AOGS 2005

Hydrogeological Evaluation of Fractured Rock Mass for Large Scale Storage Caverns

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This study aims to evaluate the hydrogeological system of large scale storage caverns under construction in a volcanic rock mass in the Yeosu peninsula of Korea. In general the porous continuum concept is still used for the hydrogeological design and safety evaluation on underground storage facilities, however, the fracture hydrological approach is used for the hydrogeological assessment of the site in this study. The fracture analysis was carried out on the basis of the fracture mapping data on surface and in tunnel, and the BHTV data for drilling holes. For the hydrogeological analysis, the hydraulic tests data, the evolution of groundwater levels from the surface monitoring boreholes and the variation of water curtain hole pressures in the caverns were utilized.

The hydrogeologic system in the study area is characterized by two major fracture zones (F1-1 and F1-3 zones) acting as a hydraulic boundary from the existing storage facilities. At the cavern level, the Hydraulic Conductor Domain (fracture zones) is characterized one local major fracture zone and two local fracture zones between the F1-1 and F1-3 zones. The Hydraulic Rock Domain (rock mass) is divided into four compartments by the above local fracture zones. The two Hydraulic Rock Domains around the F1-1 zone, the groundwater levels in the upper and lower zones are shown a great difference in the maximum of 170 m measured from the double completed monitoring holes. This might be resulted from the poor hydraulic connectivity and very low hydraulic conductivity ($7 \times 10^{-10} \sim 5 \times 10^{-9}$ m/sec) in the zone, in turn low groundwater recharge rates. On the other hand, the two Hydraulic Rock Domain around the F1-3 zone have a relatively less difference between the upper and lower groundwater levels in the range of 10 and 40 m and has a low hydraulic conductivity of $4 \sim 5 \times 10^{-9}$ m/sec, indicating relatively higher hydraulic connectivity than the F1-1 zone.

Keywords: Groundwater; fractured rock mass; storage cavern

References

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