MITIGATING FORMATION DAMAGE BY USING COMPLETION WITH BUILT-IN-CASING PERFORATIONS INSTEAD OF PERFORATION WITH EXPLOSIVE CHARGES

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This paper was presented at the SPE European Formation Damage Conference and Exhibition, in Budapest, Hungary on June 3-5, 2015.

ABSTRACT

The downside of the conventional perforating method with explosive charges and guns is that it is risky. In addition to this, the method has a negative effect on the near wellbore permeability, and it creates mechanical damage. The impact stress associated with shaped charge and the outward travelling shock wave weakens the rock matrix, which increases the risk of sand production. Another negative impact of the shape charge is the creation of a low permeability zone, in which sand grains are forced toward the vicinity of the perforation chamber. For example, a perforation process with a 55% permeability reduction around the perforation tunnel led to 60% reduction in well productivity. An intended large underbalance differential pressure offers, to some extent, a solution to clean up the crushed zone. However, the de-bonded and weakened structure of the damaged zone is irreversible. The required surge pressure to clean up the perforations varies from 200 to 5,000 psi, because not all the perforations react the same way.

On the other hand, built-in nozzles cause no damage to the formation, because no charge or shock is imposed to the formation. Furthermore, there is no longer an impact from underbalance or overbalance pressure differential between wellbore and formation. In this paper, we will introduce the engineering and mechanism of built-in casing (BIC) nozzles. With BIC, nozzles are activated from surface with deployment of specific activation tools. Once the tool engages with the targeted profile, the nozzles are opened and projected to the wellbore fluid. With circulation of cement-dissolving fluid, cement breaks and formation connection is initiated. Quantity and size of nozzles are engineered as per downhole production design criteria.

In unconsolidated or poorly consolidated reservoirs, the strength of the rock structure should be evaluated to reduce the risk of sand production. Ultimately, the differential pressure shall be high enough to effectively clean the perforations, but not so high as to cause sand production.

As mentioned above, there are a great deal of scenarios and variable parameters involved in perforation with shape charges that have to be taken into consideration to ensure an effectively performing set of perforations. Because such a study and remedial approaches are costly and not always guarantee results, an alternative method is to use BIC perforations.

To order the full paper, visit https://doi.org/10.2118/174251-MS