CHARACTERIZATION AND MODELING OF AN EOR, H_2S DISPOSAL, AND CO_2 STORAGE PROJECT IN THE ZAMA SUBBASIN, NORTHERN ALBERTA, CANADA

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ABSTRACT

Since October 2005, the Zama oil field in northwestern Alberta, Canada, has been the site of acid gas (approximately 80% carbon dioxide [CO_2] and 20% hydrogen sulfide [H_2S]) injection for the simultaneous purpose of enhanced oil recovery (EOR), H_2S disposal, and CO_2 storage. Injection began in December 2006 and continues through the present at a depth of 4900 feet into the Zama F Pool, which is one of over 800 pinnacle reef structures identified in the Zama Subbasin. To date, over 90,000 tons of acid gas has been injected, with an incremental production of over 50,000 barrels of oil. The primary purpose of this work is to verify and validate stored volumes of CO_2, with the ultimate goal of monetizing carbon credits.

Pinnacle reefs have very complex geologic and facies relationships, and as a result, a thorough understanding of the geology is necessary in order to properly monitor and predict fluid movement in the reservoir. Core calibrated multimineral petrophysics were performed on well logs, and borehole image logs were used to more accurately identify the different facies and determine each facies' properties along the wellbores. Seismic attribute data interpretations were used to identify the reef versus nonreef facies to aid in the distribution of the facies in the reservoir. These properties were then spatially distributed throughout the reservoir using a combination of multiple-point statistics and object modeling workflow to produced equiprobable reef facies, structure, and volumetric realizations.

Initial model results suggest that total reef volume, pore volume, and fracture properties are major uncertainties that will most affect future history-matching efforts. The history-matching activities will be focused on matching historic production and injection into the reef and will be used to help validate the geologic models. Of utmost importance will be matching the historic production and injection volumes, individual fluid rates, and bottomhole pressures. These data will then be used to predict future incremental oil recovery, validate long-term acid gas storage, and identify areas of unswept hydrocarbons.