

Nuclear Waste Technical Review
Board
Fall 2018 Board Meeting

OCTOBER 24, 2018

ENSA Cask Multimodal
Transportation Test and Related
Structural Modeling and Analysis

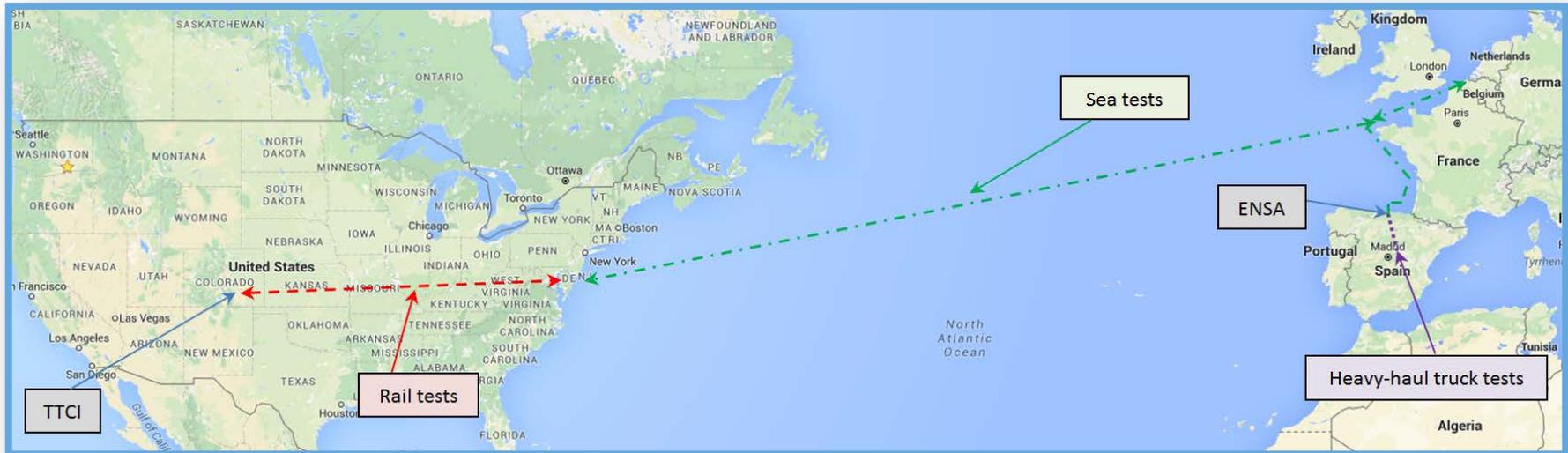
Sylvia Saltzstein, Manager

Spent Nuclear Fuel Storage,
Transportation, & Safeguards R&D

SANDIA NATIONAL LABORATORIES

Routing of Instrumented Cask & Assemblies

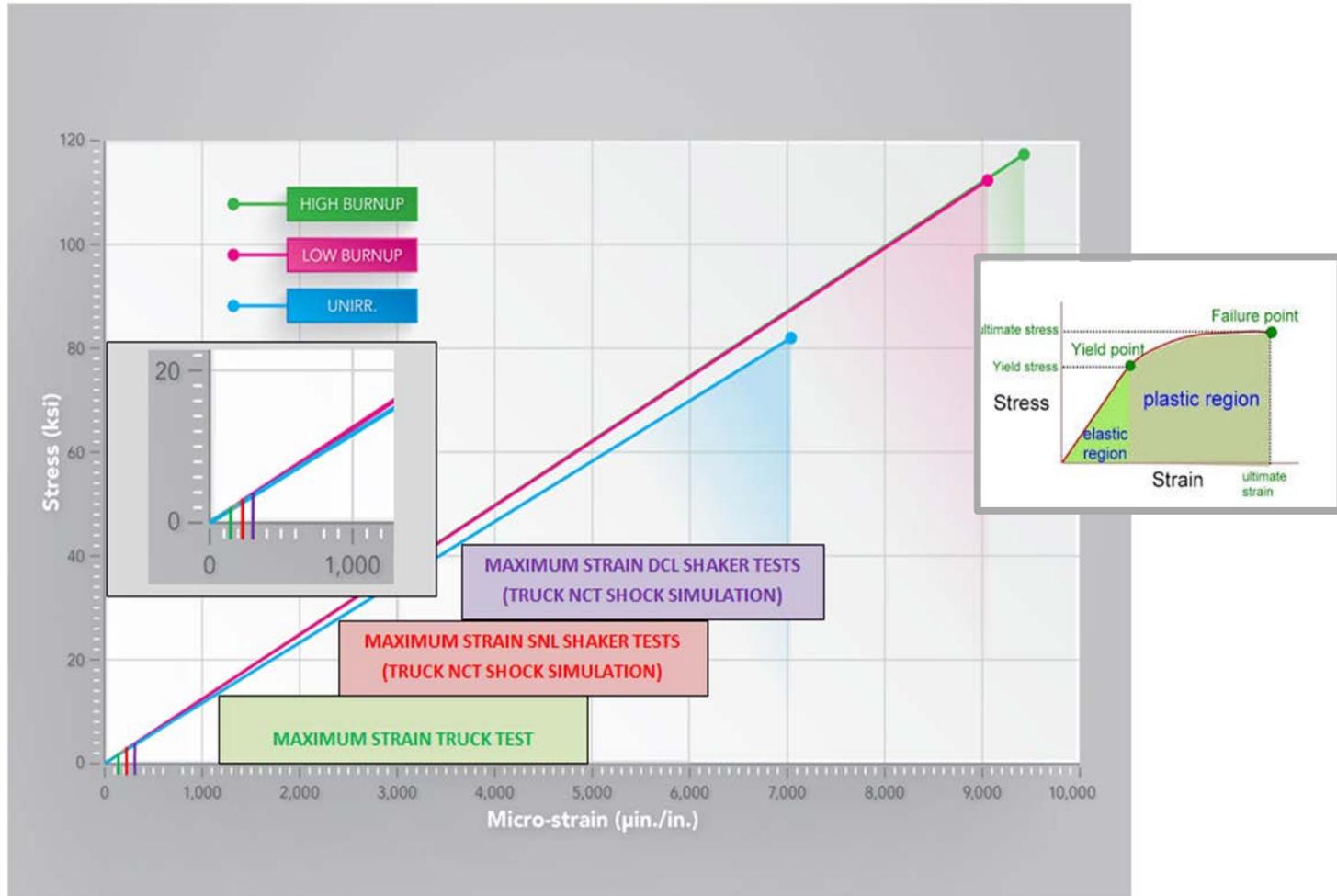
(Transportation Triathlon)



- 1) Heavy-haul truck from within Spain ~ June 14, 2017
- 2) Coastal sea shipment from Santander to large northern European port ~ June 27, 2017
- 3) Ocean transport from Europe to Baltimore
- 4) Commercial rail shipment from Baltimore to Pueblo, Colorado ~ Aug 3, 2017
- 5) Testing completed at the Transportation Technology Center, Inc.
- 6) Return trip to ENSA, September 5, 2017

How Do Stresses on Fuel During Normal Conditions of Transport Compare to Failure Limits?

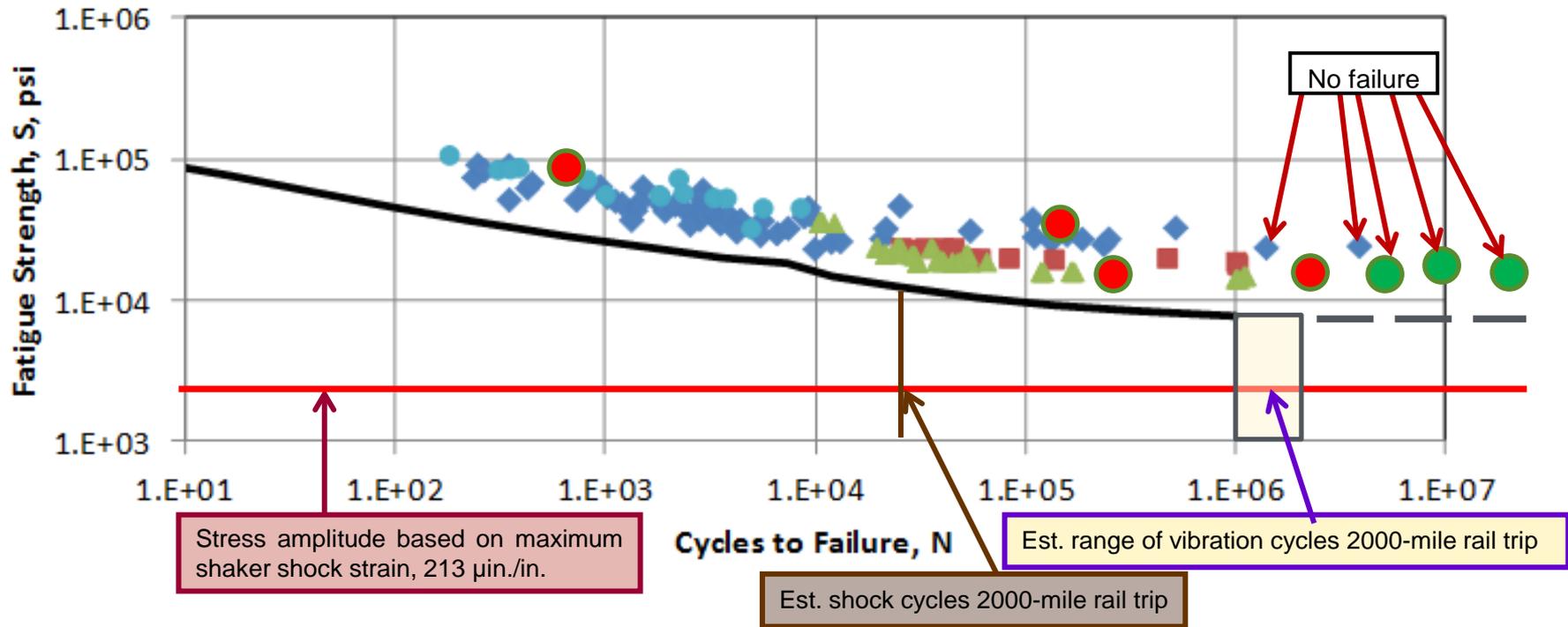
Transporting Spent Nuclear Fuel



McConnell et al, 2016, SNL and PNNL

Could Vibrations or Shocks Result in Fatigue Failure?

Transporting Spent Nuclear Fuel



Fatigue design curve (—): O'Donnel and Langer, "Fatigue Design Basis for Zircaloy Components," Nucl. Sci. Eng. 20, 1, 1964. (cited in NUREG-0800, Chapter 4)

Data plot courtesy of Ken Geelhood, PNNL
The large circles are ORNL HBR data

CONCLUSIONS

The realistic stresses fuel experiences due to vibration and shock during normal transportation are far below yield and fatigue limits for cladding. We have recently gathered actual rail data which most likely will be the prevailing transportation mode.