Reservoir Heterogeneity And Its Effect On SAGD Oil Production From The Mcmurray Formation, Christina Lake Area, Alberta

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ABSTRACT

The Oil Sands project at Christina Lake was initiated in 1996 and the current production exceeds 5,000 bbls/d with four SAGD well pairs. Of these, one well pair is still in the early stage of production and an additional 2 well pairs will be drilled in 2004.

Delineation wells were drilled on a minimum spacing of 400 m (16 wells/section) and an average of 6 wells per section were cored. In addition, three observation wells were drilled for each SAGD well pair. Formation Micro Imager (FMI) or Dipmeter (SHDT) logs were run, along with the standard logging suite, for every well, producing paleocurrent data for detailed reservoir characterization.

3D seismic data was acquired over the current area of interest. In addition, time-lapse 3D seismic, crosswell seismic, and EM (electromagnetic) surveys have been conducted over the four currently producing SAGD well pairs to monitor the steam growth and its movement in the IHS (inclined heterolithic strata) facies.

The oil sands reservoir at Christina Lake occurs within the McMurray Formation. In the Phase I area, the reservoir is composed of stacked estuarine channel deposits with several lithofacies. As a result, the reservoir is inherently heterogeneous, and delineation of the reservoir and its facies distribution requires detailed geological and geophysical evaluation.

The reservoir lithofacies include cross-bedded sands and sandy inclined heterolithic strata (IHS). The muddy IHS facies is considered non-exploitable. The cross-bedded sands have high porosity (35%) and permeability (7 Darcy) and are considered to be the best facies for SAGD production. The reservoir quality of the sandy IHS lithofacies is inversely proportional to the thickness of the interbedded mudstones. However, bioturbation of the mudstones may enhance reservoir quality.

It is therefore crucial to delineate and to map reservoir facies in detail. The integration of geological and geophysical data is necessary to develop a detailed reservoir model that reservoir engineers can utilize in planning the development of the Christina Lake project.