A FIRST EXPERIENCE IN HORIZONTAL DRILLING IN SSPC (ERB WEST FIELD): A REVIEW OF OPERATIONAL GEOLOGY

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In recent years considerable advances have been made in the technique of drilling horizontal holes. This technique has proven to be particularly applicable in fields with thin oil rims where a horizontal penetration of the reservoir can substantially increase the length of the completion interval. SSPC has investigated the potential for application of horizontal wells in existing offshore Sabah fields that have, to date, been developed by conventional wells. The Erb West field was considered a suitable candidate for a first horizontal well.

This paper outlines the operational geology aspects of this first horizontal well trial, highlighting the geological configuration of the target area, its main uncertainties and the day-to-day geological evaluation of drilling operations.

The Erb West field is a significant hydrocarbon accumulation in offshore Sabah (NW Borneo), consisting of a single 120 to 140 ft thick oil rim overlain by a large gas cap (ca. 550 ft thick). The Erb West field is a relatively simple NE-SW trending anticlinal structure with a collapsed crest and bounded to the NE by a major fault-zone. The hydrocarbons are contained within a ca. 800 ft thick sequence of Upper Miocene shallow marine sandstones in which eight main reservoirs have been defined (M4 and N2-N8 sands).

The main objective of the well was to penetrate the N6 sands in Fault Block 2B over a horizontal section of ca. 800 ft gross (ca. 450 ft net) to provide a drainage point in the southern part of the field.

The target area in the N6 sands was located in a ca. 3300 ft wide East-West trending block bounded to both the north and south by normal faults and some 1000 ft - 1500 ft away from the nearest existing wells. Structurally the main uncertainties were the location and throw of the northern bounding fault, which had to be crossed by the well before entering the target interval, and the structural elevation (true vertical depth) of the top of the sands. In addition, the alternating sand/shale sequences characterising the N5, N6 and N7 reservoir units are very similar in character and increased the uncertainty in correctly identifying the target sands (N6) directly from drilling data.

The MWD Gamma Ray log was not available for correlation for most of the drilling phase due to its interference with deviation control, leaving only the mud logs (penetration rate/cuttings descriptions) for daily monitoring of geology. Interpretation was further hampered, firstly, by the presence of numerous hard stringers (carbonate cemented layers), which slowed down the drilling speed considerably, and secondly, by contamination from cuttings remaining on the low-side of the borehole.

Identification of the target was also difficult because the horizontal section of the well followed an azimuth of approximately N200° through beds which have a structural dip of 6°/N150°, resulting in penetration of the formation from older to younger (instead of younger to older as in conventional wells). Consequently, borehole logs had to be manipulated in such a way that correlation with nearby wells could still be carried out.

The well was successfully drilled and fully met its main objectives: (1) it provided a 400 ft long completion interval on the N6 reservoir sands and (2) it penetrated the formations horizontally over a length of almost 1500 ft.

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