COMPRESSED-AIR ENERGY STORAGE IN SALT DOME AT BORABU DISTRICT, THAILAND: GEOTECHNICAL ASPECTS

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Abstract

A feasibility study has been carried out to assess the mechanical performance of the Borabu salt dome for compressed-air energy storage cavern. The effort involves geological examination of drilled-hole data, laboratory mechanical testing on salt specimens, and numerical analyses. From the existing boreholes and geophysical data, Borabu salt dome in the Khorat basin has been tentatively selected as a host rock for the storage cavern in the northeast of Thailand. Uniaxial and triaxial creep tests and cyclic loading tests determine the mechanical and rheological properties (strength, elastic, visco-elastic and visco-plastic parameters) of the salt specimens. The computer modeling uses the laboratory-calibrated properties to determine the mechanically suitable depth and the range of storage air pressures for the salt cavern. The numerical modeling predicts the time-dependent stress, strain and deformation around the salt cavern, as well as the movement of the overlying formations. The cavern is designed to have a storage volume of about 260,000 cubic meters, which is capable of converting the electric power up to 110 megawatts for 6 hours. The results suggest that the most suitable depth be 600 m for the cavern top, and 750 m for the cavern bottom. The cylindrical-shaped cavern should have the maximum diameter of 50 m. The safe maximum and minimum storage pressures should be 11.9 MPa and 4.0 MPa (or 90% and 30% of the in-situ stress at the casing shoe). The nominal injection and withdrawal rates of the compressed air are about 0.66 MPa per hour. Under these operating parameters, the predicted cavern closure is about 5%, and the surface subsidence is about 50 cm through the 20 years of operation.

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