GEOMECHANICAL PERFORMANCE OF SALT FORMATION FOR NUCLEAR WASTE REPOSITORY IN THAILAND

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Abstract

Series of mechanical laboratory testing and numerical modeling have been carried out to assess the geomechanical performance of rock salt formation in the northeast of Thailand for the nuclear waste repository. Results from the existing boreholes and geophysical data have suggested that there are three potential sites in the Maha Sarakham Salt Formation posing the geological suitability for the underground repository. The mechanical characterization, cyclic loading, and uniaxial and triaxial creep tests have been performed on the salt core specimens under isothermal conditions. The results reveal the stiffness, strength, instantaneous responses and time-dependent behavior of the salt. Finite element analyses use the laboratory-calibrated properties to assist in the design of the repository dimensions and layout under a variety of loading and boundary conditions. The numerical model employing the visco-elastic and visco-plastic constitutive equations predicts the time-dependent stresses and deformation around the salt openings, as well as the movement of the overlying formations. The analysis assumes the low temperature condition (low-level nuclear wastes). The key design requirements are 1) the mechanical stability during the emplacement period of 50 years, 2) the containment integrity for the repository during the isolation period of 500 years, and 3) minimization of the movement of the surrounding rock formations.

The results indicate that the repository horizon should invoke the long-wall pillar concept and should be located at about 500 meters depth. The repository rooms are 4 m wide, 4 m high and 50 m long, separated by 16 m wide pillar. The minimum width for the barrier and protective pillars is 50 meters. Under these design parameters, the predicted room convergence is about 15 cm before backfill installation, and the surface subsidence is about 20 cm through the next 500 years.

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