SPE Iran Section

Rock Mechanics for Underground Gas Storage

Depleted hydrocarbon reservoirs and aquifers are attractive targets for gas storage and CO2 disposal because of proven storage capacity and seal integrity, existing infrastructure and etc. Optimum well completion and injection design in depleted reservoirs would require understanding of important rock mechanics issues such as: 1) drillability and completion of new wells, 2) maximum sustainable storage pressures avoiding fracturing and fault reactivations considering rock-fluid interaction effects and 3) The evolution of cap rock integrity during storage. In first part of the course, a systematic approach with above three issues for geomechanical risk assessments of gas storage in depleted reservoirs will be demonstrated.

Unlike storage in reservoirs or aquifers which rely on natural voids in porous and permeable rocks, with storage in salt cavities the gas is stored in man-made, solution-mined cavities. The engineer designs and constructs the project. The mechanical behaviour of rock salt is characterized by its high viscosity and creep effects. These effects are determinant for the conception and exploitation of underground caverns in rock salt used for gas and oil storage. The second part of the course begins with an introduction to theoretical bases and laboratory testing methods for modelling the mechanical behaviour of salt. Then the theoretical and numerical methods for modelling the stress and displacement fields around underground openings in viscous rock formations are presented. Case-studies are presented then to show how engineers can use the models for an optimum design of the caverns and to define adequate operating plans limiting their convergence as well as risks of damage and mechanical disorders.