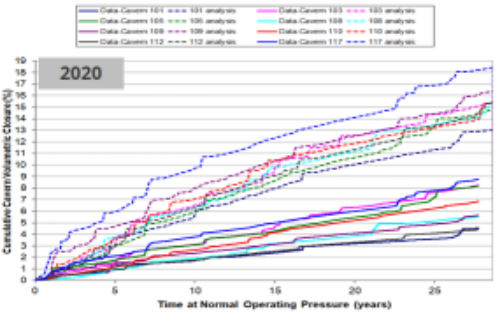
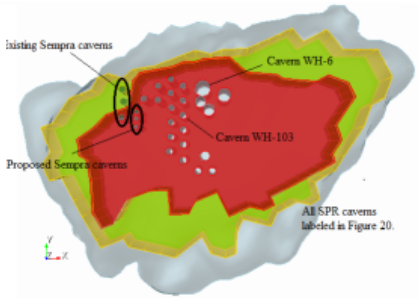
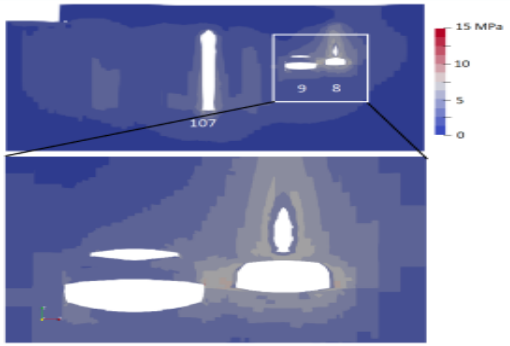
SAND2022-7279C

Sandia National Laboratories

Geomechanical Analysis of Oil Storage Caverns in Salt Domes with a Low Stress Creep Mechanism Added to the M-D Model







Steven R. Sobolik and Tonya Ross

SaltMech X -- 10th Conference on the Mechanical Behavior of Salt
6-8 July 2022, Utrecht, the Netherlands

SALTMECH X

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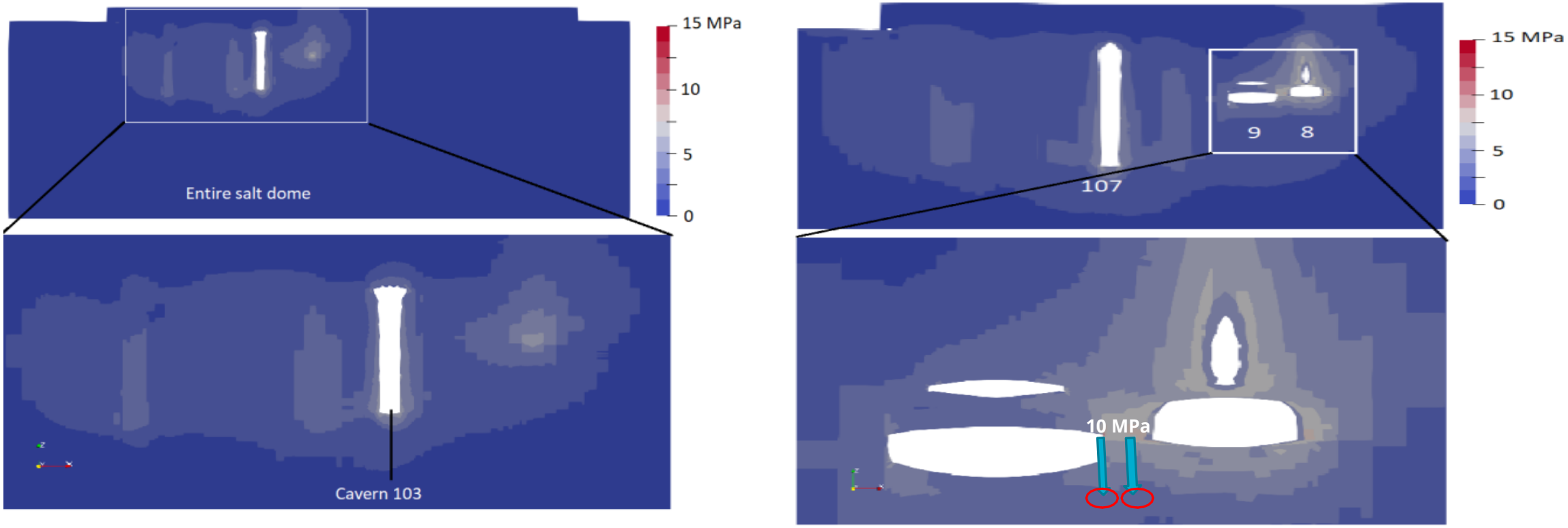
Creep at Low Equivalent Stresses - Why is it Important?



Accurate evaluation of salt creep behavior drives decisions about storage cavern operations.

Our current collection of laboratory tests sample creep at equivalent stresses ≥ 10 MPa, which comprises a very small percentage of the volume of affected salt in the dome.

What was added to create the new M-D Viscoplastic Model?

Creep behavior at low equivalent stresses is due to pressure solution redeposition.

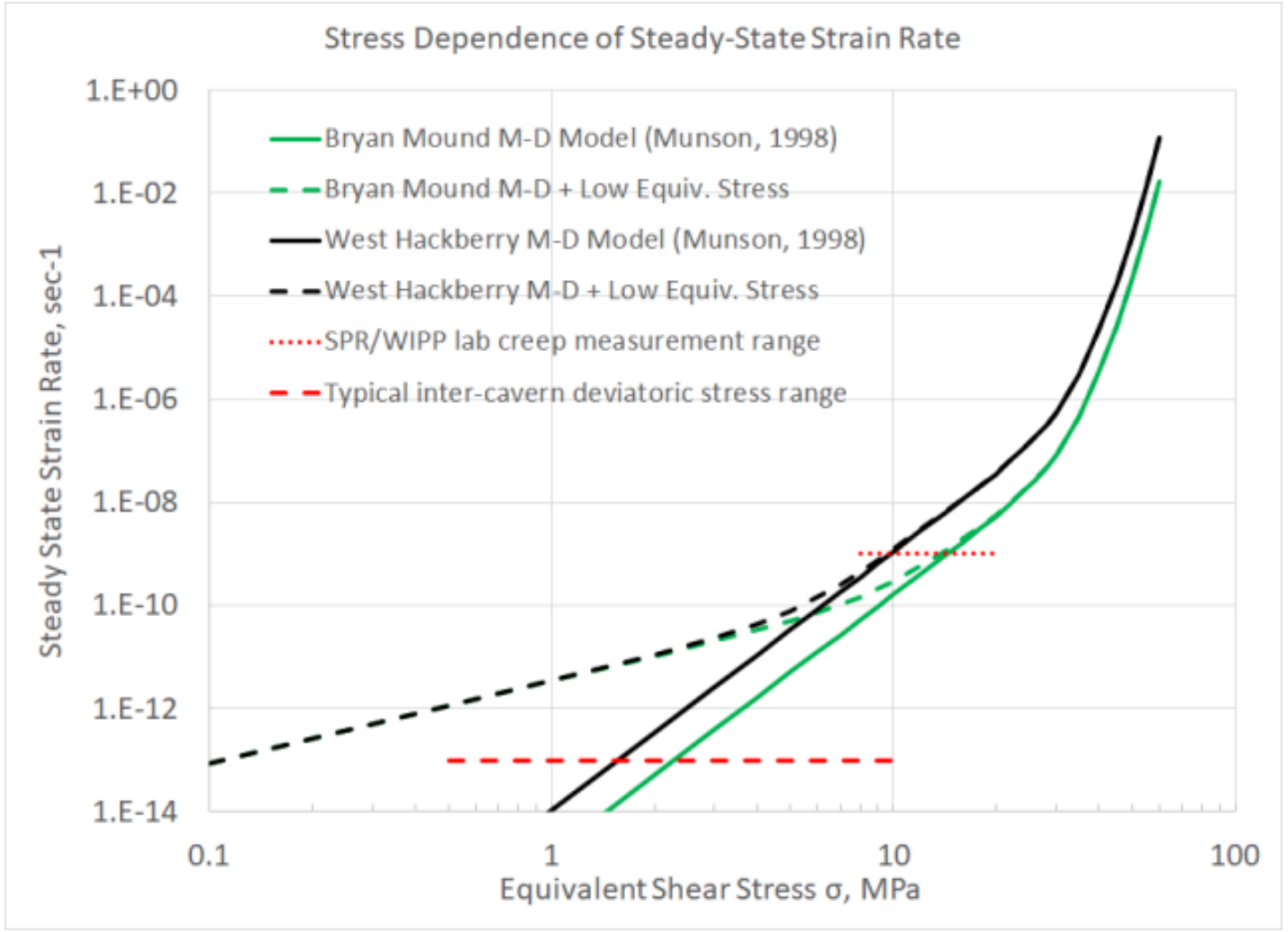
Reedlunn (2018) added a low equivalent stress mechanism to M-D model (named M-D viscoplastic model); used combination of lab data, WIPP room closure to develop parameters.

Norton-Hoff formulation chosen for simplicity.

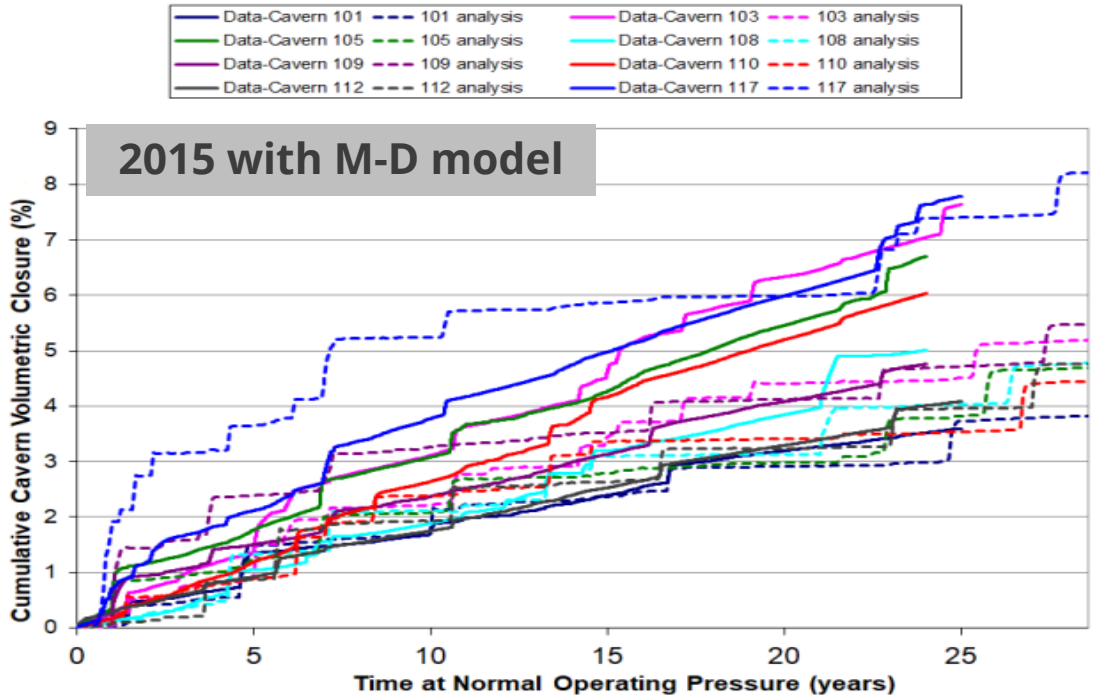
Note difference in strain rates for stresses less than 8 MPa.

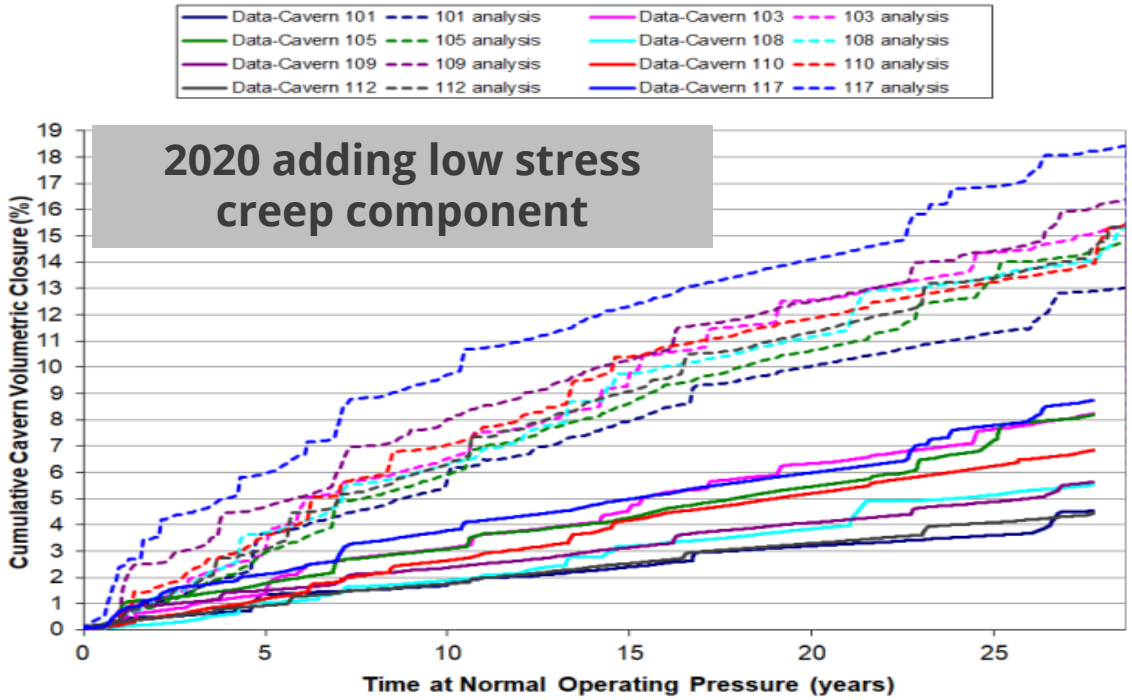
SPR West Hackberry model was rerun with addition of Mechanism 0, no other changes.

These runs were done to evaluate the new model. Lab data are required to quantify parameters.



Cavern Volume Closure with Multiplier Comparison





M-D creep model with the addition of low stress creep component had a significant effect on the predicted cavern volume closure.

Predicted closure rates using the M-D Viscoplastic model for normal cavern operations ("steady-state") are much more similar to measured values.

The paper shows that low stress creep is the dominant mechanism for cavern closure on a domal scale.

THANK YOU FOR YOUR ATTENTION