Application of Image data for Geo Steering Horizontal Wells for Better Productivity by Maximizing Reservoir Contact – A Case Study from Mumbai High Field.

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Mumbai High Field was discovered in 1974. It is located in the Western Offshore Basin about 165 km WNW of Mumbai. The field was put on production in 1976.
MH field contains light oil (38 - 42 °API) in numerous pools, some are with large gas cap, structurally trapped within gently dipping, tilted fault-blocks. The field is divided into two main structural compartments (Mumbai High North and South) by a major WNW – ESE trending graben containing impermeable shale. The main reservoir horizons in the field are Middle Miocene limestone and Lower Miocene sandstone and carbonate. The Lower Miocene carbonate formation has been named as L-III reservoir. It contains more than 90% of the total Mumbai High reserve and comprises low-energy carbonate bank made up of lagoonal limestone and shale.
The reservoir is highly heterogeneous with thin limestone pay zones with shale inter-beds having large areal extent but with different lateral and vertical poroperm characteristics. Permeability ranges from 50 - 500 md, with the higher values associated with vugs, channels and moulds developed due to severe leaching action.

Large number of wells have been drilled with horizontal drain holes in this field to exploit untapped oil pools, leading to incremental oil production and also as injectors for maintenance of pressure support by water injection. Most of these drain holes have been drilled with LWD technology. In this case, apart from basic suit of logs, the image data (density image) is critically interpreted to successfully steer and place the drain holes in relatively good reservoir facies, which leads to better productivity. Azimuthal Density Neutron (ADN) tool records density image data in 360 deg during rotation. Whenever a formation boundary is intersected, the tool records densities of the successive formations coming in contact. Hence the angular contact of the tool with the adjacent formations is recorded / displayed as a sine wave in the image form. The progress of the drain hole within / across the formations is assessed by interpreting the resultant image data accordingly.

Three wells from a single platform located in MH South have been taken as a case study to demonstrate the application and utility of density image logs (ADN) in the placement of drain holes.