CASE STUDY – MANAGED PRESSURE DRILLING

Well Control with Managed Pressure Drilling (MPD) Solution in a Deep Disposal Well

CHALLENGE

The ultimate goal of well control is to prevent the uncontrolled release of formation fluid which can lead to blowouts and well kicks; In severe instances, these outcomes could threaten human life and the environment. Vigilant monitoring of wellbore parameters using advanced sensors and monitoring equipment while drilling is paramount to promote quick diagnosis, prevention, and proactive response to potential influxes; enter Beyond Managed Pressure Drilling.

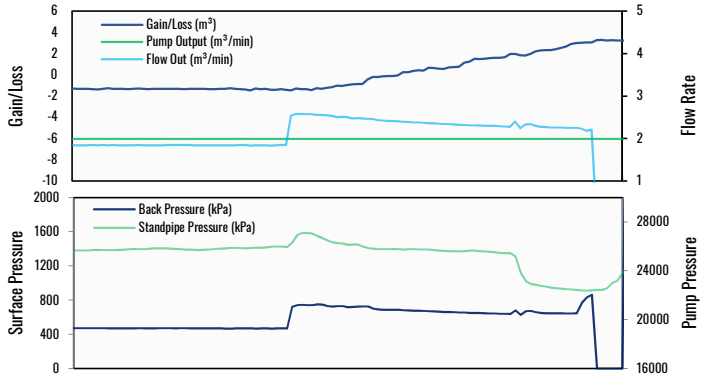
Some indicators of a potential influx include:

- Increases in drilling mud pit volume
- Unusual fluctuations in the rate of penetration
- Loss of Circulation
- Unexpected increase in flow rate
- Unusual pressure changes

While drilling the second intermediate section of a deep disposal well in Alberta using MPD, at a depth of 4043mMD, an increase in flow out, an increase in backpressure than the targeted back pressure, a drop in standpipe pressure and a 4m^3 pit gain were observed. All are indicators of a potential influx in the wellbore.

Figure 1 shows the unusual changes in flow out, backpressure, standpipe pressure, and pit gain/loss. All indicators of potential influx in the Deep Disposal well

Figure 1: Indicators of Potential Influx (18minutes)



SOLUTION

With these indicators, it then becomes important to properly diagnose the influx. In some cases, similar indicators could mean wellbore breathing/ballooning, for which Beyond MPD is equipped with the required technology to verify while adhering to Safe Work Procedures (SOP).

Beyond surface equipment on this Deep Disposal well has the capability of providing instantaneous back pressure of up to 10300kPa which is equivalent to 350kg/m^3 density in a 3000mTVD well. Therefore, by adjusting choke settings as needed, operators can maintain wellbore pressure and a target Equivalent Circulating Density (ECD) within safe limits.

Confirmed Influx was circulated out through MPD equipment with a maximum applied back pressure of 9500kPa while preparing to displace to 1560-1590kg/m^3. After displacing, backpressure was adjusted to maintain an ECD of 1650kg/m^3 until flow in matched flow out.

RESULTS

Utilizing the abilities of Beyond MPD technology, the influx was properly diagnosed and circulated out through MPD. The maximum gas rate recorded by Beyond's gas meter was >200kscm/day. A gradual decrease in the gas rate over time was observed as the influx circulation operation through MPD advanced, as illustrated in Figure 2 below. This implied that the influx had been successfully managed allowing the safe resumption of drilling operations.

Cost savings on mud additives were achieved by eliminating the need for an excessively high mud density to achieve overbalance in the well. Any additional Non-Productive Time (NPT) costs were eliminated since drilling operations were successfully resumed after displacing to a higher-density drilling fluid.

Figure 2 shows how Beyond MPD's responded to the influx as well as some of the parameters tracked during this process.

Figure 2: Circulation of Influx (19 hours)