Case histories

SPE/IADC 52849

"Well Engineering Aspects of a 2 7/8-in. Ultra Slim Lined Well Campaign"

This paper describes the approach taken in planning and executing the first two 2 7/8-in. lined ultra slim wells in Petroleum Development Oman. Well Engineering has long recognised that new technology would have to be sourced to facilitate the process of maintaining a constant downward trend in well costs. One of these initiatives has been the application of Coiled Tubing Drilling (CTD). During the CTD campaign in 1997, it was recognised that although CTD technology has future promise in niche applications of its own, there was also potential for some of the associated technology to be applied within the conventional rig fleet to provide total flexibility and reduce well costs. This project was focused on developing the ability not only to drill slim horizontal holes (3 3/4 in.), but to run and cement 2 7/8-in. slim liners with standard drilling rigs.

Yibal is a mature field and for many years has been produced using conventional horizontal sidetracks from vertical wells. In the long term development plan for the field it was recognised that the number of existing sidetrack candidate wells was limited. Coupled with this the reservoir model shows that further development using conventional sidetracks will leave a significant volume oil in place in small Oil Pockets. A way to successfully develop these oil pockets was clearly required for the future economic development of Yibal. The objective of the Ultra Slim Hole Project was to use the existing 4-1/2-in. horizontal liner stock and deliver a 2 7/8-in. lined, cemented, perforated and stimulated well bore.

The two wells were a success, both on technical and production results. All operations were conducted starting from a horizontal 4 1/2-in. liner. Window milling in the 4 1/2-in. liner was conducted using motors. A 3 3/4-in. hole was then drilled. Conventional TLC logging was conducted through the 4 1/2-in. monobore completion. The longest OH cemented section of liner was 650 m. This was perforated with tubing activated 1 11/16-in. guns. Further 2 7/8-in. lined wells are now planned, including a proposed level IV Multilateral 2 7/8-in. well.

—P Saville, et al, Petroleum Development Oman

SPE/IADC 52850

"Case Study in Improving Capital Efficiency"

The initial phase of Venezuela's first large-scale horizontal development drilling program in the Orinoco Heavy Oil Belt was recently completed. This project is operated by Petrozuata CA, a joint venture between Petroleos de Venezuela (PDVSA) and Conoco Inc. The planning process began in 1994 with the evaluation of worldwide heavy oil operations. A test well was also drilled which incorporated design changes to improve well productivity and allowed the operator to gain experience in Venezuelan operations.

The Petrozuata development program was based on drilling 95 horizontal wells of identical design as efficiently as possible in order to maximize the project economics. To accomplish this goal, a minimum well design was established based on managed risk. Technical limit methodology I was then applied to the individual well operations to establish breakthrough targets for drilling performance. To ensure targets were met, a well manufacturing process, including fit-for-purpose drilling rigs, contracting strategy, procurement strategy, and detailed operational plans were developed.

Performance improved significantly from an initial 19.2 days to 6 days to drill and complete 9,000 ft MD wells with over 6,000 ft horizontal sections. A capital efficiency improvement of 30% was realized, This paper details how shared goals, teamwork, and continuous improvement initiatives between the contractor and operator resulted in world-class drilling performance, record setting horizontal completions, and a new standard for future Venezuelan operations.

—K L Jackson, R Aranaga, Petrozuata CA
–R M Brennan, Conoco Inc
–R Hawker, Remedy Resources Consultants Ltd

SPE/IADC 52851

"Lessons Learned from an Australian Deepwater Subsea Drilling and Completions Team Pursuing the 'Technical Limit' in Performance"

This paper examines the lessons learned to date in the drilling and completion of the wells on the Laminaria and Corallina subsea development in 400 m water depth in the Timor Sea, Northern Australia. The "Technical Limit" concept (pursuit of perfect performance) is applied and lessons learned in its application are described. An overview of the Laminaria and Corallina Field Development is presented including a review of the Well designs. The paper goes on to describe the lessons learned from the following elements of the drilling and completion project: planning; risk management; contracting strategy; team organisation and training; project schedule; well quality and drilling and completions performance. The paper concludes with a summary of recommendations for similar future projects.

—M J Doig, P Page, Woodside Offshore Petroleum
–M Cropper, Dresser Kellogg Well Management
–T Civiello, Sedco Forex

SPE/IADC 52854

"Dieksand 2: First Extended Well Through Salt, Increases Production from an Environmentally Protected Field"

The Mittelplate Field is accessed from the North Sea's only drilling artificial island, and stands as today's largest German producer. However, the tidal flats around the island, became an environmentally protected nature reserve, which limited significant increases in production. This changed with the onset of extended reach drilling techniques, where drilling from shore proved a feasible option. The consortium of RWE-DEA AG (operator) and Wintershall AG established an International Drilling Team and concentrated its engineering effort in the contingencies for the well, caused primarily because of the need to intersect a salt dome, at high inclination, and the limited amount of available geological information. These contingencies influenced changes to conventional ERD wells, by increasing top hole sizes, and casing specifics. This then had a knock-on effect to other techniques, such as achieving directional control, ensuring sufficient hole cleaning practices, whilst being hampered by known wellbore stability issues, such as the effects of salt tectonics. Known risks were reduced by upgrading the rig capabilities, as well as incorporating an ERD customized pro-

file, friction reducing techniques, and casing, centralization and cementing procedures. The well was finished in between 159 days and reached 7,727 m MD (TVD 2,019 m) with a horizontal displacement of 6,938 m.

—K Sudron, Schlumberger IPM, et al

SPE/IADC 52855 (ALT)

"Drilling and Completion of Depleted Carboniferous Reservoirs in the UK Southern North Sea"

The objective of this paper is to outline and discuss the learning which improved the drilling and completion process of horizontal wells in depleted Carboniferous reservoirs.

The learning is derived from 3 replacement wells drilled and completed on the Conoco (UK) Ltd. Murdoch development, which is a mature development in the Quadrant 44 area of the United Kingdom Southern North Sea (UK SNS). The replacement wells were drilled in an effort to restore production volumes that were lost when two of the original wells mechanically failed due to downhole conditions.

This paper will summarise the following failure analysis of the original wells, as well as basis of design for the three replacement wells including sand control issues of depleted reservoirs.

Operational summaries for the 3 wells will be thoroughly discussed.

The learning gained from the failure of the first well were applied to the planning and implementation process of the two remaining wells; allowing the successful drilling and completion of two high rate gas wells. The initial production rates of these two wells were equal to or greater than the original development wells, but at significantly reduced reservoir pressures.

—K A Bourassa, J Bujnoch, Conoco UK