

Casing Leak Investigation and Successful Repair in an Onshore Environment: A Case Study in Kharaib Formation

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ABSTRACT

This paper is a case study on the treatment and prevention of external casing leak in Kharaib wells due to exposure to highly corrosive water from the overlying Shuaiba formation. Severe casing leaks are the main production problem facing the Kharaib reservoir. A significant number of Kharaib horizontal and deviated wells have developed casing leak at some point in their lifespan, with many occurring within the first two years of production. The source of the corrosive water is Shuaiba, a fractured formation above and in proximity to the Kharaib reservoir. A total loss of circulation is almost always encountered while drilling across Shuaiba. Although the production casing covering Shuaiba is cemented in two stages, there is often no cement present across this interval, providing a point of contact between highly corrosive water and the casing. A multidisciplinary team reviews and confirms the casing leak before deciding to repair or salvage the well based on its potential. The principal indicators of casing leak are a sudden increase in liquid production to a rate often twice that of the target reservoir potential, a jump to 100% water cut, as well as a shut in bottom hole pressure equal to the formation pressure in Shuaiba, which is some 200 psi higher than in Kharaib. Further diagnostics are run in inconclusive cases. Several methods were attempted to repair casing leaks in problematic wells. Remedial cement squeezes, sufficient in most casing repair jobs, were unsuccessful in these wells. Different completion designs were also considered in order to prevent leaks from developing in new wells, such as running an externally coated tubing or a liner with packers across the Shuaiba total loss zone. However, these methods only provided temporary relief, delaying the onset of casing failure without preventing it. The issue was complicated further due to project economics. Finding a straightforward solution to the casing leak problem was unlikely. The focus of this study is to evaluate potential solutions for treating existing casing leaks and to help wells penetrating similarly challenging formations.