A-112

Running an Extremely Long 4-1/2" Liner in a Highly Deviated Gas Well

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In 2020 Neptune Energy drilled Adorf Z15 and discovered the Adorf Carboniferous Gas Field in the Western Emsland close to the Dutch-German border. Adorf Z15 has a final inclination of 40-45° and a total length of 3740 m. Because of the success of this well, it was decided to drill Adorf Z16, which was drilled in 2021 from the same site as Adorf Z15 because of several surface constraints. Consequently, the well length as well as the inclination had to be increased significantly compared to Z15 as the geological target of Top Carbon had a vertical section of 1850 m.

The reservoir was drilled with a 6" bit using an RSS with comprehensive LWD package. Due to these LWD results, it was decided to further increase the final depth of the well from the originally planned 4990 m to approx. 5400 m. The following reaming operations were done close to the limits of the rig & drillstring and in addition, overpulls were observed while pulling through a tight spot within the 7" liner. An MFC showed a deformed area, while the exact reasons are still unknown, but salt collapse is the most likely reason. Thus, it was decided to reduce the collapse risk of this 7" liner by further increasing the total length of the liner to 2000 m (instead of the originally planned 820 m) and to set the liner hanger in the 9-5/8" casing above the 7" liner hanger system instead of a setting depth within the 7" liner.

Running such a long liner system requires the displacement of the reservoir drill-in fluid since calcium carbonate caused high torque and drag values. Thus, a baryte system was displaced into the well, while an adequate 7" hydraulic liner system with a XO to 4-1/2" casing was prepared at short notice by NOV. Multiple torque & drag simulations were performed to ensure the best decision was made on landing string configuration in order to get the liner to TD and setting the packer successfully. Finally, this 4-1/2" x 7" x 9-5/8" liner was successfully run in hole to TD, which covered all permeable sands and the entire 7" liner of the previous section. Because of the complexity of this job, NOV provided the ICON tool, which measured the actual loads (memory mode), such as tension, compression, torque, and pressure at the liner top while running and setting.

The analysis of this data afterwards provided valuable insights into actual versus simulated downhole conditions, as well as a proper set packer, especially important since a very low pressured formation (Stassfurtcarbonate), which caused significant losses during the previous 8-1/2" section, was present behind the 7" liner system and a proper isolation was a key requirement for the integrity of this gas well with high reservoir pressure.