Case study: Canada

RPM 3-phase Triangulation technique enabled better understanding of SAGD reservoir depletion

Baker Hughes Formation evaluation services through cased hole continue to provide customers with answers about their reservoirs. Time lapse logging with **RPM™** instrument & data processing with patented 3-phase triangulation technique helped the client understand the depletion of reservoir in Steam-assisted-gravity-drainage (SAGD) wells.

The well was completed in 2009 and the steam injection started in early 2012. The temperatures prior to steam injection were in the range of standard RPM instrument, which is rated up to 350^{0}F. The data recorded with **Carbon-Oxygen (CO)** mode of RPM was used to quantify water & oil saturation whereas the data processed with patented **GasView™** technology quantified gas & liquid phase saturation. 3-phase triangulation technique delivered quantitative 3-phase fluid saturation & repeatability of the logs from 2009 and 2011 confirmed the presence of around 60% oil-saturated reservoir.

High-temperature (HT) RPM instrument, rated up to 500^{0}F, was used to record CO & GasView data after steam injection in 2012. 3-phase triangulation analysis confirmed the build-up of steam envelope, as expected, and quantified the residual oil saturation in the zone, where steam was being injected. But, the log also showed an increase in oil saturation above & below the steam envelope, resulting in the oil-water contact (OWC) moving down. This has been analyzed to be an effect of increase in oil volume because of reservoir heating. There wasn't any noticeable change in Sigma even though there was a drop in the OWC.

Subsequent logs in 2014 with HT RPM instrument repeated the log response in 2012, confirming that the oil-water contact had actually moved down.

The logs also confirmed the increase of oil saturation above the steam envelope.

The 3-phase triangulation technique delivering quantitative 3-phase fluid saturation analysis opened up options for the customer to expand the perforated interval for increasing the production.

Challenges

- Temperatures beyond the range of standard RPM instrument, due to injection of steam
- Quantify steam saturation i.e. identify steam envelope build-up
- Quantify residual oil and water saturation

Results

- Delivered 3-phase fluid saturation using GasView and CO service
- Enabled quantification of steam saturation using GasView service
- Helped in better understanding of the changes in the oil-water contacts