Optimizing Perforations

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ABSTRACT

The principal of perforation gun technology has not undergone vast modifications since its introduction to petroleum industry. Perforation geometrical parameters such as shots size, shape, approach angle, and "drilled" angle influences the fluid pressure regime around the perforations. Three aspects of unconventional reservoirs can be optimized for a robust well performance: production, hydraulic fracturing, and proppant migration. To optimize production, the near-bore pressure losses must be minimized. Most of the pressure losses are because of perforations and tortuosity. We model the reservoir pressure with losses vs. flow rate using nodal analysis (IHS Harmony Software) and decline curve analysis for a single well model (EXCEL); flowrate and ultimate recovery factor are significantly improved with minimizing pressure losses. Changing the shape of perforation also affects the hydraulic fracturing process. Our computer simulation using ANSYS software for a homogenous media with eight perforations, using laminar and turbulent models shows that if the circle was changed to an oval, during injection high stress regimes would occur at the ends, in effect causing fractures to propagate from the ends. The use of fracturing ballistics gel experiment also shows a correlation between perforation shape and fracture width, length, and height. For vertically drilled well, if long ways of oval is vertical, fracture shows improved height gain. If oval is horizontal, fracture shows width gain. We also evaluated the flow streamline for two models: The first model has oblique shot penetration angle, while the other model has straightly penetrated shots. As the penetration angle becomes more oblique, pressure losses are seen to decrease. In conclusion if parameters of a perforations are changed it gives the possibility to optimize a specific well to developers desires.