

Storage of Compressed Cold Gas in Underground Caverns

Client:

Confidential Client

Location:

New York

Service Provided:

Performed advanced thermo-geomechanical analysis

Value Provided:

- Specialized expertise in testing of geologic materials and advanced numerical analysis helped clients manage geologic risks

Background & Project Challenges

The cold compressed gas storage concept involves storing cold gas in an existing salt cavern under pressure and removing the gas during peak demand times. More gas can be stored in a fixed volume by lowering the gas temperature and increasing its pressure producing an economic advantage.

Performance of an underground cavern depends on the physical and mechanical properties of the surrounding rock. Storing cold, compressed gas in underground caverns provides a safe, economical storage and supply of natural gas.

Developments in sophisticated analysis tools allow detailed examination of the effects of pressurization and cooling on the complex behavior of geologic materials. Results from these analyses show us that cavern stability can be safely maintained indefinitely in certain geologic formations by controlling the operating pressure and temperature of the stored contents.



Geocomp Role & Accomplishments

Geocomp was part of a team engaged to examine the feasibility of storing compressed cold natural gas in underground caverns located in the southwestern part of New York State. GeoTesting Express developed equipment and test methods to measure strength and stiffness of salt cores and dolomite samples at temperatures down to -200°F. The test results conclusively show that chilling the rock to temperatures as low as -150°F does not degrade the mechanical and physical properties of the saltstone and dolomite. On the contrary, the data show that the strength of rock increases with decreasing temperature.

Advanced thermo-geomechanical analyses were performed to determine if salt caverns can remain stable under the combined effects of cold temperature and high pressure. The analyses show that thermal compression of the rock may produce cracks along horizontal and vertical planes that radiate outward from the cavern walls for distances of 200 to 300-ft. The cavern walls, however, remain stable and gas tight.

The analyses also show that the most critical time for cavern stability is during initial cooling when the tensile stresses are the greatest. Faster cooling appears to cause more cracking. Despite this cracking, the cavern remains stable because the rock remains uncracked in the radial direction away from the chamber and vertical stresses within the cracked zone are safely transferred to rock outside the tensile zone.