CASE STUDY – MANAGED PRESSURE DRILLING

The Application of Managed Pressure Cementing (MPC) in Alberta's Duvernay Formation

CHALLENGE

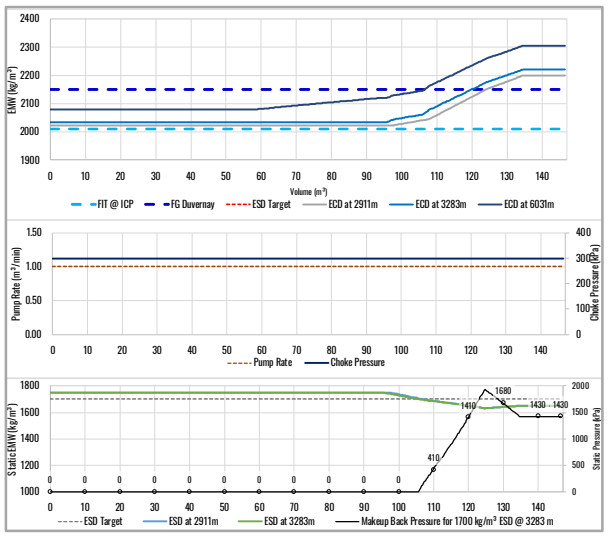
As the popularity of Managed Pressure Drilling increases in Alberta, the use of its concept in Cementing has also increasingly been adopted.

Wells drilled in the Duvernay Formation often use MPD for the management of pore pressures and hole stability. After reaching the target depth set for the wells, it is imperative to have a fluid system that is statically overbalanced before the commencement of casing cementing operations.

Keeping overbalanced conditions in the well while cementing conventionally usually involves using a heavier mud weight (for keeping statically overbalanced conditions) as the initial wellbore fluid before starting the cementing operation. This causes a high initial Equivalent Circulating Density (ECD) which could potentially lead to losses or formation breakdown if this ECD surpasses the Fracture Gradient of the formation.

Figure 1 shows an example of a simulation of a well that utilized a heavier initial mud density where initial ECDs surpass the Fracture Gradient (FG) established from Formation Integrity Tests (FIT) performed at the Intermediate Casing Point (ICP).

Figure 1: Simulation with 1750kg/m³ initial fluid (MPC)



SOLUTION

Incorporation of the concept of MPD, i.e. using the ability to apply back pressure to keep the wellbore overbalanced during pumps on/off events during cementing is an advantage. Beyond surface equipment has the capability of providing a back pressure of up to 10300kPa which is equivalent to 350kg/m³ density in a 3000mTVD well.

With the availability of Beyond surface equipment, the operator can utilize a lighter mud weight as initial wellbore fluid and keep the wellbore statically overbalanced during pump-off events by supplementing the density with back pressure.

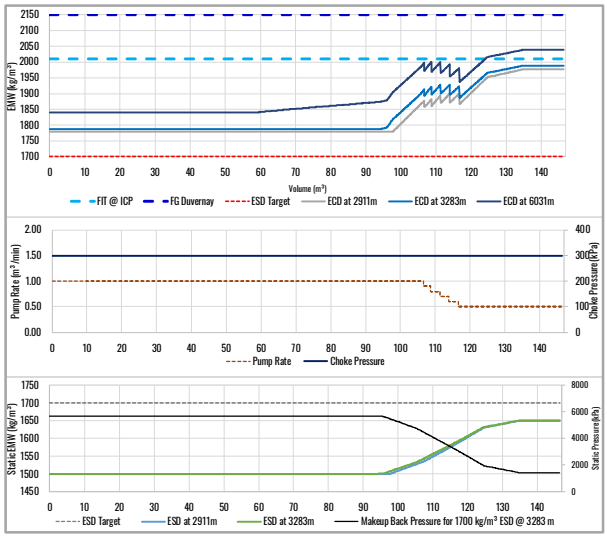
Not limiting this application of MPC in Duvernay formation, it can be tailored to specific well conditions and challenges, providing a flexible solution to a wide range of formation scenarios.

RESULTS

Figure 2 shows a simulation of the same well that used lighter initial mud density where initial ECDs remain within the drilling window reducing the likelihood of formation breakdown.

These results would suggest that reducing initial mud weight and utilizing MPC for this cement job, significantly reduced initial ECD at 6031m from 2080kg/m³ to 1840kg/m³ consequently maintaining wellbore integrity.

Figure 2: Simulation with 1500kg/m³ initial fluid (MPC)



Figures 1 and 2 contain three graphs with the following information: Dynamic Equivalent Mud Weight (EMW) at various observation points (including TD), Pump rates, Choke Pressure, Static EMW, and Static Pressure versus volume of fluid pumped. They are results charts produced from the simulation of MPC of a 5.5" and 4.5" tapered casing string in a 6031mMD/2899mTVD hole.