

Integrated Earth Model Workflow for a Comprehensive Redesign of the Permian Vacuum CO₂ Asset Reservoir Model

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Vacuum Field is located in Lea County New Mexico, on the Northwest Shelf of the Permian Basin. Discovered in 1929, the field has produced 167 MMSTBO and 215 BCFG from the Guadalupian (Permian) San Andres Formation, which is currently under waterflood and CO₂ injection. The 500-foot thick gross reservoir section consists of anhydritic dolomite, with the main reservoir lithology being shelf-edge grainstones and packstones. A Formation Evaluation program initiated in 2006 confirmed and improved the understanding of a significant potential through the Transition Zone and Residual Oil Zone (TZ/ROZ) in the San Andres. This evaluation aided in the decision to evaluate a CO₂ EOR flood vertical expansion project. Subsequently, a regional-scale study was initiated in 2008 by the team to understand how nearby analog fields were producing their TZ/ROZ's through CO₂ flooding. One key Applied Reservoir Management Team (ARMT) recommendation from this study was that reprocessing the current seismic would yield a much clearer and more realistic structural picture of the reservoir.

A significant finding from the 2009 seismic reprocessing was that the seismically defined structure did not correlate with the previous earth model interpretation. In addition, the previous earth model did not include the new log data from the recent data acquisition program, nor did it fully encompass the underlying TZ/ROZ. The decision was made to build a new 3D Gocad reservoir model from scratch - taking into account the newly reprocessed seismic (both amplitude and impedance data), creating new structure maps, utilizing the calculated logs from the 2006 FE program for porosity distribution within the model, integrating new core data for permeability transforms, and extending the model to include the TZ/ROZ reservoir interval. This presentation will review the workflow utilized to create this comprehensive model.

The new 2009 Gocad model is being utilized by the team to calculate updated OOIP numbers for the field, evaluate the potential of the TZ/ROZ, for daily operations such as workovers, replacement wells, new drill locations, planning horizontals, and researching problem wells. The instrumental lesson learned is that it is necessary to have a robust model that integrates all available data, inclusive of data that was previously believed to have no major significance. These types of data can have major impact, especially after further reprocessing (logs, seismic).