OTC 18375

A Process Used in Evaluation of Managed-Pressure Drilling Candidates and Probabilistic Cost-Benefit Analysis

R.R. Brainard, RRB ENERGY INC.

This paper was prepared for presentation at the 2006 Offshore Technology Conference held in Houston, Texas, U.S.A., 1–4 May 2006.

Abstract

The paper will discuss the processes, methods, factors and parameters utilized to evaluate potential candidates using a defined process and simulation methods for the application of Managed-Pressure Drilling (MPD) technology in well construction operations. The use of MPD technologies can influence many wellbore pressure-related drilling challenges, including lost circulation, kicks, wellbore ballooning, tight pore pressure (PP)/fracture pressure (FP) margins, close tolerance casing programs, wellbore stability problems, shallow water/gas flows, slow ROP, etc. These techniques may also enable future well programs that are currently thought to be conventionally "undesignable" with single gradient mud systems.

Potential drilling efficiency benefits may include improved HSE, drilling with less Non-Productive Time (NPT) or trouble time, improved wellbore stability, reduced mud losses, improved ROP performance and extension of casing seats/fewer casing strings

A process has been applied to evaluate the economics of candidate wells for the use of MPD. This evaluation has included the use of a probabilistic Monte Carlo simulation of the potential results of the use of MPD and takes into account time dependent, cost dependent and performance related factors. The use of other technologies such as wellbore strengthening or wellbore stability technologies in conjunction with MPD can also be modeled to look at the overall benefit of use of all applied technologies within the well construction process.

The significance of MPD, in the face of increasing well construction costs around the world, is that these techniques may allow step-change reductions in drilling duration and associated costs. More importantly, MPD may allow the drilling of wells that cannot be drilled with conventional drilling processes. MPD technologies may also allow improved well performance through a more efficient completion size and an increase in recoverable reserves.

Managed-Pressure Drilling (MPD)

Managed-Pressure Drilling (MPD) is an advanced form of primary well control that many times employs a closed and pressurizable drilling fluid system that allows potentially greater and more precise control of the annular wellbore pressure profiles than mud weight and pump rate adjustments alone. The primary objective of MPD is to optimize drilling processes by decreasing non-productive time (NPT) and mitigating drilling hazards in the well construction process. [1]

The IADC Managed Pressure Drilling and Underbalanced Operations Committee defines Managed-Pressure Drilling as: "MPD is an adaptive drilling process used to more precisely control the annular pressure profile throughout the wellbore. The objectives are to ascertain the downhole pressure environment limits and to manage the annular hydraulic pressure profile accordingly." [2]

MPD processes employ a collection of tools and techniques which may mitigate the risks and costs associated with drilling wells that have narrow downhole environmental limits by proactively managing the annular hydraulic pressure profile. The techniques used in MPD may include control of backpressure, fluid density, fluid rheology, annular fluid level, circulating friction, and hole geometry, or any combinations thereof. MPD may allow faster corrective action to deal with observed pressure variations. The ability to dynamically control annular pressures facilitates drilling of what might otherwise be economically unattainable prospects under the conventional drilling process. MPD techniques may be used to avoid formation influx and typically flow incidental to the operation will be safely contained using an appropriate process. [2]

Wellbore pressure-related drilling challenges result in significant NPT within the well construction process. The wellbore related part of these problems may include loss of circulation, kicks, ballooning of the wellbore, drilling in a tight PP/FP margins, use of close tolerance casing programs, wellbore stability problems due to fluctuation and/or cycling