Above-zone pressure monitoring and geomechanical analyses for a field-scale CO2 injection project in Cranfield, MS

GCCC Digital Publication Series #13-17

Seunghee Kim
Seyye Abolfazl Hosseini

Keywords:
Field study-Cranfield-MS; Modeling-Flow simulation; Monitoring-downhole pressure

Cited as:
Kim, S. and Hosseini, S.A., 2013, Above-zone pressure monitoring and geomechanical analyses for a field-scale CO2 injection project in Cranfield, MS: Greenhouse Gases: Science and Technology, DOI: 10.1002/ghg.1388, 18 p., in press. GCCC Digital Publication #13-17.

Abstract:

Pressure and temperature monitoring of an above-zone monitoring interval (AZMI), as well as of an injection zone (IZ), has been attempted at a field-scale CO2 injection site in Cranfield, MS. Recorded pressure data in the AZMI revealed a certain amount of increase with no evidence of direct fluid flow between the IZ and the AZMI. We therefore attempted to interpret the field-measurement data from a geomechanical perspective. First, we tried an analytical approach that combined Green's functions with a poroelastic theory that is based on Segall's derivation (1992). The analysis was shown to provide fast fi rst-order and probabilistic estimation. Next, we attempted a numerical simulation in which fully coupled calculation between fluid flow and poroelasticity was implemented. Numerical-simulation results using COMSOL matched well with the field data at one monitoring location in the AZMI. However, field data differ from those of a numerical simulation at the other monitoring well. We suggest that field measurement at the other location in the AZMI might be disturbed during the pressure monitoring, based on bottom-hole pressure records in the IZ and thermal signals. Following the numerical simulation, we discuss the effect of single-phase fluid flow assumption, observations for thermal effect and pore-pressure–stress coupling, and desirable resolution of pressure gauges for the optimal utilization of above-zone pressure monitoring.

To access full text, please contact the author or visit:
http://onlinelibrary.wiley.com/doi/10.1002/ghg.1388/abstract