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Revolutionizing Injection Analysis: DFOS (Distributed Fiber Optics Sensing)-Based Fracture Evaluation and Rate Distribution

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Abstract

The CHP field, a mature oil field with complex geology, is facing challenges in maintaining optimal reservoir pressure due to pressure decline. Water injection has been implemented to mitigate this issue, but it raises concerns about cap rock integrity and fracture propagation. Fractures can propagate beyond intended zones, leading to loss of injection fluid, reduced injectivity, and potential environmental hazards. Understanding fracture dynamics and injection profile is crucial for optimizing the injection strategy, ensuring well safety, and maximizing oil recovery.

The CHP field's unique characteristics, such as low-pressure reservoirs with static fluid levels below ground level, pose significant challenges for injection operations. The discrepancy between surface rate and formation injection rate measurements can lead to inaccuracies in Step Rate Test (SRT) data interpretation. To accurately assess injectivity and fracture behaviour, it's essential to account for these unique characteristics, potentially using downhole measurements to directly measure formation injection rates and temperatures.

Accurate determination of fracture height and initiation pressure is critical for managing fracture risk and optimizing injection strategies. By understanding the extent of fracture propagation and the pressure required to initiate fractures, operators can design more effective injection programs, minimize the risk of caprock breach, and maximize oil recovery. This knowledge can also inform decisions about well placement, injection rates, and reservoir management.