Expanding the Reach Envelop for Milling in Unconventional, A Case Study

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Abstract

Objectives/Scope: This case study addresses the existing Extended Reach “ER” Coiled Tubing simulation techniques, with improvements based on field results and empirical analysis from actual Coiled Tubing interventions. It reveals the novel CT string design that enabled the first successful new extended reach lateral milling in the Kingdom of Saudi Arabia.

Methods, Procedures, Process: Coiled Tubing reach prediction is achieved via software simulations, the input parameters are many, some are based on decisive measurement where others are experimental and have a wide error range. In order to minimize the error range an actual intervention data are revers engineered from field data to land on acceptable rules of thumb. With the existing limitation of Coiled Tubing reach in unconventional gas completions, where 2-3/8in Coiled Tubing is used in 5-1/2in casing completions. Multiple stimulated zones at the toe are often left with restricted flow conditions due to the un-milled frac plugs or ball seats. Three factors are addressed in this study and analysed to provide the best combination, several similar wells were intervened, and the Coiled Tubing modelled reach (lockup and weight on Bit “WoB”) was compared with the actual reach results. The First, friction/drag reducers. Second, the combination of down hole tools (Agitators and Milling Motors). Last, The CT String design. And their combination to maximize Coiled Tubing reach while having sufficing WOB to mill the last plug and ball seat in the well.

Results, Observations, Conclusions: Study results show 15% gain on average in extending the Coiled Tubing reach with Milling capacity. Those results are achieved through the combination of the Extended Reach Tools “ERT” and friction/drag reducers. Additionally, a 50% reduction in circulating pressure has been obtained, which results in extending coiled tubing fatigue life. Measurements of the flowback fluids properties are stated to gauge the friction reducer performance. The economical feasibility of the solution is to be included revealing the marginal improvements.

Novel/Additive Information: The results of this work enabled the decision makers proceed with upgrading the Unconventional Gas drilling plans from that point forward. It established the new set of rules for designing Coiled Tubing intervention in unconventional gas environment providing guidelines to services companies and pipe manufacturers as well as confidence at operator side.