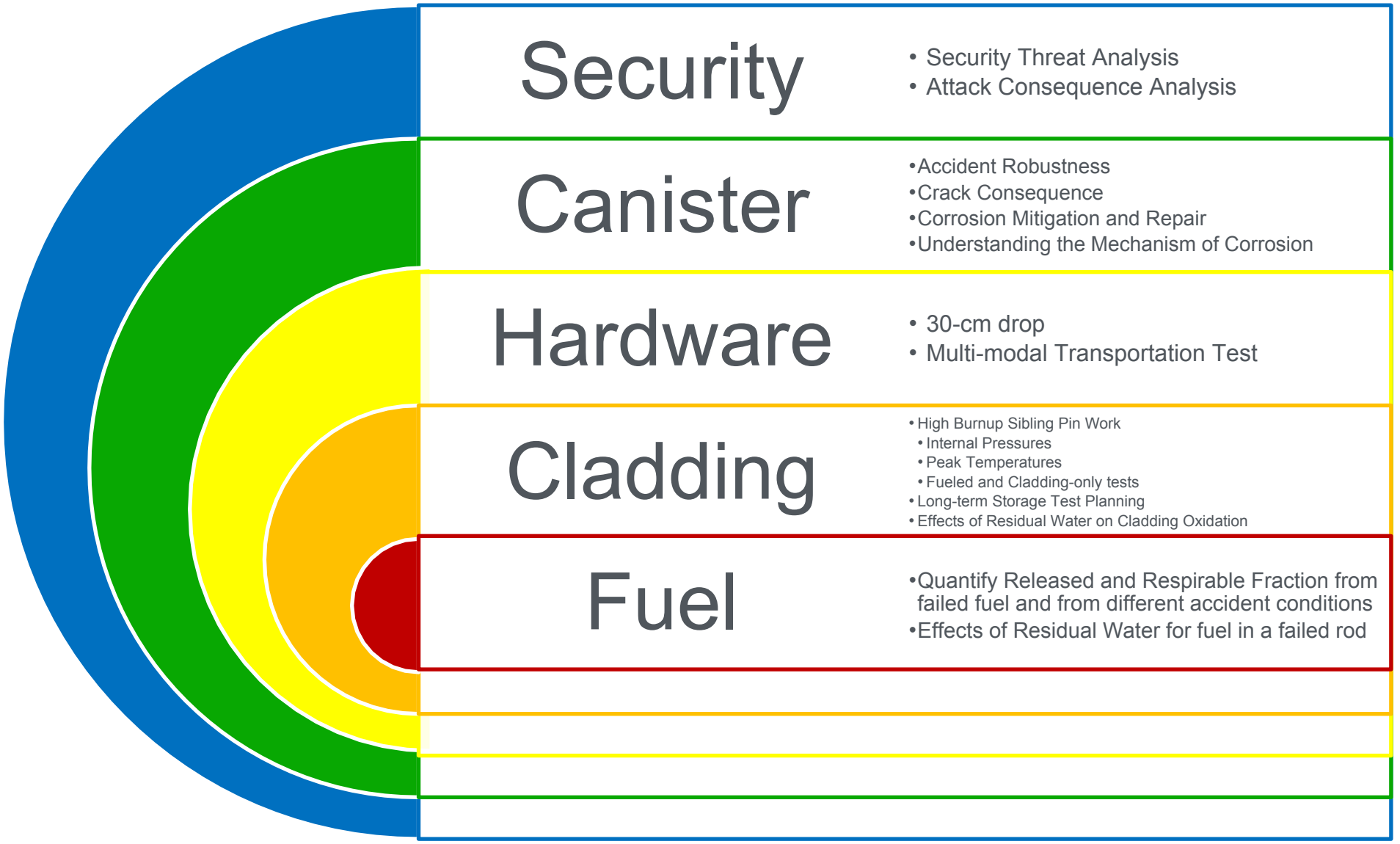
Full-Scale Canister Aging Management Testing

DOE-NE has a unique opportunity to use six TN-32PTH2 and nine TN-24PT4 canisters and associated Advanced Horizontal Storage Modules (ASHMs)

Several different research projects scheduled and proposed

- Canister deposition sampling
- Thermal and drying
- Stress corrosion cracking
- Seismic
- Cold sprays
- Filler (post-closure moderator exclusion)

Aging Management of Defense in Depth



5-Year R&D Plan Overview

(Subject to change based on funding appropriation, additional opportunities, or changes in direction based on learnings)

YEARS

GAPS

Demo/Sibling Pin Testing	• Continue collecting temperature data from the Research Project Cask and plan for its transport • Develop a gap analysis for ATF and higher burnup fuels	• Continue and complete Phase 1 sibling pin testing. • Develop Phase 2 test Plan and Assessment of Gross Rupture. • Obtain Data on BWR, IFBA, and ATF cladding/fuels • Clean up hotcells and dispose of waste.	• Prepare facility and move canister	
Thermal Profiles	• Complete Round Robins • Perform Sensitivity and Uncertainty Analyses • Conduct small & large scale vertical and horizontal testing	• Continue testing/analyses on canistered and bare fuel systems in horizontal and vertical orientations, emplacement in transportation cask, leaking canisters, plugged vents, wind effects, and time to boil.		Close Gap
Stress Profiles	• Design, Fabricate, and Test 8-Axle Railcar • Complete 30cm drop test analysis • Determine pinch loads and seismic loads adding simulated irradiated materials	• Determine the magnitude of pinch loads via drop tests in the horizontal and Vertical Orientations adding simulated irradiated materials.	• Build cumulative effects models • Collaborate with the Republic of Korea on their MMTT program	
Welded Canister-Atmospheric Corrosion	• Continue corrosion initiation and crack growth rate tests • Continue brine stability testing and collect additional dust samples • Refine, improve, and validate deposition models	• Obtain residual stress measurements on different canisters • Perform small scale and larger-scale testing to provide data for deposition modeling	• Conduct a full-scale canister deposition demonstration at various heat loads to provide data on deposition and brine stability • Examine multiple repair and mitigation techniques to extend the lifetime of a canister	
Drying	• Design and perform lab-scale tests with well-defined conditions to improve sampling and analysis techniques • Collect and analyze in-service gas samples	• Design and perform larger-scale tests using heater assemblies to quantify residual water as a function of drying parameters	• Design and perform a full-scale test using heater assemblies • Perform a consequence analysis	Close Gap
Canister Failure Consequence	• Grow through wall stress corrosion cracks for testing • Incorporate particle size distribution of SNF released in different scenarios • Test and model flow through more realistic microchannels and aerosols. • Analyze particulates captured in filters used during the drying process of failed fuel.	• Test viability of canister repair and mitigation techniques under realistic pressure and canister conditions. • Measure aerosol release and depletion in realistic DSC environments		Close Gap