

Characterization of leakage through cap-rock with application to CO₂ storage in aquifers – single injector and single monitoring well

GCCC Digital Publication Series #10-23

M. Zeidouni
M. Pooladi-Darvish



Keywords:

Monitoring; Monitoring-downhole pressure

Cited as:

Zeidouni, M. and Pooladi-Darvish, M., 2010, Characterization of leakage through cap-rock with application to CO₂ storage in aquifers – single injector and single monitoring well: presented at the Canadian Unconventional Resources & International Petroleum Conference, Calgary, Alberta, Canada, 19-21 October 2010. Society of Petroleum Engineers, Paper No. 138178, 16 p. GCCC Digital Publication #10-23.

Abstract:

The geological storage of carbon dioxide provides the possibility of maintaining access to fossil energy, while reducing emissions of carbon dioxide (CO₂) to the atmosphere. One of the essential concerns in geologic storage is the risk of CO₂ leakage from the storage formations. Leakage occurs through possible pathways in the seal, which include a) transmissive faults, b) abandoned wells (penetrating the entire seal or part of it), c) active wells that partially penetrate the seal, d) and local seal weakness and fractures.

CO₂ leakage to the subsurface formations can adversely affect the existing and potential energy and mineral resources and shallow ground water resources and soils. As such, detection and characterization of CO₂ leakage pathways from storage formations into overlying formations is necessary. The target aquifer could be tested for the leakage pathways before CO₂ storage. This will allow for the determination of proper storage aquifers and locations for the injection wells. In this work, we suggest a flow and pressure test and present an inverse methodology to detect and characterize leakage pathways based on the pressure data.

The flow test is based on the injection (or production) of water into (or from) a storage aquifer at a constant rate. The pressure is measured at a monitoring well in an aquifer overlying the storage aquifer, which is separated by an aquitard. The objective of the test is to locate and characterize any leakage through the separating aquitard. The interpretation method is based on forward and inverse solutions of a new analytical model presented in an earlier work. We present an inverse procedure to obtain the leakage pathway transmissibility and location, based on the pressure measurements in an observation well completed in the monitoring aquifer. Inversion analysis is utilized to evaluate the capability of leakage parameters' estimation through pressure monitoring.

To access full text, please contact the author or visit:

<http://www.onepetro.org/mslib/app/Preview.do?paperNumber=SPE-138178-MS&societyCode=SPE>