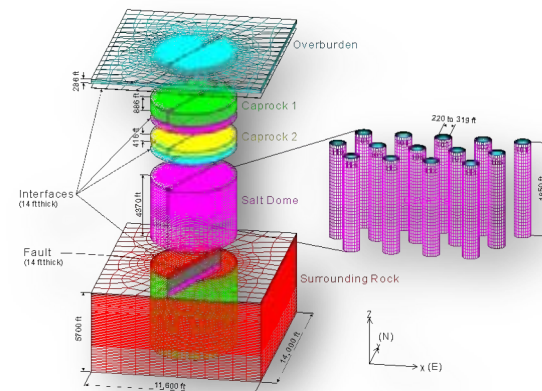
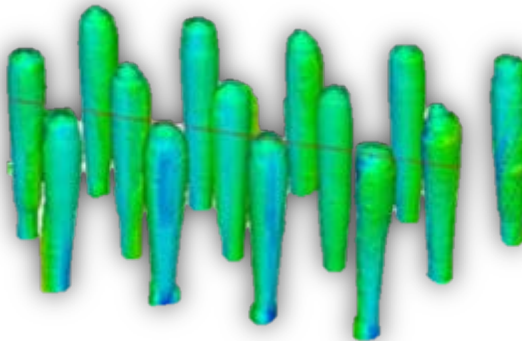
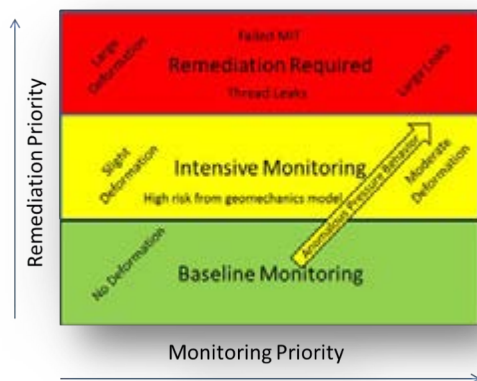


# A System for Salt Cavern Well Integrity Grading

## Salt and the Environment

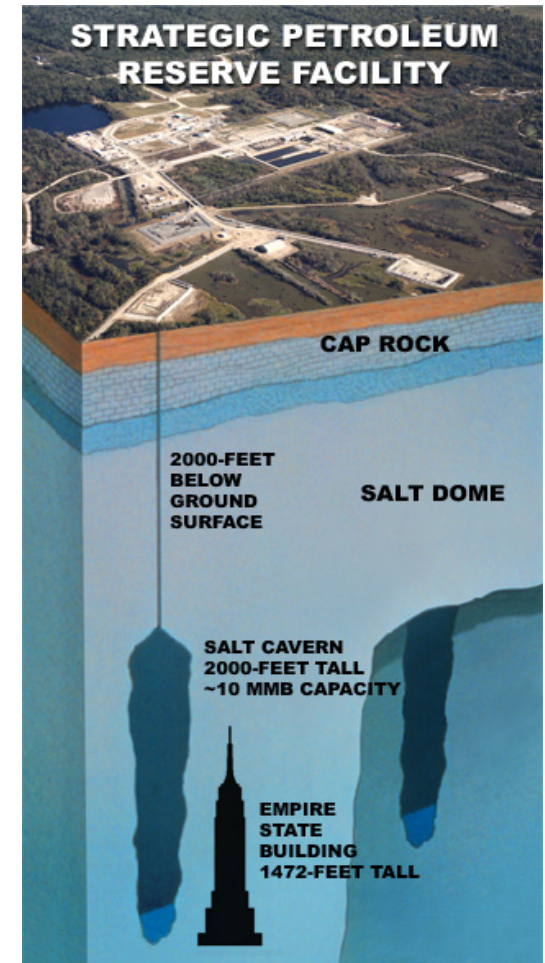


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Document ID SAND2018-5600 C

# Presentation Overview

- The Strategic Petroleum Reserve
- Brief background – motivation for well grading
- General well grading components
- Summary



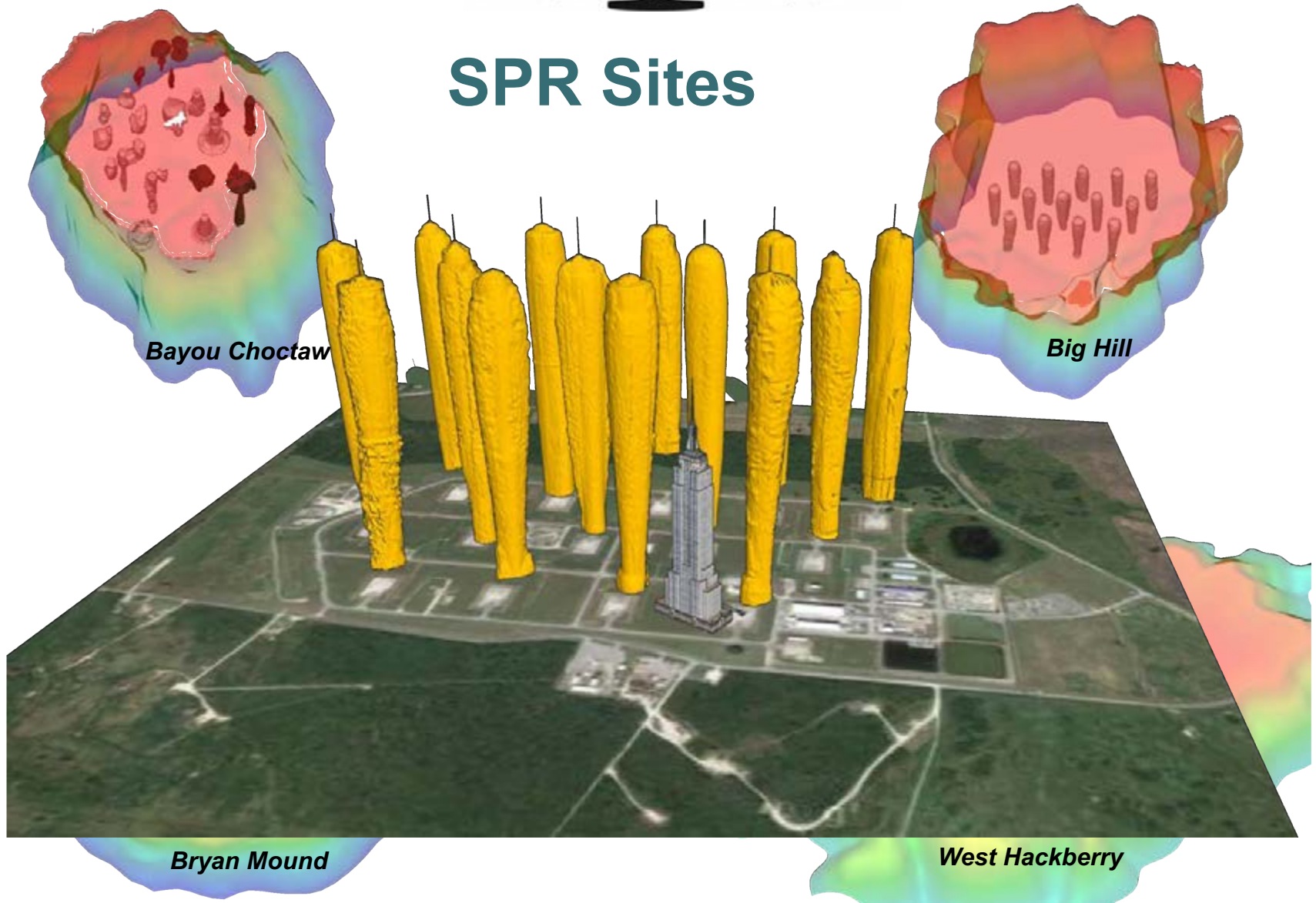
# Background on SPR Sites

## The Department of Energy Strategic Petroleum Reserve

- SPR is spread across 4 Gulf Coast site locations
- Current oil inventory of about 662 million barrels
- Composed of 63 solution mined caverns with about 120 cavern access wells
- Length of cased well sections range from ~1400 to ~2500 feet
- Mixture of pre-existing and purpose built caverns
- SPR – owned by DOE

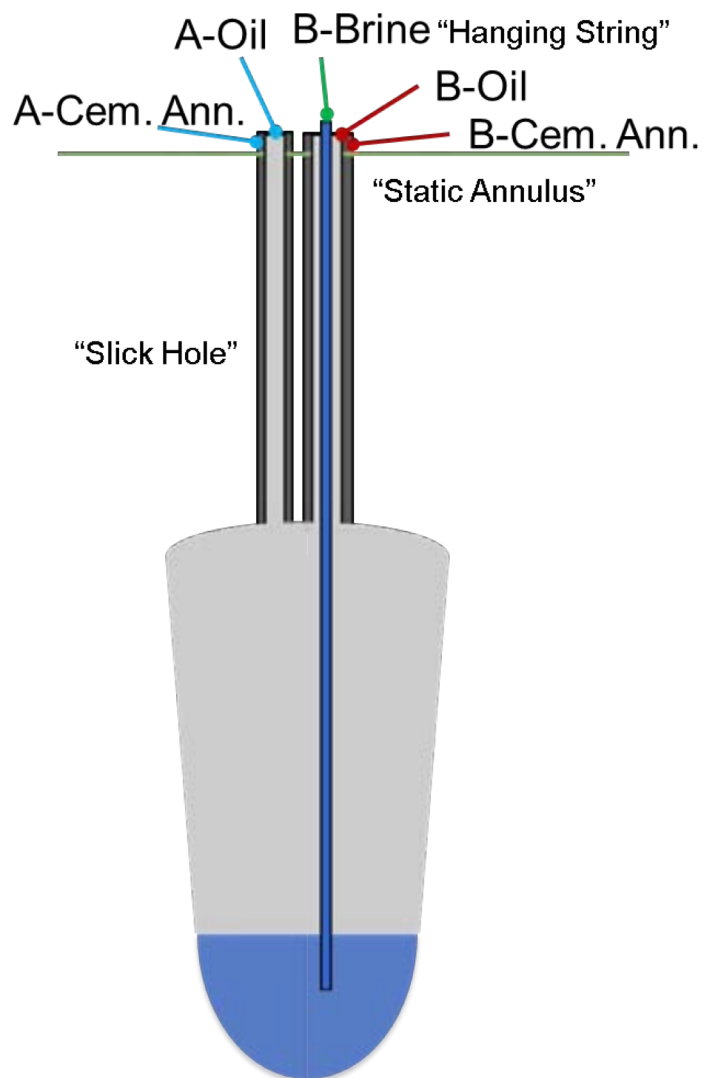


## SPR Sites





## Cavern Well Configuration

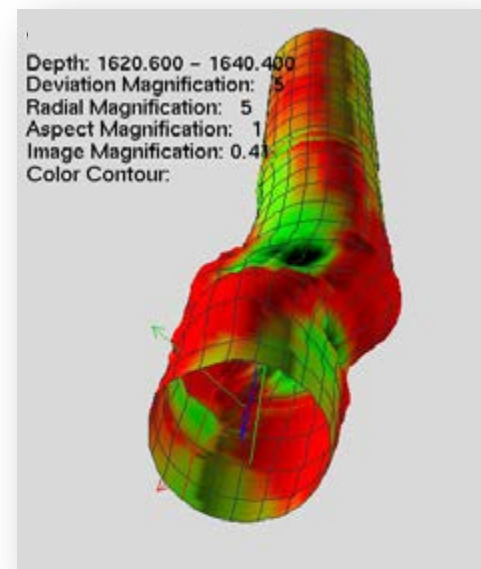
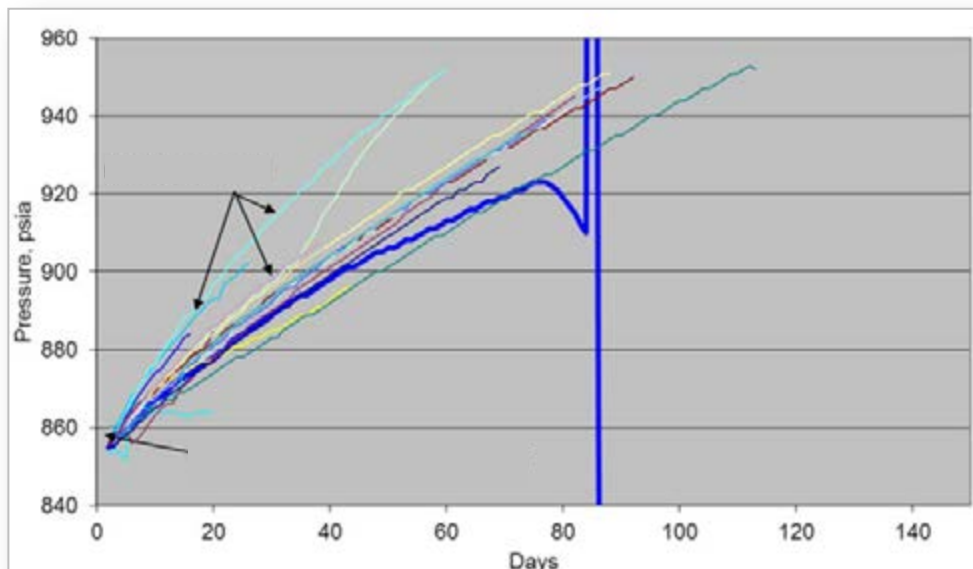


## Cavern Well Head



## Background - Motivation

- The SPR must maintain the integrity of cavern access wells to meet drawdown requirements
- Were experiencing a number of well integrity issues at some SPR sites
- Evidence from multi-arm caliper logs of accumulating casing deformation
- Need to prioritize remediation/monitoring resources



# Well Grading Components

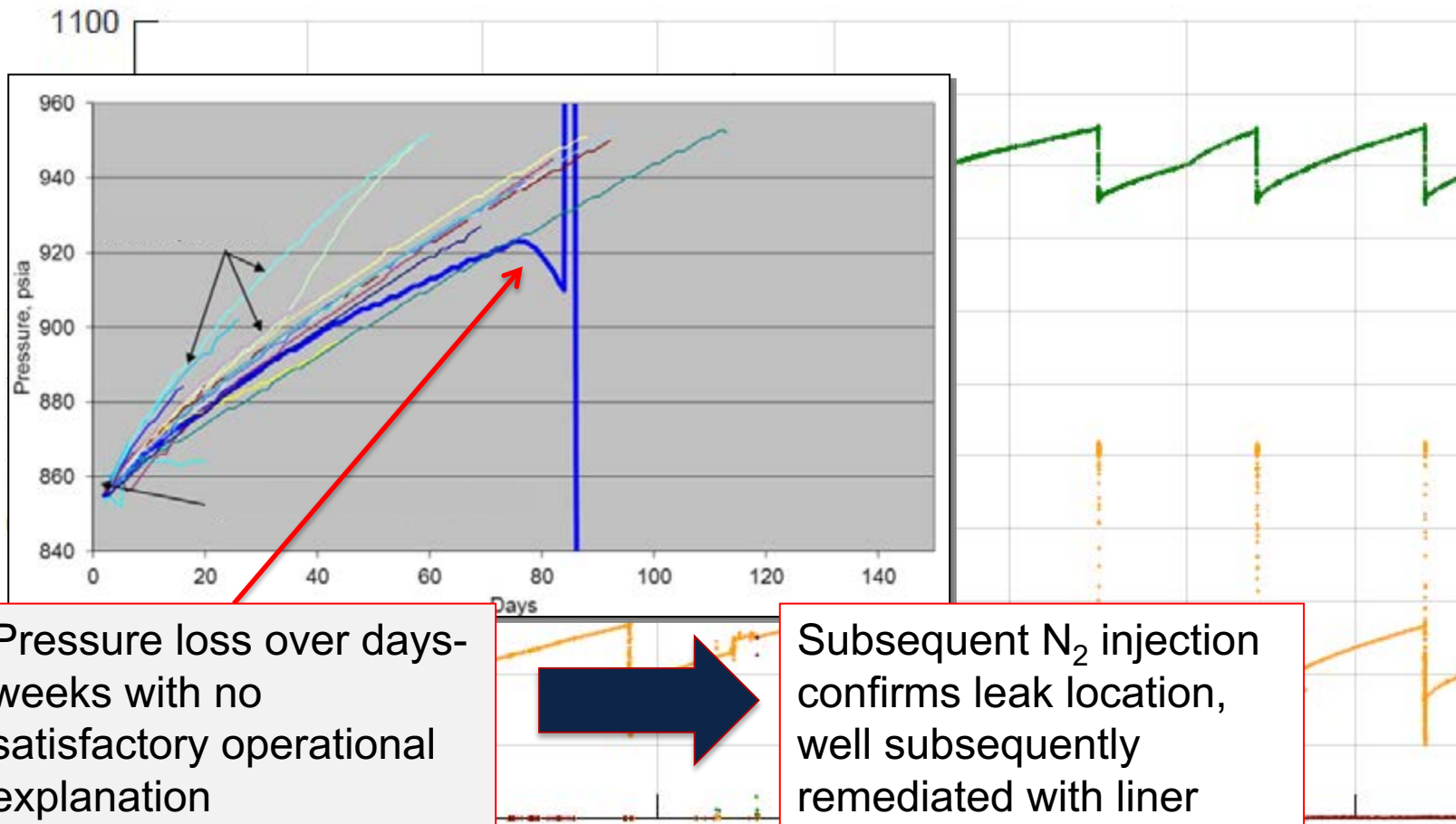
Discussions amongst subject matter experts resulted in the following main well grading components:

- |   |   |             |
|---|---|-------------|
| <ol style="list-style-type: none"> <li>1. <u>Cavern pressure history</u></li> <li>2. <u>Multi-arm caliper survey results</u></li> </ol>   | } | Remediation |
| <ol style="list-style-type: none"> <li>3. Geomechanical simulation results</li> <li>4. Geological elements</li> <li>5. Well history</li> <li>6. Cavern Geometry</li> <li>7. Offsite activities</li> </ol> | } | Monitoring  |

Well ID	Remediation Grade	Monitoring Grade
19	4	2.29
15A	2.5	1.51
20	2	1.67
101A	2	1.89
15	1.75	1.55
17A	1.75	1.57
102A	1.75	1.47
18	1.25	1.58
19A	1.25	1.41
101B	1.25	1.90
17	1	1.42
18A	1	1.53
20A	1	1.60
102B	1	1.27

Each main component may then have various sub-components.

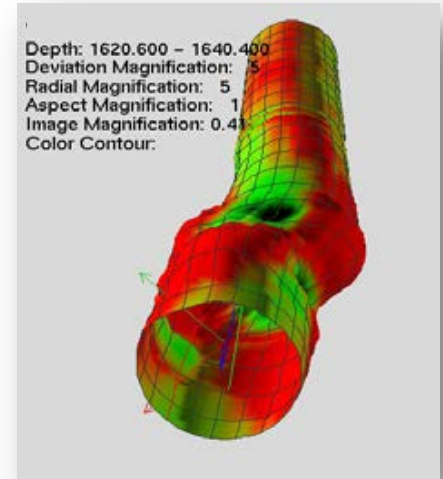
# Pressure History



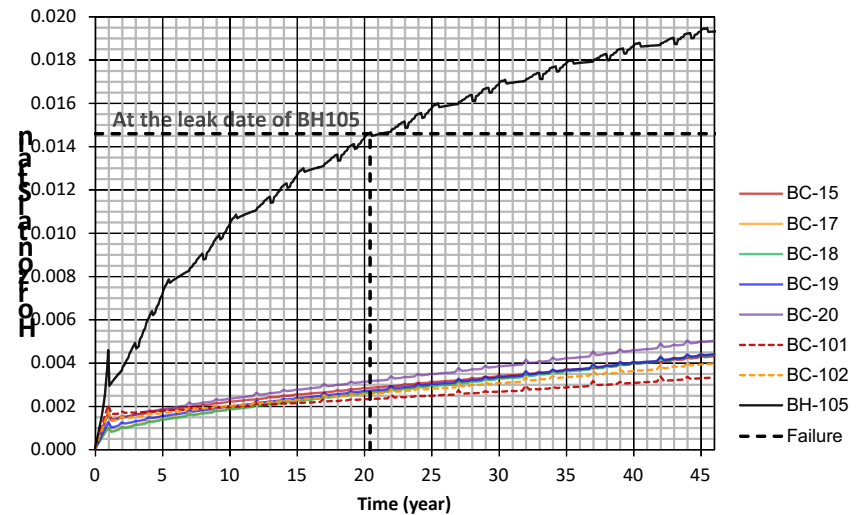
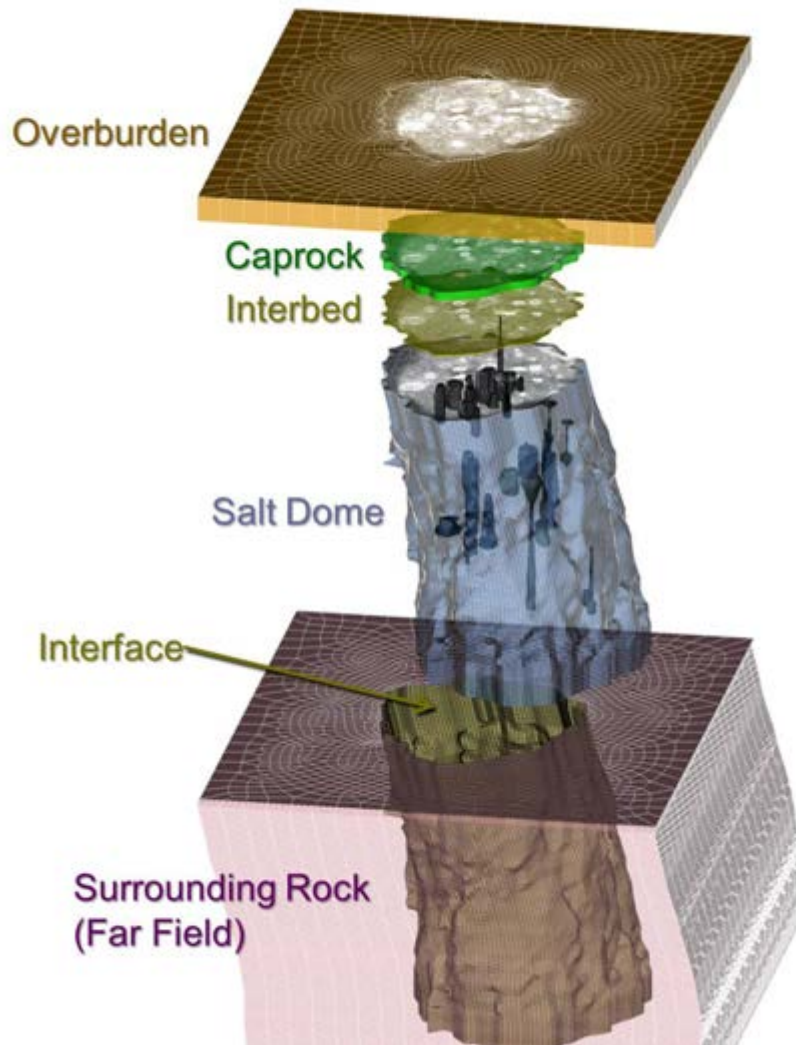


## Multi-arm Caliper Survey Component

- Provides direct measurement of casing deformation as an indicator of potential casing failure
- Can be used for semi-quantitative, well-to-well comparisons
- Available for virtually all of SPR cavern wells
- With multiple surveys, can provide a time-dependent analysis of casing deformation rates



# Bayou Choctaw Geomechanical Modeling



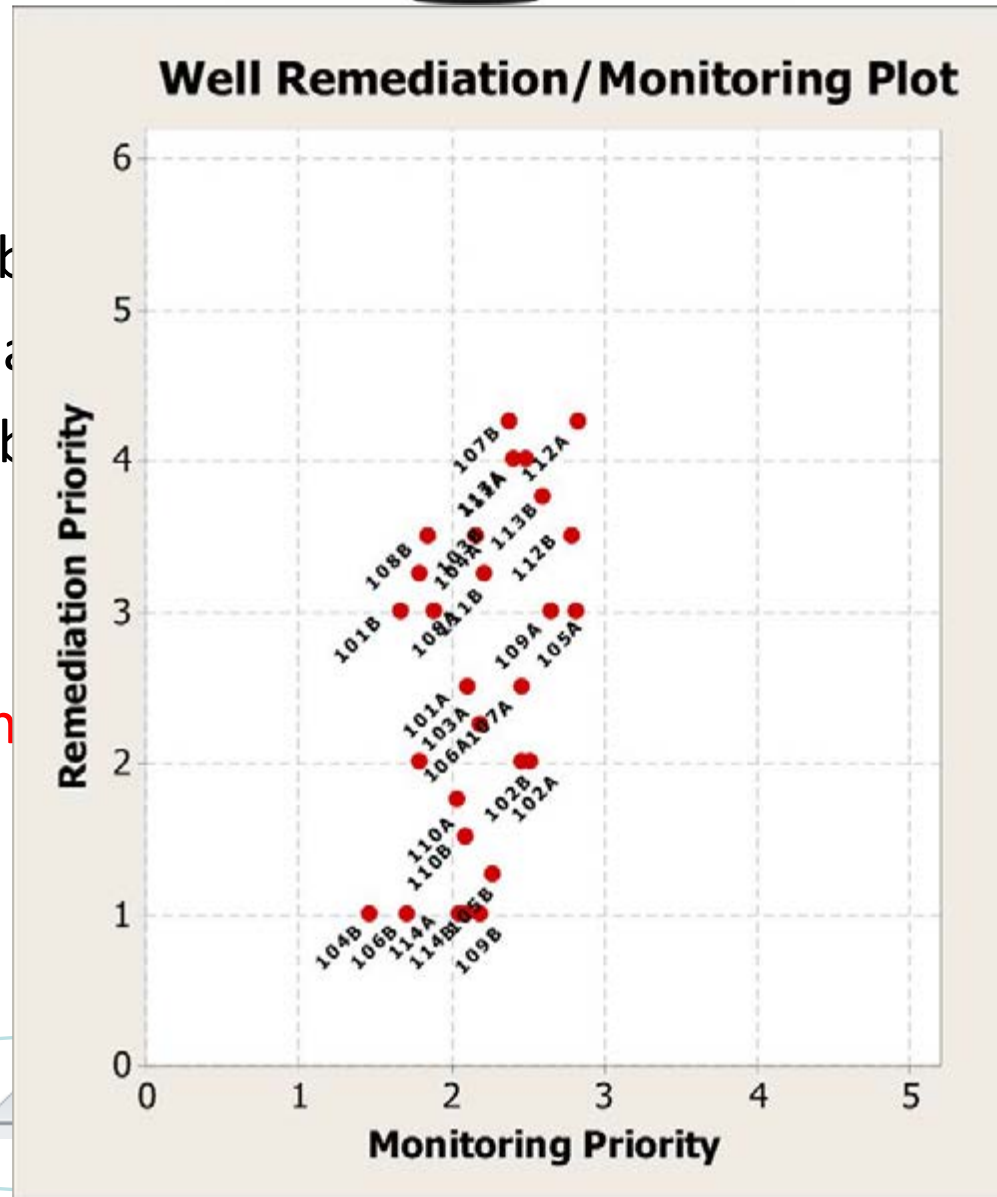
Modeling results show BC casings are not predicted to fail due to tensile or shear strain. This information is included in the well grading process.

Modeling by B. Park Sandia National Labs



- Spreadsheet based
- Familiar format
- Easily updated

Main Component



J	K	P
vern Geo.	Offsite Act.	Monitor Axis
0.10	0.05	1.00
1.33	1	1.30
1.33	1	1.26
1.33	1	2.10
1.33	1	2.06
1.67	1	2.48
1.67	1	2.48
1.33	1	1.94
1.33	1	1.85
1.33	1	2.01
1.33	1	1.95
1.67	1	1.38
1.67	1	1.29
1.33	1	1.55
1.33	1	1.46
1.67	1	1.38
1.67	1	1.33
1.67	1	2.04
1.67	1	1.96
1.33	1	1.52
1.33	1	1.48
1.67	2	1.39
1.67	2	1.30
1.67	1	2.22
1.67	1	2.18
1.67	1	1.77
1.67	1	1.69
1.67	2	1.82
1.67	2	1.87

ALL Post\_Rmdtn

Offsite Act.

# Well Grading SAND Reports





## Summary

- SNL/OM/DOE team has developed a process and framework for the grading of cavern wells for remediation and monitoring
- This process has been applied to all wells at all SPR sites
- We now have a priority grading for SPR wells
- Is updated as new information is available
- A SAND report documenting this process is available for each SPR site – DOE Office of Scientific and Technical Information - [www.osti.gov](http://www.osti.gov)

Thank You  
[blober@sandia.gov](mailto:blober@sandia.gov)

This work was supported by the US DOE SPR