



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

SAND2018-5480PE

**Spent Fuel and Waste Science and Technology Storage and
Transportation R&D Campaign:**

*What We Have Done,
What We are Doing,
and How it Fits Together*

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SFWST R&D Working Group Meeting
Las Vegas, Nevada
May 22, 2018



S&T R&D is Driven by the 2017 Internal Gap Analysis & NEI R&D Priorities and Is Enhanced by the Demo Data

We have fuel in hot cells.



We completed non-destructive tests.



HEAT-TREAT SEGMENTS of 3 RODS to 400°C:

- 1/MS + 1/ZircLO + 1/Zirc-4 = 3 RODS
- COOL RODS AT 5°C/Hr TO 100°C

Do NOT HEAT-TREAT SEGMENTS of 2 RODS:

- 1/MS + 1/ZircLO = 2 RODS

HEAT-TREAT 3 RODS to DEMO TEMPS:

- 1/MS + 1/ZircLO + 1/Zirc-4 = 3 RODS
- HEAT ACCORDING TO MEASURED DEMO TEMPS
- COOL RODS AT 5°C/Hr TO 100°C

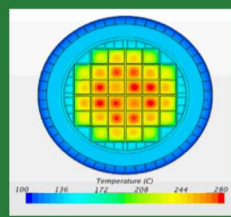
PERFORM CURET TESTS on SEGMENTS of 2 RODS:

- 1/MS + 1/ZircLO = 2 RODS

THEN PAUSE... Our community reviews the data, and we determine a path forward.

We are starting destructive analysis.

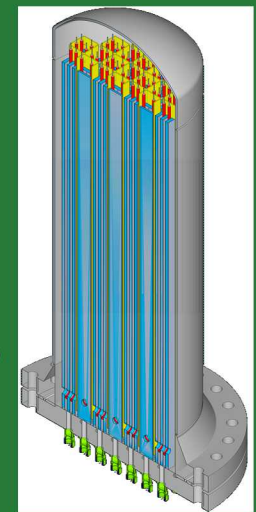
We have thermal models.



We are getting new thermal data from the Demo.



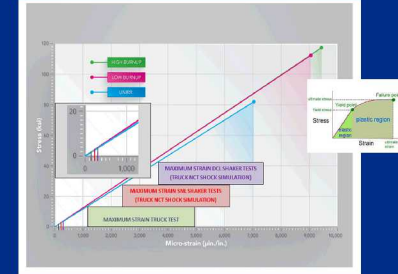
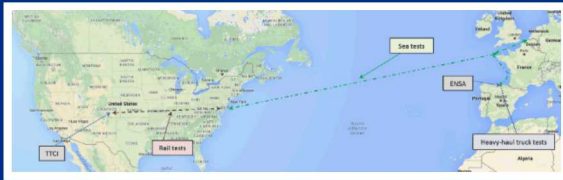
We will build a test apparatus to identify thermal conservatisms & develop more realistic assumptions.



SISTER ROD MECHANICAL TESTING DATA

THERMAL BEHAVIOR

PROVIDES KNOWLEDGE ABOUT SPENT FUEL INTEGRITY WHICH IS COMPARED TO DATA FROM THE TRANSPORTATION TESTS

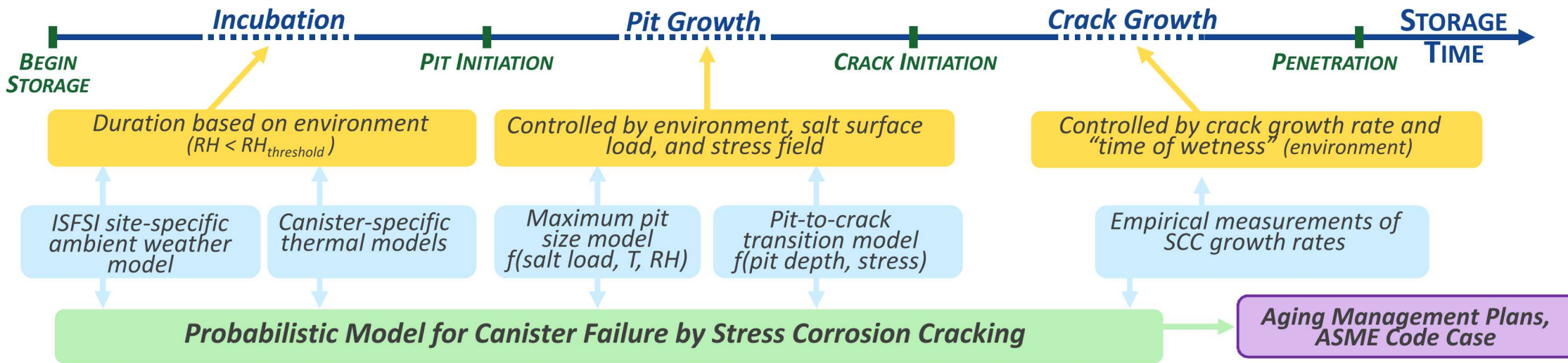


SPENT FUEL TRIATHLON: QUANTIFICATION OF NORMAL TRANSPORT SHOCKS & VIBRATIONS



Stress Corrosion Cracking R&D:

Evaluate Time Dry Storage Canisters Can Be Safely Stored as a Function of ISFSI Location



CURRENT AND FUTURE WORK IN EACH OF THE ABOVE AREAS

SNL — Surface environment, brine stability

SNL/Ohio State Univ. — Pitting initiation/growth, pit-to-crack transition

CO School of Mines (CSM)/SNL — Pitting initiation/growth (effect of stress)

SNL/LANL — mockup pitting/cracking

CSM — Pit-to-crack transition (modeling)

NC State U (SNL) — SCC growth rates

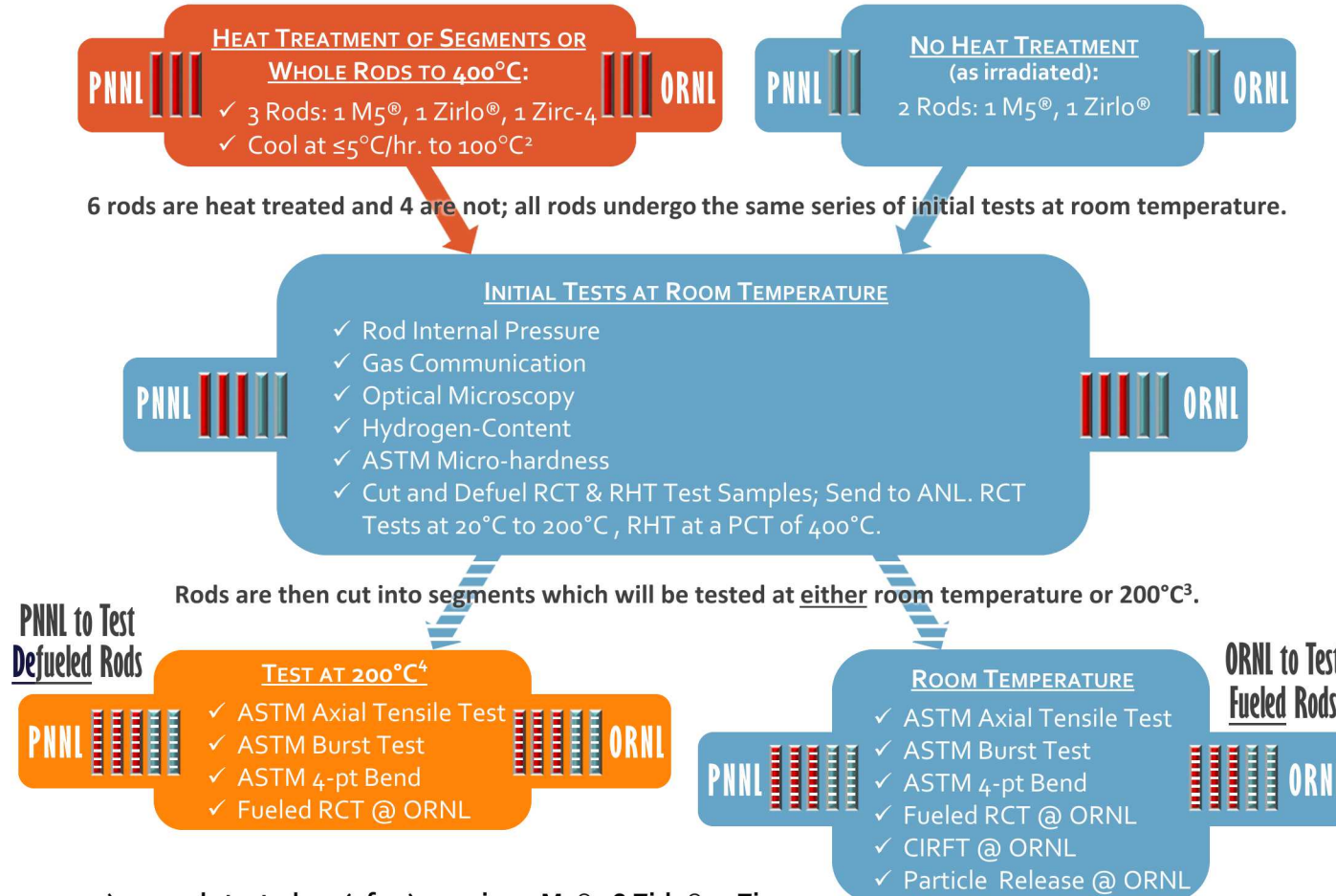
Ohio State Univ. (SNL) — SCC growth rates

SRNL — SCC growth rates

High Burnup Spent Fuel Data Project Sister Rod Test Plan Visualization

4-17-18

We start with 25 Sister Rods. Ten will be used for this test plan¹ – 5 tested by PNNL and 5 tested by ORNL. Both labs will perform the same tests, but ORNL will test fueled rods and PNNL will test defueled rods. ANL will perform RCT & RHT on segments of the rods.



- 1) 10 rods tested; 15 (of 25) remain: 5 M5®, 8 Zirlo®, 2 Zirc-4.
- 2) Cooling rate may change based on PNNL cooling rate test results.
- 3) All tests are repeated at two places along each rod, preferably at the top and near the middle.
- 4) Not all tests may be able to be performed at 200°C .
- 5) Deviations from this test plan will be based on continuous learning and approved before execution.
- 6) As test results are obtained, our community reviews the data, and DOE determines a path forward.