Multilaterals: New life for old wells

SPE/IADC 52870

"Continuous Improvement in Design and Execution of Multilateral Projects in Greater Ekofisk Field"

Since 1996, Phillips Petroleum Company Norway has drilled and completed 3 bilateral production wells in mature chalk fields offshore Norway. There have been technical challenges all the way, but lessons learned have been captured from well to well in a very effective and constructive manner resulting in both technical and commercial success.

This paper describes the technical innovation and approach employed by the members of Phillip Norway WCT in realisation of the multilateral projects. Results from PLTs will be given to document the contribution from the lateral branch in the three wells and a comparison to other standard horizontal wells from the same platform will be presented. Well schematics with depths and casing program will be given to support the technical discussion carried out in the paper. The lessons learned during this multilateral well development campaign have general application to mature fields in other areas of the world.

—J R Berg, Phillips Petroleum Co Norway
—G Liland, et al,
Sperry-Sun Drilling Services

SPE/IADC 52871

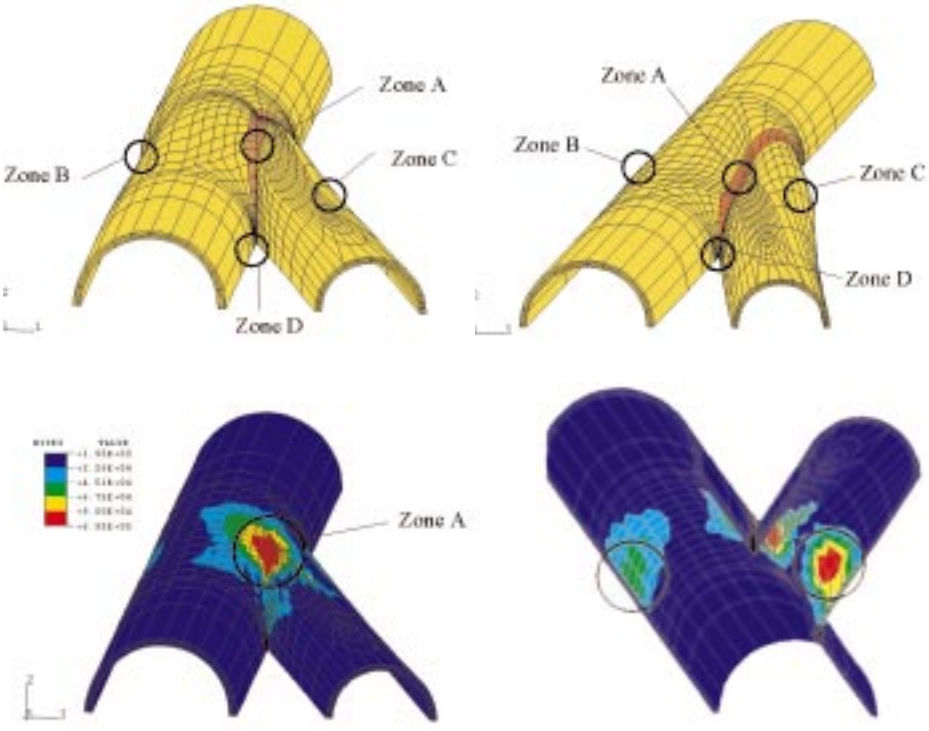
"Multilateral Well Utilization on the Increase"

Shell UK Exploration and Production (Shell Expro) has applied multilaterals with TAML junction levels 1-4 in 6 fields to date and will be applied to an additional seven fields within the next 2 years. In the Tern Field, a mature reservoir in the northern sector, multilateral wells have provided a means to optimize slot usage, commercially develop nearby lower-quality reserves, and drill and produce appraisal wells.

Shell Expro is also a major proponent of the level 6 multilateral (sealed junction) that is being planned.

This paper will show how Shell Expro has applied multilateral wells in field development using level 1 and 2 junctions in the Southern Gas Basin in the Southern North Sea; level 4 junctions in the Central and Northern Sectors. The paper will identify the quantitative risk analysis (QRA) process used to determine how multilateral and the complementary technologies of underbalanced drilling and intelligent well completions can be properly applied to optimize field development.

—R Vullinghs, J A Dech,
Shell UK Exploration and Production



SPE/IADC 52873: This paper describes finite-element work undertaken to assess the effects of internal and external pressure on a sealed multilateral junction. The simulation showed that an unreinforced junction with lateral inclined at 2.5º has burst/collapse resistance of less than 20% of the original casing string. Other simulations were run to determine how to improve these results, for instance by firmly cementing the junction.

SPE/IADC 52876

"Conductor Sharing—Viable Alternative to Multilaterals"

Conductor sharing allows 2 or more wells to be drilled from a single drilling slot, expanding well capacity of a platform at minimal cost. As limited slot availability is one of the driving forces behind the selection of multi-lateral wells, conductor sharing is a possible alternative. Experience with both technologies on the Bongkot field has proved that conductor sharing can offer greater operational flexibility than the multi-lateral alternatives at equivalent costs.

In multilateral wells full isolation of the drains requires expensive equipment and complicated procedures. These complexities increase the cost of well construction and increase the risk of partial or complete failure to reach the objectives. With the multi-lateral on production the costs and risks associated with well servicing operations are also higher.

Drains drilled from shared conductors are operated independently during drilling, completion and production phases. Proven technologies can be used at all stages of the well life, minimising both equipment costs and the risks of failure. Initial well costs are therefore lower while maximising production flexibility. Well servicing operations are reduced in both frequency and complexity.

To date on the Bongkot field, conductor sharing has been used in seven slots for gas producing wells and horizontal oil

wells. A multilateral was previously drilled on the field, allowing a direct comparison of the 2 methods. The cost differential of drilling and completing 2 horizontal wells from a shared conductor and one multilateral well was less than 10%.

—J Dharaphop, et al, PTT E&P

SPE/IADC 49477

"Successful Redevelopment of Existing Wells Using Multilateral Drilling Techniques"

The Thamama formations in the Zakurn field form a multilayered carbonate reservoir separated by hard, impermeable layers. The field had been developed over the past 20 years with conventional deviated and, more recently, horizontal wells, with openhole completions. Because certain existing wells in the reservoir had begun to exhibit a declining production trend, various techniques to boost production were investigated. Trials showed that the use of multilateral drilling techniques to access the individual layers of the reservoir could offer a significant improvement in production rates. Subsequent drilling of several multilaterals have substantiated the findings indicated during the trials. The layered nature of the reservoir and the preexisting well designs have required the use of innovative directional drilling tools and techniques. Case histories demonstrate the techniques used and the resulting improvements in production.

Several multilateral reentry wells with up to 6 horizontal branches have been drilled in the subject reservoir. Lateral sections up to 1,500 ft in length have been achieved, often including turns of over 120 ft to optimise production rates. Sidetracking out of existing casing and from open hole has been required, often with build rates in excess of 60º/100 ft. A unique non-articulated drilling motor and measurement-while-drilling system has been used with very successful results. Production rates from the multilaterals have been seen to improve significantly.

—I Tantawi, Zakum Development
—R Russell, R Taylor,
Halliburton Energy Services

SPE/IADC 52873

"Burst and Collapse of a Sealed Multilateral Junction"

This paper describes finite element work which was undertaken to assess the effects of internal and external pressure on a sealed multilateral junction. The studies consider a junction formed between a 9.625-in. mainbore and a 7-in. lateral. Results showed that an unreinforced junction with lateral inclined at 2.5º to the mainbore would have burst and collapse resistances of less than 20% of the original casing string.

Subsequent finite-element simulations were then performed to suggest methods for improving these values. Findings indicate that both burst and collapse pressures can be made to approach original casing values by providing steel reinforcement at the junction. A significant increase in burst pressure is also predicted if the junction can be firmly cemented. The extent of this increase is dependent on the quality of the cementing. Benefits under external pressure are limited due to failure of the cement.

—M Bayfield, S Fischer,
Shell International Exploration Production
—L Ring,
Shell Exploration and Production