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Case Study in Malaysia – The Disappearing Plug Improves Cost Efficiency in Horizontal Completions

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Abstract

During the past 4 years, a major operator in Malaysia has developed several large-bore gas wells with horizontal trajectories. The completion team was faced with several challenges in designing the completion of these wells, particularly in the area of deploying a plugging device to test the completion string and to set the production packer. Traditionally, two conventional plugging methods have been used — slickline-deployed plugs or ball-activated pump-out plugs. Due to the deviated trajectories and associated intervention risks, both methods were deemed unfeasible. A coiled-tubing intervention could have been considered, but this method would have added significant cost to the completions. To actualize these wells, therefore, SSB needed to find an alternative method that would provide a low-risk, cost-effective tubing-testing and packer-setting device.

An option that would eliminate the problems discussed above, a novel “disappearing plug” plug concept, was presented to the operator. This method is unique in that after usage, the plug material dissolves, leaving close to full tubing drift. Another advantage of the disappearing plug including those without high-angle trajectories is that it can provide interventionless completions that minimize exposure to health, safety and environmental issues and saves rig time. The operator chose this option.

The paper discusses the plug design and how it reduced completion costs and risks by eliminating extra trips into the wellbore for running and retrieving plugs or test tools. The discussion also covers the factors an operator must consider before choosing the disappearing plug option as well as a few case histories, which will provide experience into specifics required for successful usage of the plug as well as best practices.

To date, the operator has successfully installed 29 disappearing plugs, and no failures have occurred.

Introduction

The targeted completions into which the disappearing plugs were to be installed can be broken down into two well types—big-bore completions requiring sand control and big-bore straight and tapered completions without sand-control requirements. In the subject wells, all had a degree of deviation that would increase the complexity and risk of completion installation using traditional methods. Since the disappearing plugs minimize intervention needs, they reduce HSE risks and save rig time as well. Therefore, they also can provide advantages for wells without high angle trajectories.

In late 2004, the operator had planned to complete a shallow gas-bearing well with a horizontal trajectory that had a measured depth of approximately 6500 ft with a maximum deviation of 80 degrees. The completion design was to incorporate a 7-in. tubing string with a hydraulic-set packer. A primary completion concern was the need to run a plugging device below the packer so that the packer could be set. A wireline-set plug had been considered, but it was deemed too risky because of the extreme deviation. When considering the risks associated with running a wireline fishing job in a big-bore completion-string design, the operator decided to look for another option. A ball-activated pump out plug was reviewed; however, in a horizontal big-bore completion, placing a ball on seat presents another tricky challenge, especially when there might be debris in the well. Furthermore, in a big-bore completion, the energy released when the plug expands is very high due to the high fluid volume of the completion string. This usually results in a violent hydraulic impulse, which can damage sensitive completion components. Ball-activated pump-out plugs also introduce debris into the well, as when the ball and seat is expended, the items will remain in the well.