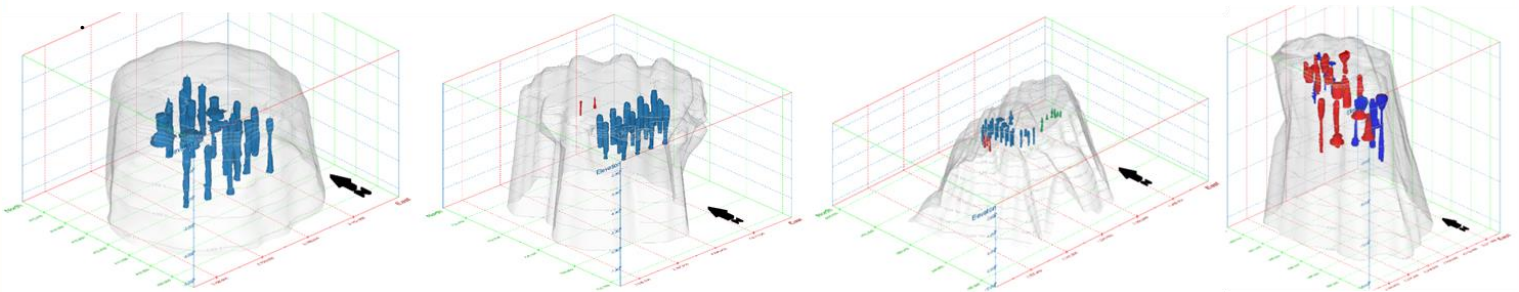


Geotechnical Advisors

Sandia has been working the SPR project since 1978. The Labs became geotechnical advisors in 1980 and the initial program objective was to acquire technically comprehensive, site-specific data to support the planning, design, construction, and operation of the SPR storage facilities. The role shifted from basic geotechnical concerns to instrumentation, long-term monitoring, and special studies.

Today the R&D support specifically addresses unknowns and concerns of a geo-technical nature related to ongoing integrity of underground caverns and includes support of any drawdown(s) or deliveries of SPR oil. The work falls into two areas: geotechnical, including updating geologic understanding of the salt domes, modeling the caverns' geomechanical behavior and assuring the integrity of caverns and wells drilled into them; and engineering, including understanding fluid behavior, analyzing the leaching process that occurs during removal of oil from the reserve and assuring the SPR meets environmental, safety and oil quality requirements.



Geotechnical Aspects to Understanding the Reserve

The purpose of Sandia's geotechnical study of the SPR is to furnish sufficiently comprehensive, site-specific data and analysis to help assure ongoing site integrity and long-term viability of the Reserve as a national emergency response asset. This is accomplished through the following technical activities:

- Characterization of Site Impacts from Ongoing/Planned Events
- Geologic Assessment
- Providing Innovative Solutions to Cavern Integrity Issues
- Wellbore Status Monitoring, Reporting and Advice
- Subsidence Modeling and Impacts
- Modernizing Site Monitoring Approaches
- Oil and Brine Chemistry Implications to Operations
- Full Cavern/Well Design and Development
- Cavern Mechanics and Structural Implications
- Salt Leaching and Mitigation Strategies
- Cavern Operational Analyses

Current Challenges

With recent sales, exchanges, and emergency drawdown activities of the SPR, Sandia is fully engaged in analyzing impacts of those activities and providing recommendations to the oil storage program to include:



Geomechanical modeling – Numerical modeling and laboratory testing to model and predict the long-term mechanical behavior of each cavern. This work helps define optimal cavern operating conditions to promote and maintain cavern health.

Wellbore diagnostics and leak analysis – With an aging infrastructure, the SPR has experienced integrity losses in wellbore casing. Sandia is involved in understanding how to manage and prevent losses of wellbore integrity. Analyses include well-by-well risk management, multi-arm caliber analyses, wellhead pressure monitoring, and has included lab-scale experiments on annulus flow paths and behavior. Leak analyses can be performed with Sandia's in-house hydrostatic column leak model.

Cavern shape management – Cavern integrity impacted by ongoing fluid transfers is monitored by executing a salt solution mining code (SANSMIC) along with ongoing sonar data collection. Analysis can guide cavern use and suggest operational changes to maintain cavern longevity.

Cavern monitoring – Sandia uses its own software system (CAVEMAN) that is designed to continuously integrate cavern data to monitor cavern pressurization rates and alert operators when measured rates deviate from predicted rates – this can indicate possible well/cavern leaks.

Enhanced Monitoring – Sandia analyzes a host of data collected from the SPR's physical monitoring systems with the primary focus of ensuring cavern integrity. Physical monitoring systems include cavern pressure sensors, microseismic information, GPS, tiltmeter, and Interferometric Synthetic Aperture Radar (InSAR) surveys.

Oil fill management – Sandia helps analyze oil data streams and reports on the quality and significance of the data, vapor pressure regain trends, oil layering in the caverns, cavern fill/ullage monitoring, and impacts to deliverability.

Working Together

Sandia National Laboratories is one of DOE's 17 national labs. In this role Sandia delivers essential science and technology to DOE. To ensure continued success, Sandia also successfully teams with both DOE and their M&O contractor to ensure SPR mission readiness.

Sandia is a Federally Funded Research and Development Center (FFRDC):

- FFRDCs operate in the public interest with objectivity and independence, free from organizational conflicts of interest, and by maintaining core competencies in missions of national significance.
- This Congressional designation allows Sandia enhanced access to privileged government information, and access to government personnel, facilities, and other resources.
- FFRDCs can offer continuity of mission, culture, expertise, and institutional memory regarding issues of enduring concern to the sponsor.
- Provide uninterrupted, consistent support based on a continuing relationship with the sponsor.
- Hallmark is objectivity through our ability to produce thorough, independent analyses to address complex technical and analytical problems including urgent and high-priority challenges.