



**Modeling CO₂ Partitioning at a Carbonate CO₂-EOR Site: Permian Basin Field
SACROC Unit**

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**P. Hosseinioosheri
S.A. Hosseini
V. Nunez-Lopez
L.W. Lake**

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**BUREAU OF
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GEOLOGY**



TEXAS Geosciences
Bureau of Economic Geology
Jackson School of Geosciences
The University of Texas at Austin

Abstract

The relative partitioning of CO₂ during and after CO₂ injection in a CO₂-EOR process is affected by several parameters. While many geological properties cannot be changed in a specific hydrocarbon (HC) reservoir, it could be shown that an intelligent selection of CO₂ injection strategy improves both the incremental oil recovery and CO₂ storage capacity and security. Therefore, we investigated and discussed the partitioning of CO₂ among different phases (oil, gas, and brine) after two well-known CO₂ injection schemes using field-scale compositional reservoir flow modeling in the SACROC (Scurry Area Canyon Reef Operators Committee) unit, Permian Basin. First, we used a high-resolution geocellular model, which was constructed from wireline logs, seismic surveys, core data, and stratigraphic interpretation. As the initial distribution of fluids plays an important role in CO₂ partitioning, a comprehensive pressure-production history matching of primary, secondary, and tertiary recovery was completed. The hysteresis model was used to calculate the amount of CO₂ trapped as residual. CO₂ solubility into brine was verified based on previous experiments. The model results showed a new understanding of relative CO₂ partitioning in porous media after a CO₂-EOR process. We compared the contribution of CO₂ trapping mechanisms and the sweep efficiency of Walter-Alternating-Gas (WAG) and Continuous-Gas-Injection (CGI). We found that WAG injection showed a significantly superior behaviour over CGI. WAG not only decreased the amount of mobile CO₂ (structural trapping), but also resulted in a competitive incremental oil recovery in comparison with CGI. Thus, clearly WAG injection is preferred as it strongly enhances CO₂ storage efficiency and containment security. The present work provides valuable insights for optimizing oil production and CO₂ storage in carbonate reservoirs like SACROC unit. In other words, this work helps decision makers to set storage goals based on optimized project risks.