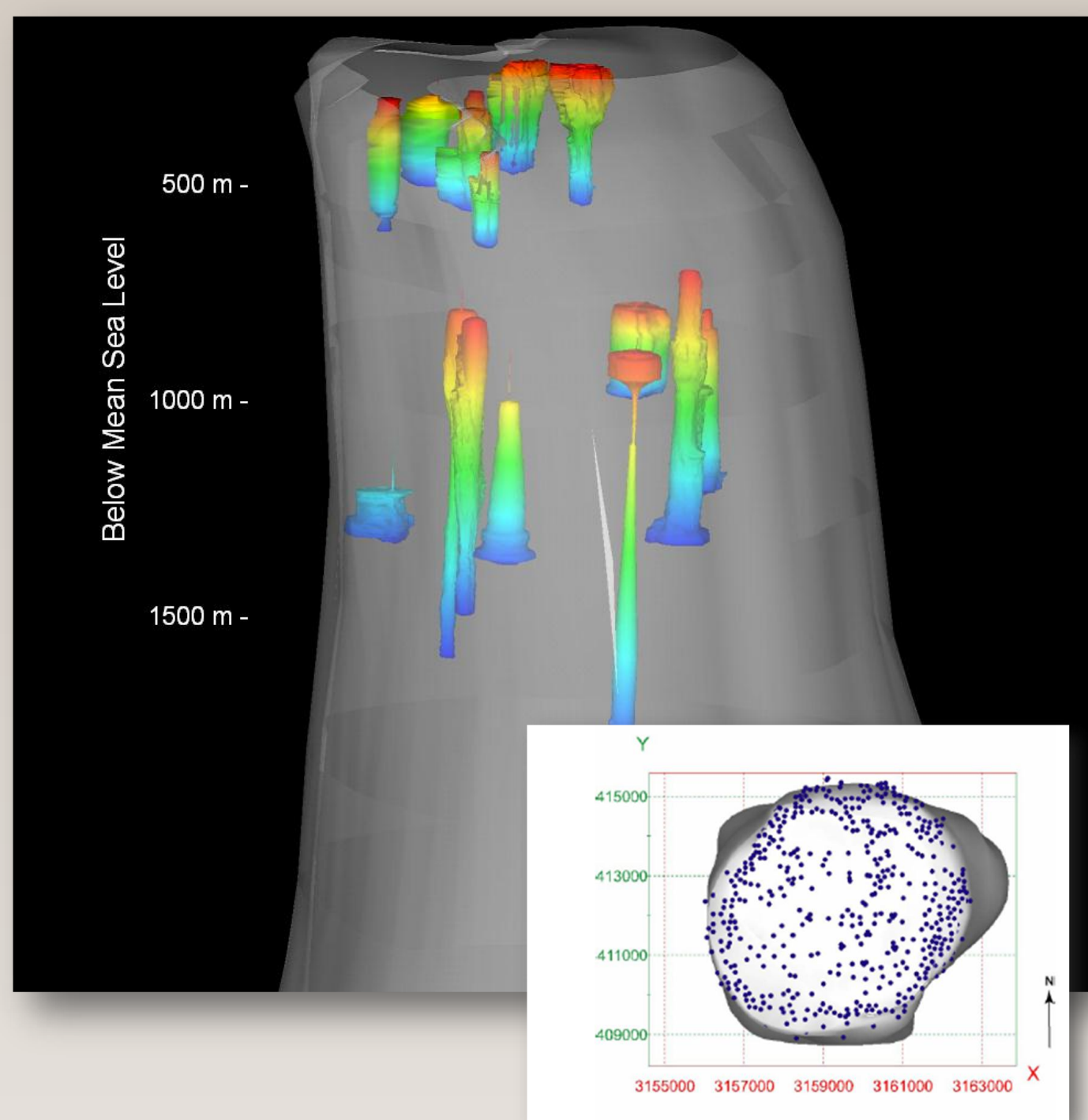


Geomechanical Aspects of Well Integrity:

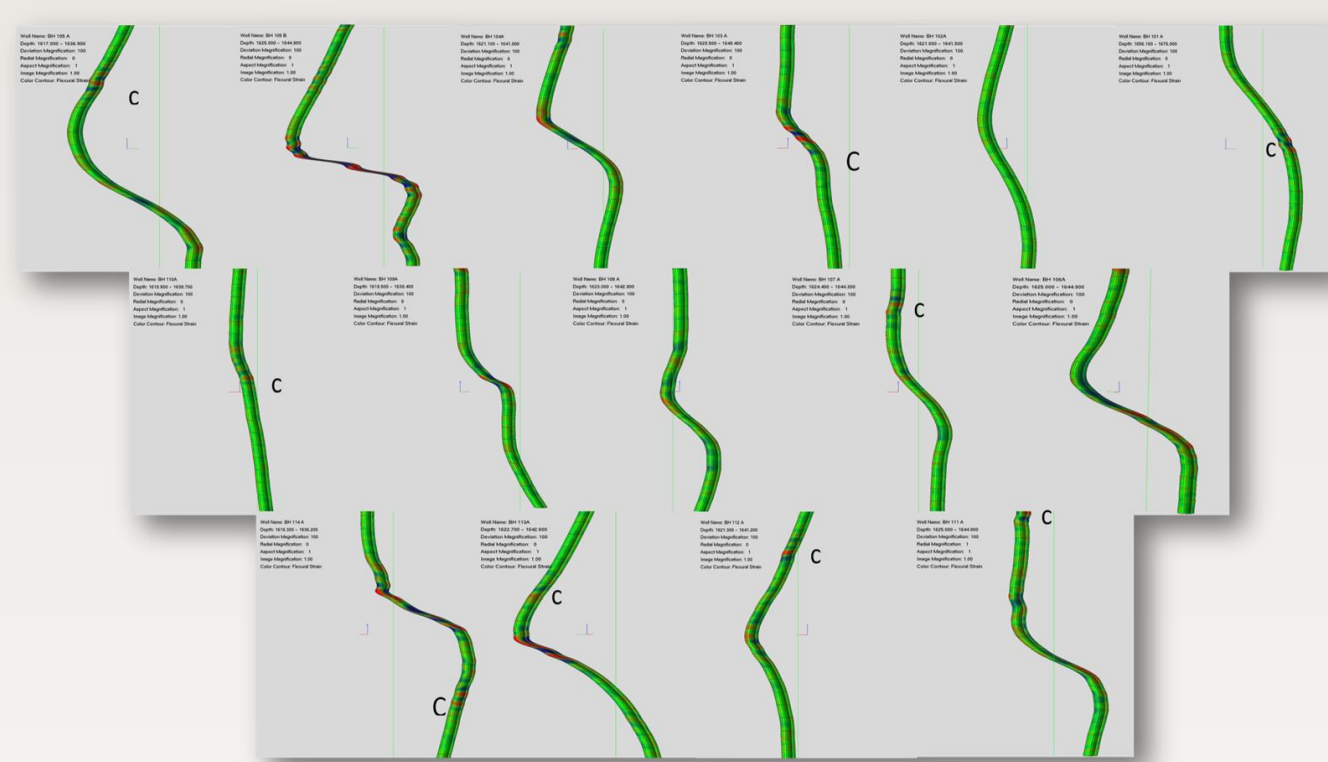
Examples from the Strategic Petroleum Reserve, the Delaware Basin, New Mexico, and the California Diatomite Fields

The Strategic Petroleum Reserve (SPR) covers four sites in Louisiana and Texas. SPR consists of 62 caverns and holds 727 million barrels oil. Each cavern has 1 to 3 wells. Some of these wells are 50 years old. During the thirty-year operational history of the SPR, well pressure history has been maintained and systematic well integrity testing has been conducted. These SPR wells are subject to extensional and shear deformation in response to creep closure of the caverns below the wells and the subsidence of the shallower formations and caprock.

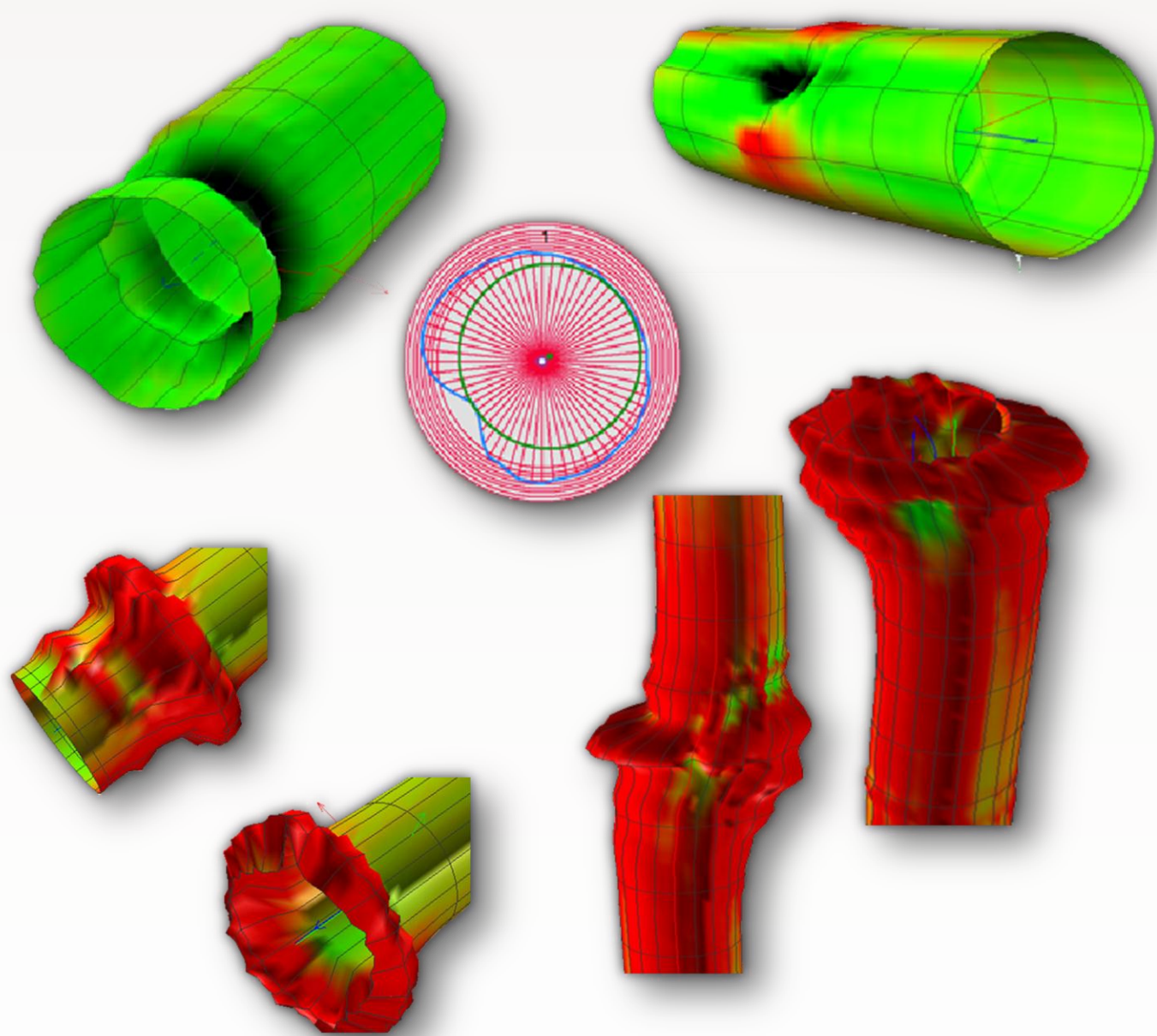


Caverns and Wells: Bayou Choctaw, LA

BH Dog-legs at Salt/Caprock Interface
Data from Weatherford Multi Arm Caliper

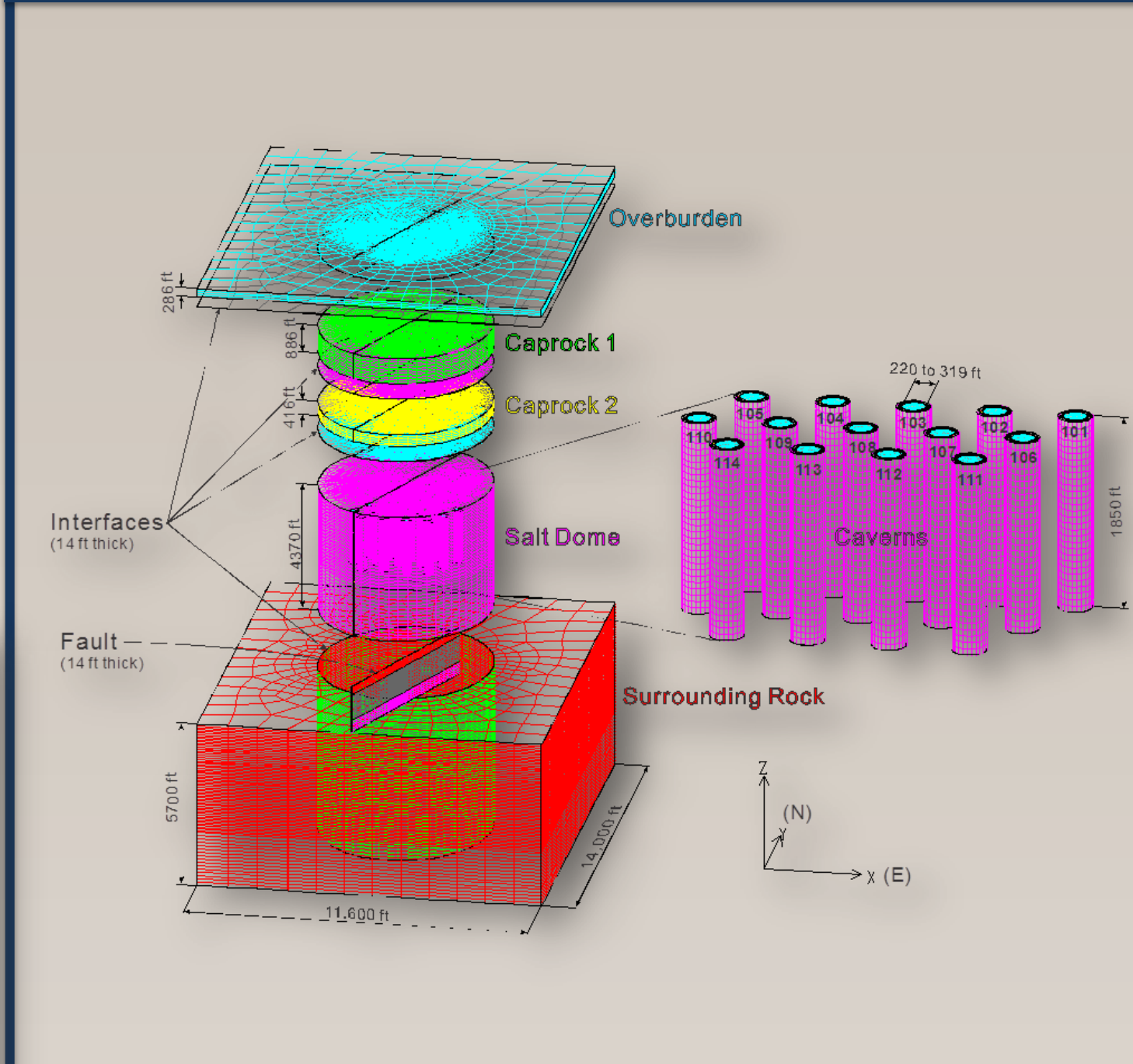


Examples from SPR wells

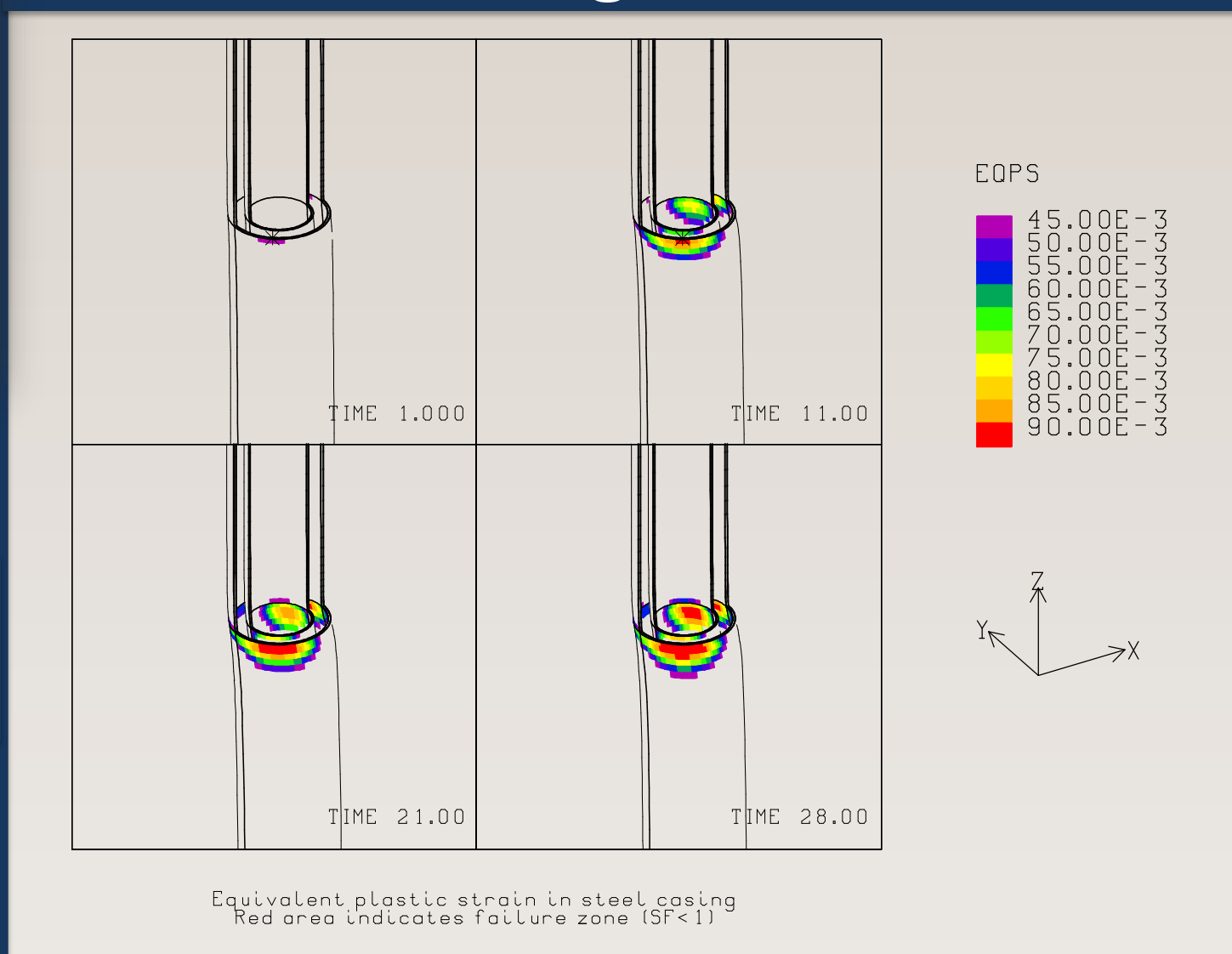


Exceptional Service in the National Interest

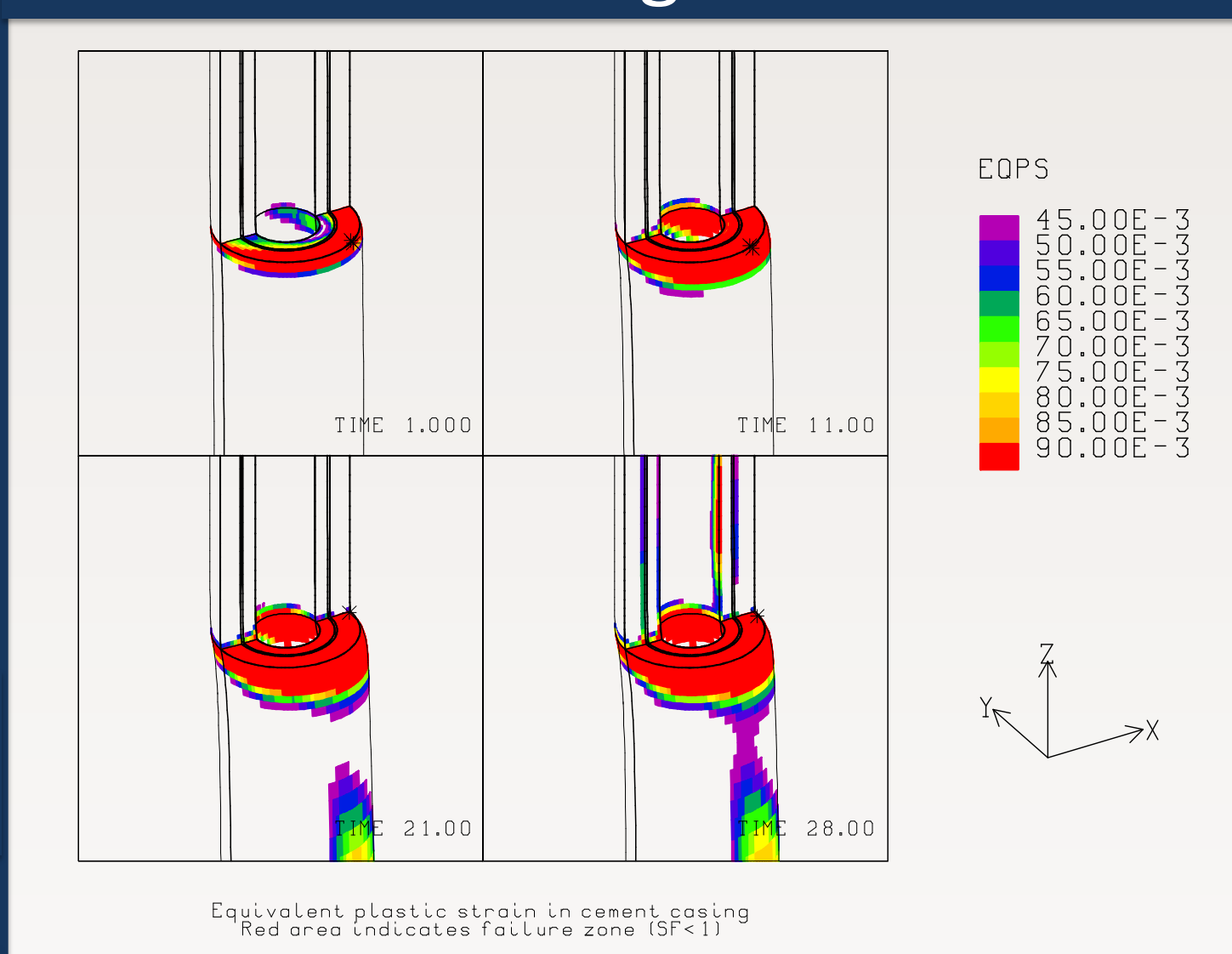
3D Geomechanical Model of the Big Hill Texas Site



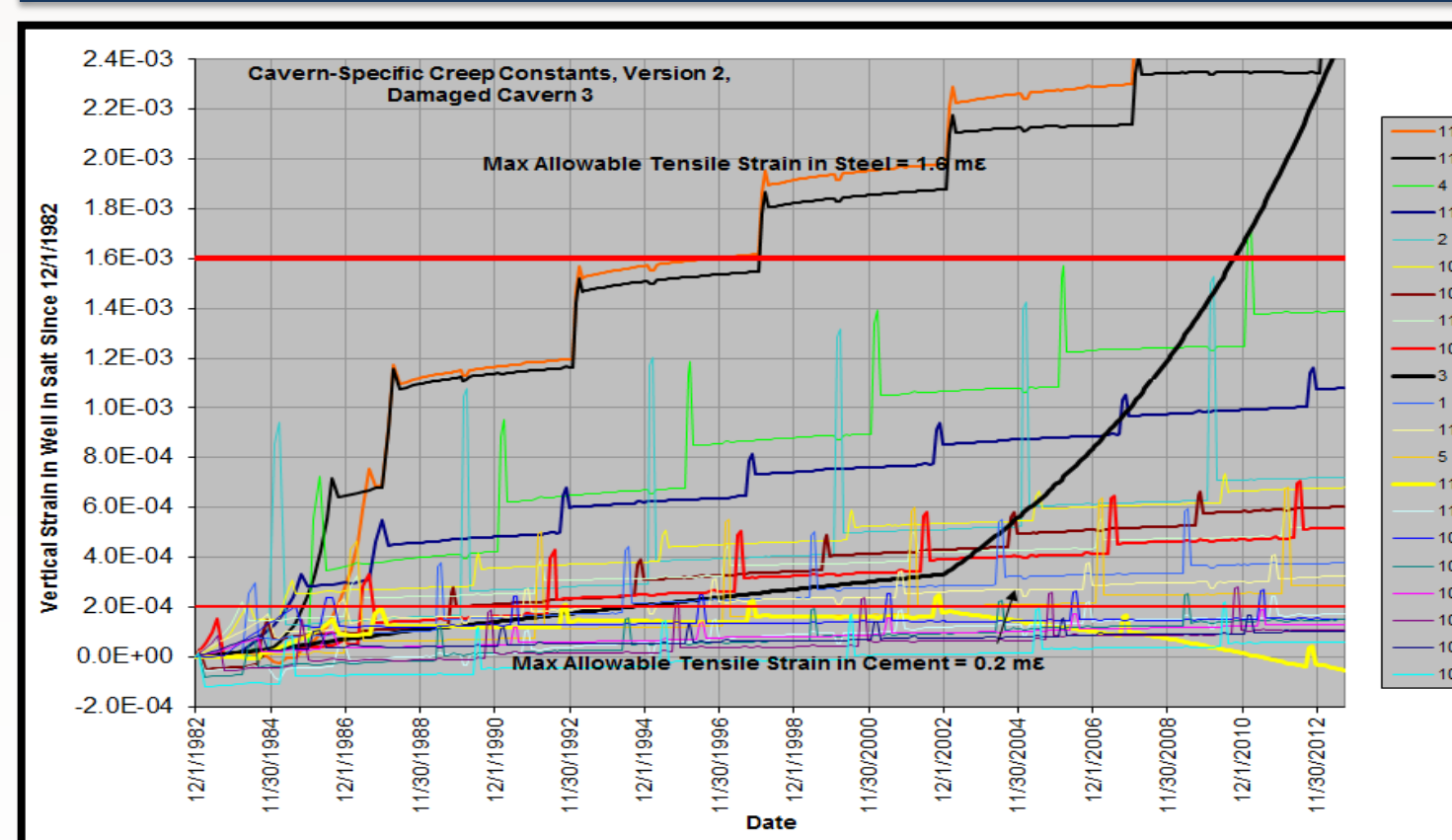
Predicted Equivalent Plastic Strain in Steel Casing of Cavern 105



Predicted Equivalent Plastic Strain in Cement Casing of Cavern 105

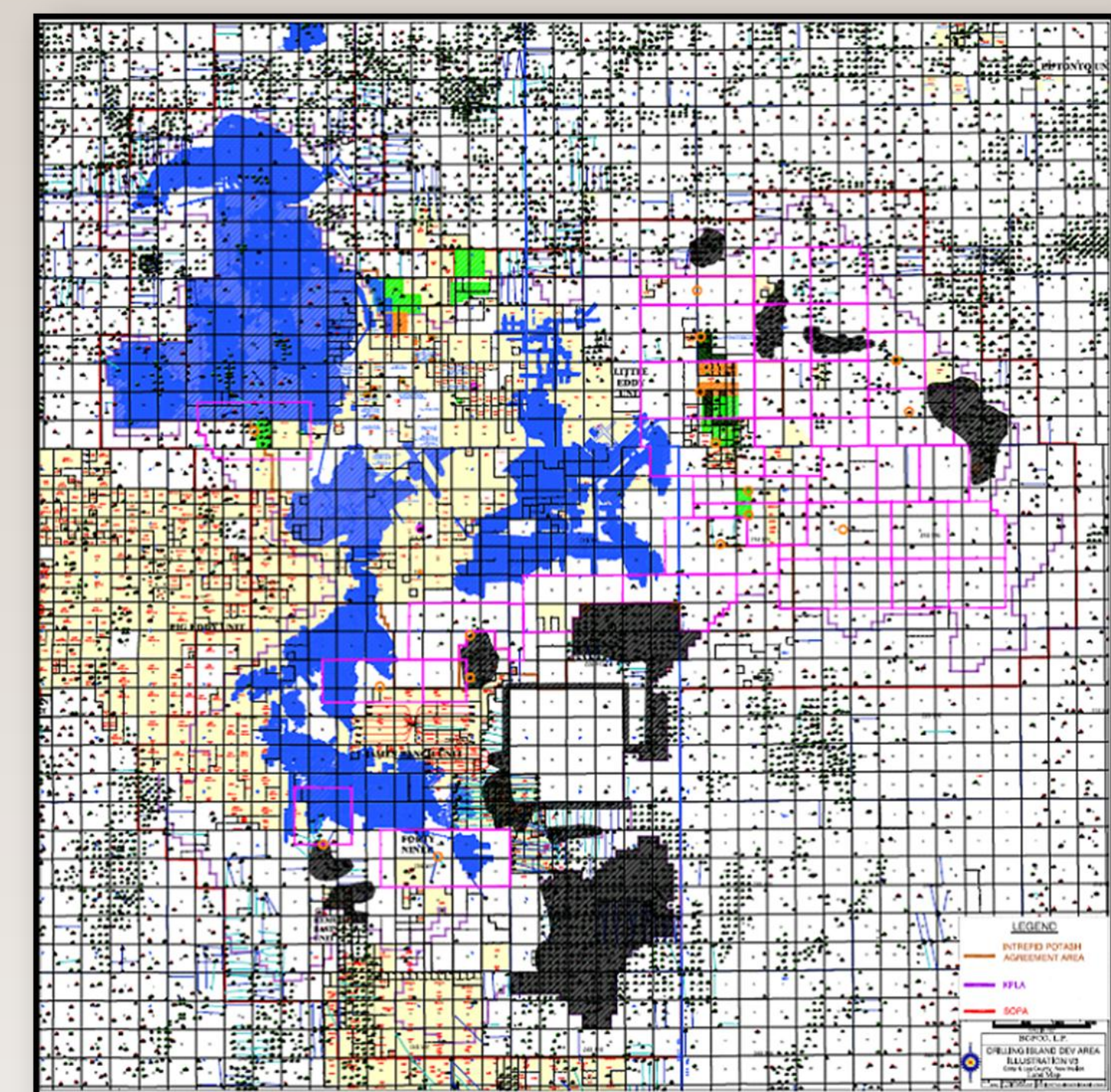


Axial Wellbore Strain in Salt

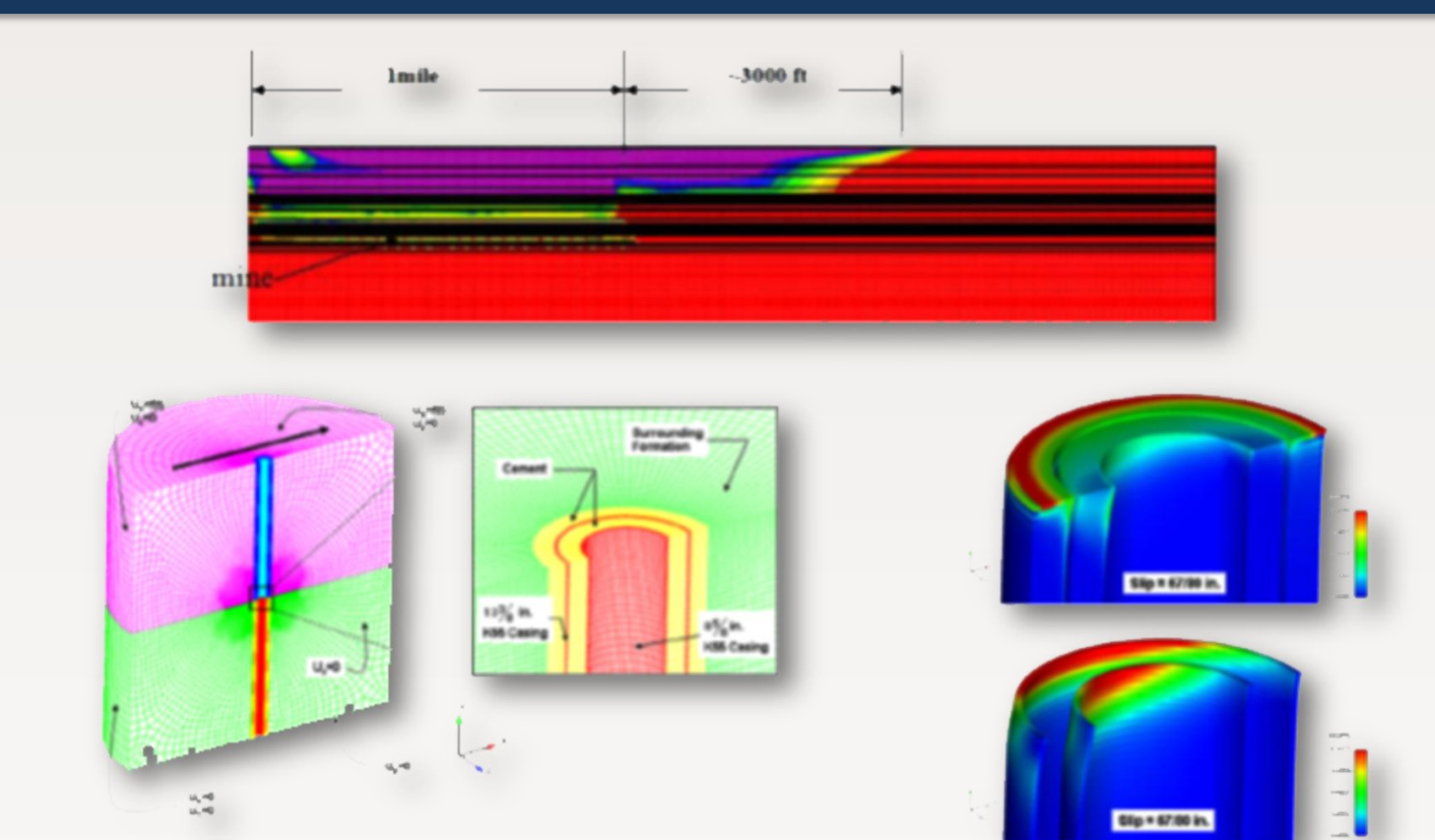


Within the Delaware Basin of southeastern New Mexico, we have modeled the geomechanical response of oil and gas wells as driven by subsidence due to neighboring underground potash mining. In this case, lateral strain, along clay seams and beds, occurs in response to subsidence induced strain. Our modeling indicates that lateral displacements of 1mm along these clay seams can yield the casing. This impact is not affected by multiple casing if cement is present. The cement between casings instantaneously transfers the load on the outer casing to the inner casing. To validate these models, we have tested standard Permian Basin casing and joints in large load frames to understand under what strains the casing or joints lose hydrologic integrity.

Oil and Gas Wells and Potash Mines – Reserves SE New Mexico



3D Models of Casing Strains



BLM Casing Testing – Gas Migration Project

