AAPG Datapages/Search and Discovery Article #90306 ©2017 AAPG Latin America & Caribbean Region GTW, Optimization of E&P Projects: Integrating Geosciences and Engineering from Block Acquisition through Production, Rio De Janeiro, Brazil, August 22-23, 2017

Recommended Methodology for Drilling and Multistage Completion for Horizontal Wells in Tight Gas Formation in Neuquén Basin-Argentina

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ABSTRACT

Unconventional Play development has extended its limits primarily due to technological advances and improved “know-how” of the drilling and multistage fracturing completions in horizontal wells. Advances have been supported primarily in disciplines such as geomechanics and through the optimized design of multistage hydraulic fracturing. This papers details step by step the methodology leading to a series of design and operational recommendations that allowed the successful drilling and multistage completion of first horizontal well in one of primary tight gas formation in Neuquén Basin. The drilling took place under very harsh and challenging conditions related to state of stresses in formation and initiation and propagation pressures behavior. The Lajas Formation in its basement layer (+/- 4200 mts. DST) at southeast of the Neuquén basin presents a transition between normal to strike-slip state of stress in formation and pore pressure gradient determined through LOT and DFIT tests as high as 0.7 psi / ft. These conditions require a very detailed analysis of feasibility for the drilling and completion of a horizontal well prior to evaluating any reservoir development plan. In other words, without having the certainty of being able to successfully carry out the drilling and completion of the wells, it is not possible to think in terms of “recovery reserves”. The methodology described here starts with the elaboration of a 3D geomechanical model based on validation and analysis the drilling, electrical logs and completion operation data from 10 off-set wells in the area visualized for landing of the horizontal well’s section. The team elaborated the following recommendations for risk mitigation and pre horizontal-well planning based on 3D Geomechanical models:

• Azimuth window for the drilling and landing horizontal well section, which will ensure the feasibility of multistage fracturing completion.
• Drilling-mud window suitable for safe drilling and hole stability.
• Mathematical model based a well know “Hoop Stress” equations, used to define the pressure and angle of plane initiation of the fracture at wellbore in order to determine the operational feasibility of carrying out the hydraulic fracturing process and the logistics conditions necessary for its success execution
• Fracture design developed based on the optimal number of fracture stages for the length and drainage area established for the horizontal well section and reservoir characteristic of the pay zone

The result of applying recommendations described in this presentation led to the drilling and successful completion of the well. Implementing the methodology also made it possible to predict, with less than 5 percent difference between predicted and actual values, fracture gradients and fracture initiation pressures.