IADC Underbalanced Committee attacks fundamental questions

UNDERBALANCED OPERATIONS are rapidly gaining in popularity around the world, but some fundamental questions and problems are not fully resolved. What is an underbalanced well, anyway? When are underbalanced wells the appropriate strategy? What are the safety-critical issues appropriate for underbalanced operations? How can we accurately model the process?

The IADC Underbalanced Operations Committee, one of IADC's most active working groups, is hard at work to settle these and other issues. Much of their ongoing work is being conducted through an interactive forum on IADC's website (http://iadc.org/committees/underbalanced/index.html). The IADC Underbalanced Drilling Conference and Exhibition, being held 27-28 Oct in The Hague will present more than 2 dozen technical papers on this fast-evolving technology. (See separate article, p 37.)

One proposed definition put forth on the website describes underbalanced drilling as "a 'planned' condition where the bottomhole pressure exerted by the hydrostatic head of the fluid column is less than the formation pressure being drilled". Similarly, "low head" or "near-balanced drilling" was described as "a condition where the hydrostatic head of the wellbore fluid column is reduced to either balance or be slightly greater than the formation pressure, thus not planning to induce hydrocarbons or formation fluids into the wellbore".

With these definitions in hand, one can begin analyzing the pros and cons of underbalanced operations in a given situation. One tool, prepared by **Tim Harrison** of **Phillips Petroleum** and posted on the website, is a decision tree. Mr Harrison devised 3 linked decision trees. The first considers fundamental issues, such as the anticipation of hydrocarbons, lost circulation, stuck pipe, and hard drilling. The second explores issues of reservoir damage, production impairment, and cost and safety benefits when hydrocarbons are anticipated. The third considers similar issues for depleted reservoirs.

The decision tree is useful for first-order analysis. If the project is then determined as a candidate for underbalanced drilling, a more detailed screening is called for. This second-order screening requires information about borehole stability, well design, production modeling, equipment suitability, detailed engineering. this time-consuming process is very reservoir specific. Further candidates will be de-selected by this process.

Because modeling is useful at this stage, the UB Operations Committee has formed a Modeling Work Group, at the suggestion of **Arjan Kemp**, **Intevep**. The group set itself an ambitious program.

First it will compile a list of all underbalanced models and software, along with desired model features. An overview of the models would subsequently be presented for IADC approval.

Suggestions for underbalanced modeling requirements came quickly. Suggestions for required data input included wellbore geometry (casing, liners, open hole; friction factors; directional plan), fluid properties (library of often-used fluids; models for Newtonian, Bingham-plastic and power-law fluids; gas properties; viscosity vs temperature correlations), drill string properties, bottom hole assemblies; circulation parameters (liquid and gas rates, circulation depth, gas-lift depth, reservoir inflow, well head pressure, bottomhole circulating pressure, ROP). Other suggestions for the model included multi-phase flow characteristics, and real-time data acquisitions. ■

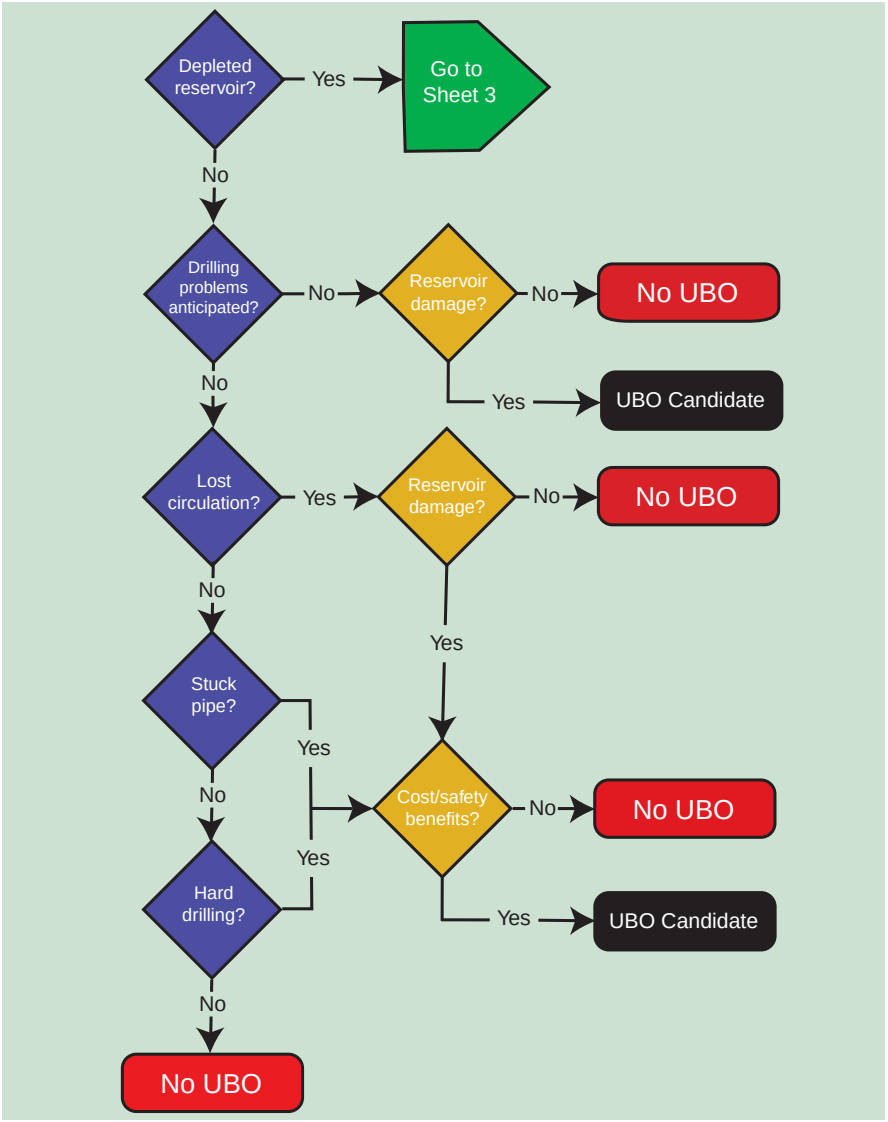

Figure 1: Decision tree for underbalanced operations when hydrocarbons are anticipated. "Sheet 3", referred to above, is a decision tree for depleted reservoirs and is one of 3 decision trees available on the IADC Underbalanced Operations Committee website, iadc.org/committees/underbalanced/index.html. The underbalanced decision trees were prepared by Tim Harrison, Phillips Petroleum Co.