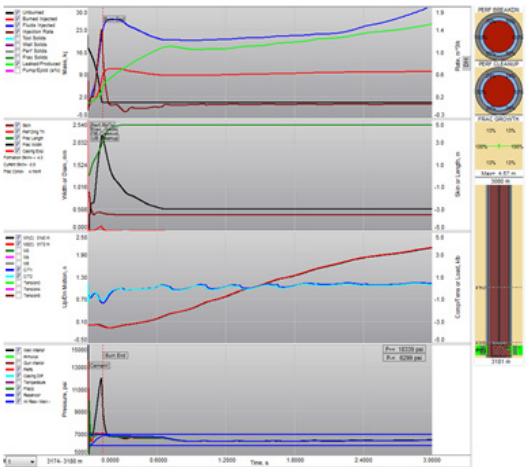
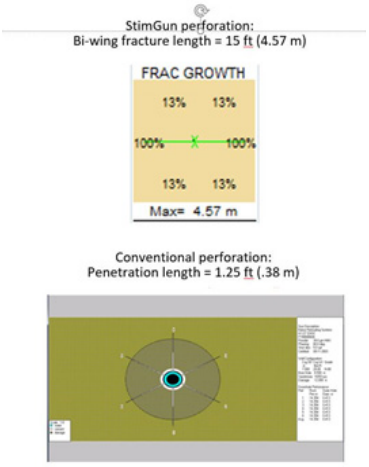
Case study: South India

TerraPERM service recovered production in well in South India





An operator in south India was facing production issues in an exploratory gas well. The company was trying to evaluate the producability of the formation which had near-wellbore formation damage from drilling, completions, and perforating activities. In addition, the low native permeability of the formation (10% porosity and 1-4 mD permeability) had led to greater formation loss and permeability in the damage zone.

The operator observed low or no inflow over five intervals using conventional perforating techniques. In tight rock formations, conventional perforating provides limited depth of penetration, leading to insufficient connectivity between the wellbore and the formation. To alleviate this situation, they used the **TerraPERM™ perforating service** by Baker Hughes.

Baker Hughes used its **StimGun™ propellant-assisted perforating system** and deep penetration charges. StimGun dynamically cleans and stimulates the near-wellbore area for improved wellbore connectivity. The decision was made to use StimGun, although it required an integrated knowledge of perforating strategy, formation properties, well architecture, and well stimulation techniques, which would be provided by Baker Hughes.

The StimGun assembly consisted of the perforation gun, special propellant sleeve surrounding the gun, centralizing rings, and finned tandem/bull nose-subs. Typically, a minimum of four shots per foot are required to adequately ignite the sleeves, which generate as much as 25,000 psi at the perforations. Once the propellant sleeve was ignited, a burst of high-pressure gases entered the formation and caused breakdown, clean-up, and fractures. Computer modeling that simulates the dynamic behavior of the propellant/perforating events was critical to optimal job design and performance success.

Challenges

- Near-wellbore formation damage needed to be overcome in order to evaluate the formation and recover production
- Formation had low native permeability
- Conventional perforating options were not viable due to insufficient connectivity between the wellbore and the formation

Results

- The job was executed successfully without operational risk
- Well production resumed at the rate of 3240 m^3 per day
- Propellants used overcame near-wellbore damage and achieved deeper penetration

Pre-job analysis results from the **PulsFrac™ Dynamic-event modeling software** were used to assess risk and define job parameters such as propellant quantity, fluid-level requirements, pressure magnitude, and duration, and to provide the expected perforation tunnel clean-up, breakdown, and fracture results.

The job was executed successfully without any operational issues. Modeling results had indicated the well would benefit from the StimGun treatment without compromising its integrity. Predicted results indicated 100% perforation breakdown, post-treatment skin of -3.5 and a maximum fracture length of 15 ft (4.57 m). Upon activation, the operator reported that the well started flowing gas through a 12/64-in. choke with an initial flow pressure of 300 psi at the maximum flow rate of 3240 m^3 per day.

The job was completed successfully, and the operator was satisfied with the solution provided by the Baker Hughes TerraPERM services.

The propellants used were effective for overcoming the near-wellbore damage and recovering the lost production. In addition, deeper penetration was achieved than using conventional perforating methods.

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