Acid-Gas Injection in the Long Coulee Glauconite F Pool, Alberta: Implications for Enhanced Gas Recovery and Acid-Gas Disposal

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Summary

The disposal of acid gas (a mixture of carbon dioxide - CO_2 - and hydrogen sulfide - H_2S) in depleted oil and gas reservoirs is considered to be an economic and safe way to reduce anthropogenic emissions of these gases. In Alberta there are more than 40 of these schemes presently in operation, of which disposal into the Long Coulee Glauconite F pool in southern Alberta is one. The Glauconite F pool consists of a small oil leg and large gas cap trapped in quartz arenite, current-ripple laminated and plane bedded sandstones, interbedded with bioturbated, wavy-bedded shale. The sandstones and shale are interpreted to be tidal-flat deposits laid down in a brackish-water setting. Permeability and porosity relationships within the sandstone suggest that the sands are nearly isotropic in the horizontal plane. Vertical permeability is approximately 25% of the maximum horizontal permeability. The lateral seals for the pool are shale-filled upper Glauconite Fm channels. The top seal is a regionally extensive unit of shale and interbedded calcite-cemented sandstones deposited in a non-marine setting.

Permeability and porosity measurements, and mapping of the reservoir were used to model the flow of acid gas (in this case 98% CO_2, 2% H_2S) to determine the impact of acid-gas injection on reservoir performance and recovery. A few notable conclusions are drawn. Firstly, acid-gas injection resulted in increased gas recovery regardless of the quick breakthrough of CO_2 at offsetting gas producers. Second, CO_2 breakthrough occurred faster than H_2S breakthrough, indicating there was gas partitioning in the reservoir. This is considered to have occurred due to the preferential solubility of H_2S in the formation brine leading to stripping of H_2S from the injected gas front. Third, acid-gas injection resulted in partial re-pressurization of the gas cap, which improved oil recovery from the underlying oil leg.