Potential Formation Damage: An Integrated Reservoir Characterization Study of the Naturally Fractured Carbonate Middle Duperow Formation at the Kevin Dome, Montana

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Abstract

In this study, we integrate geologic and engineering data of a naturally fractured carbonate reservoir at the Kevin Dome, Montana. Well test data are correlated with core description, geochemical and lithology study to determine the flow behavior and communication within the injection test interval and to the surrounding area. Based on a dual-continuum geologic model, numerical brine injection simulations are carried out to validate the interpretation results from our well test analytical models and forecast the probability of CO2 injection success using current reservoir properties. As a result, our well test analytical models as well as lithology/core description suggest that fluid flow may be mainly restricted to the injection interval and the assumption of radial (horizontal) flow may be appropriate. The well test models also indicate that there is potentially formation damage with a positive skin factor although prior to brine injection well tests, well stimulation through acid treatment was performed. Our numerical simulation results appear to confirm this formation damage by showing additional pressure buildup in the injection data during later test periods. To explain this, acid may have dissolved dolomite then dolomite or calcite may have been formed again further into the matrix/fracture system. Another possible explanation is mechanical clogging of the fractures due to acid dissolving dolomite and dislodging fine grains. Our work also predicts that if no

additional well stimulation is performed, the project will have a lower probability of successfully injecting 1 million tons of CO2 into the Middle Duperow formation over 4 years.