

Geoscience Integration – Geology, Geophysics, and Petrophysics of SAGD well pair planning – a Case Study from Long Lake, Northeastern Alberta

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Long Lake is an integrated steam-assisted gravity drainage (SAGD) and upgrading operation owned and operated by Nexen Inc. and its joint venture partner, CNOOC (formerly Opti Canada Inc.). In 2008, Long Lake began to produce hydrocarbons, the start of a multi-decade project to recover a portion of the billions of barrels of bitumen trapped within the sands of the Aptian-age McMurray Formation. Over the life of the project, a continual feedstock of bitumen will be required to maintain production levels and maximize efficiency of the plant. As the initial SAGD well pairs mature and their bitumen productions rates decline, planning productive future well pairs will be essential. The Long Lake South West project area is the location of at least 30 future SAGD well pairs. The planning of these future SAGD well pairs will be used to illustrate the integration between geosciences.

To successfully achieve the objective of planning productive future SAGD well pairs and replacing depleted well pairs requires an integrated approach between geology, geophysics, and petrophysics. The integration between these geosciences begins with the data acquisition from a vertical evaluation well, whereby a core is typically cut and petrophysical logs acquired. The core is described and analysed, and the petrophysical logs interpreted. The core description, core analysis and petrophysical analysis are integrated and calibrated to each other. Applied to this integrated data set is an interpretation of formation markers, stratigraphic frame work and depositional model. The interpretation from the well data is then tied to the 3D seismic survey and formation markers, stratigraphic framework and elements of the depositional model are correlated and mapped across an area.

The core and petrophysical data from an oil sands evaluation wells provide a 2 dimensional interpretation of rock and fluid types in the subsurface, and the integration with 3D seismic provides a correlation of surfaces between wells. This integration kicks off a 3 dimensional assessment of the rocks and fluid types which is used to understand the degree of uncertainty in the interpretation that still exists between oil sands evaluation wells.

This presentation begins with the data from an oil sands evaluation well and will illustrate the integration between geology, petrophysics, and geophysics to produce an interpretation of the subsurface that characterizes the geology, reservoir and resource in place. This geoscience interpretation is then used to plan future well pairs and constructing geo-models for reservoir simulation, ultimately providing an assessment of future performance.