



Repeat Seismic Insights into Clearwater SAGD Production at Orion Cold Lake.

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Abstract

The Orion Project in the Cold Lake Area of Northern Alberta produces bitumen from the Clearwater Formation using the process of steam assisted gravity drainage (SAGD). Most production from the Clearwater has occurred using cyclic steam stimulation (CSS) processes and commercial SAGD production from this reservoir is a recent development. The Clearwater reservoir is a fine-grained feldspathic litharenite sand with few mud interbeds, and was deposited in a marginal marine setting during the Albain. The average net pay in the Orion production area is 21 meters with 33% porosity and 69% oil saturation. The first two well pairs of the pilot averaged 500 bopd for 10 years before commercial production began in 2007 with 20 additional well pairs. A base-line swath seismic survey was acquired in 2007, and three additional swath seismic surveys were repeated, approximately every two years afterward. The result is a repeat-seismic data set acquired at significantly reduced cost that has allowed us to compare and corroborate reservoir simulation models and map wellbore steam conformance.

The Clearwater Formation has a higher initial gas-oil ratio (GOR) compared to the reservoirs in the McMurray Formation. Although the effect of solution gas on successful CSS development in the Clearwater is well understood, how gas impacts SAGD performance requires new analysis. Seismic responds to the total combined gas effect which includes the injected steam vapour, solution gas and generated gas from aquathermolysis. The simulation, being constrained by this total gas volume, can further refine the fractional distribution of these gases. We have used the repeat-seismic interpretations iteratively with the reservoir simulation to guide our gas interpretations. Insights from these surveys will also optimize the placement, spacing and completion design of production wells for Phase 2 of the Orion Project.