Underbalance operations continue to gain favor

CT UNDERBALANCED

THE AUTHORS WILL describe the technical basis for the design and implementation of a coiled tubing underbalanced drilling (UBD) campaign in the Sajaa field in Sharjah, UAE. The campaign calls for up to three multilaterals per well to be drilled underbalanced from existing wells through-tubing.

The authors will also describe the analysis, modeling, result and their implication in the selection of the operational approach. The key issues associated with the campaign, many of which were unique and challenging within the context of UBD, and their consideration in the basis of design and implementation plan will be discussed.

The goal was not only to create the technical basis of design for the Sajaa-3 well, but also to set the parametric limitations for a wide range of well types that were likely to be encountered in the continuation of the campaign. Based on this work, an approach to drilling and monitoring the well to minimize the risks was developed and formed the basis of the drilling operation.

The campaign is now on its third well, and the results of the drilling operation of Sajaa-3 and the subsequent wells, and their implications to the design basis are also discussed.

Basis of Design for Coiled Tubing Underbalanced Thru-Tubing Drilling in the Sajaa Field (IADC/SPE 87146) **P V Suryanarayana**, **K Hasan**, **Blade Energy Partners**; **B Smith**, **BP Sharjah**.

ECD IN CASING DRILLING

Casing drilling is a relatively new process that allows oil and gas wells to be drilled, evaluated and cased in one operation. It has the potential to reduce drilling time and costs. Determination of an accurate equivalent circulating density (ECD) is critical for safely controlling formation skin damage and protecting wellbore integrity.

However, conventional hydraulic models cannot be used for casing drilling operations because the mechanical design, method of drilling and the clearance between casing and the wellbore require particular considerations.

Three approaches to the determination of ECD have been considered in the study: hook-load measurements, pump-pressure measurements and conventional hydraulic models. While three methods were investigated, the study focused mainly on modeling ECD using hook-load measurements.

Since the annular clearance is very small in casing drilling, a narrow-slot flow approximation model is adopted that takes into account the effect of pipe rotation. A Yield-Power-Law (YPL) drilling fluid is considered in the study.

Field Experimental Study and Modeling of ECD in Casing Drilling Operations (IADC/SPE 87149) **M Yu**, **S Z Miska**, **N E Takach**, **The University of Tulsa**; **H J Diaz**, **PDVSA**.

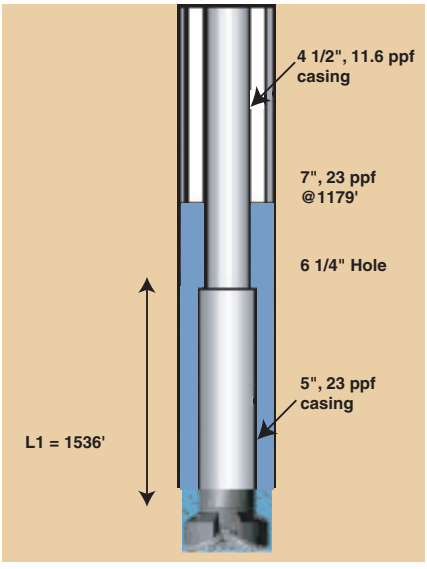
PRESSURE CONTROL

Maintaining underbalanced conditions from the beginning to the end of the drilling process is necessary to guarantee that underbalanced drilling (UBD) operations successfully avoid formation damage and potential hazardous drilling problems such as lost circulation and differential sticking. However, maintaining these conditions during operations with jointed-pipe is an unmet challenge that continues motivating not only research but technological developments.

The authors propose a UBD flow control procedure that represents an economical method for maintaining continuous underbalanced conditions and, therefore, to increase well productivity by preventing formation damage. It is applicable to wells that can flow without artificial lift and within appropriate safety limits.

The flow control procedure is based on the results of a relatively new comprehensive, mechanistic steady-state model, validated with both field data and full-scale experimental data, and on the results of a simplified, time dependent, mechanistic model, which numerically combines the accurate mechanistic, steady-state model, the conservation equations approximated by finite difference, and a well deliverability model.

Both steady-state and time dependent models were used to simulate drilling



Pipe rotation plays an important role in determining ECD in the annulus between casing and a wellbore. IADC/SPE 87149

and pipe connection operations under reservoir flow conditions. Actual reservoir data and well geometries from two different fields in which UBD is being employed were used as input data to simulate simultaneous adjustments of controllable parameters such as nitrogen and drilling fluid injection flow rates and choke pressure to maintain the bottom hole pressure at a desired value.

This value is selected to allow flow from the reservoir to substitute for reduction or cessation of nitrogen injection during drilling and for interruption of nitrogen and drilling fluid circulation during pipe connection. Finally, a specialized procedure for UBD operations that will avoid formation damage and drilling problems is proposed to maximize the use of natural energy available from the reservoir through the proper manipulation of such controllable parameters.

Improved Bottomhole Pressure Control for Underbalanced Drilling Operations (IADC/SPE 87225 – Alternate) **C P Tellez**, **Pemex**; **J R Smith**, **J K Edwards**, **Louisiana State University**.