SPE 114766

Successful Deployment of Innovative Completion Technology Designed for Multi-Stage Fracturing Treatments in Horizontal Producers Achieved Significant Rate Increase in Saudi Arabia

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This paper was prepared for presentation at the 2008 SPE Annual Technical Conference and Exhibition held in Denver, Colorado, USA, 21–24 September 2008.

Abstract

One of the key strategies in Saudi Aramco's optimum gas development project includes drilling single and multi-lateral horizontal wells designed to achieve maximum reservoir contact to maximize productivity. This strategy has proven very successful over the past few years as the majority of horizontal gas producers have yielded excellent results, with open-hole completions in particular. Consequently, most of the planned future wells will be drilled as open-hole horizontal completions.

However, due to the complex nature of the Khuff reservoir some wells have experienced complications during the drilling phase, encountering unexpected reservoir challenges, and hence not meeting production targets. These wells require stimulation to regain their productivity, but the available choices to achieve effective stimulation in horizontal open-hole completions have traditionally been limited at best. Previous stimulation attempts with coiled tubing have yielded modest improvements mainly due to the difficulty in accessing the long, deep, and high pressure/temperature zones requiring treatment. Bullheading treatments at high injection rates have also yielded similar modest well productivity enhancement. Consequently, Saudi Aramco field tested an innovative new completion technology that provided the ability to selectively fracture stimulate multiple zones along the horizontal section, yielding excellent and highly promising results which compared favorably with the performance of non-stimulated offset wells.

It is well known in the industry that fracture stimulating horizontal open-hole completions with conventional methods is a challenging endeavor, and that often-time results are disappointing. The new completion technology overcomes challenges associated with horizontal well fracturing, and provided a tool to achieve effective stimulation. Through this technology multiple mechanical isolation points are created in the wellbore, using specially designed multiple open-hole packers, and then selected zones of varying lengths can be individually treated in accordance with reservoir characteristics and production targets.

This paper details the planning and design processes leading to the implementation of the technology, the experience and lessons learned during deployment of the completion, and the stimulation treatment execution and post-stimulation results. Lessons learned from this successful experience are discussed as a way to enhance the benefits from this promising technology.