From: Bodek, Robert
Sent: Tue Apr 13 13:43:50 2010
To: Beirne, Michael
Cc: Ritchie, Bryan; Hafle, Mark E
Subject: RE: Macondo TD
Importance: Normal

Michael,
While drilling in the 8.5" x 9⅞" hole-section, we encountered a sand approximately 400' above the projected top of the reservoir. Up until this point, as dictated by previous well control events, we had been operating under the premise that sands were 0.3ppg over-pressured relative to modeled shale pressures. In this hole-section, we had a GeoTap tool in our bottom-hole assembly (BHA) which would allow us to directly measure sand pressures. We took a GeoTap sand pressure at 17,723' (MD). This sand pressure worked out to be a 14.15ppg downhole mud weight equivalent. At the time, we were drilling with a 14.3ppg surface mud weight, giving us approximately a 14.5ppg equivalent static density (ESD), and a ~14.7 equivalent circulating density (ECD). We drilled ahead through our reservoir interval to a depth of 18,260' with the aforementioned fluid properties. At 18,260', our rate of penetration (ROP) had slowed significantly. The decision was made to pull out of the hole for a new BHA. We surmised that our underreamer had failed. Upon pulling off bottom, we lost full returns, and had to shut-in the well. Upon monitoring the well with pumps off, we observed static losses with a 14.3ppg surface/14.5 ESD. Several applications of lost circulation material (LCM) were pumped into the open hole in an attempt to stop static fluid losses. We also displaced the riser with base oil and 14.0ppg mud to reduce the downhole hydrostatic pressure. After pumping several LCM applications and cutting mud weight in the riser, losses were no longer observed, and we pulled out of the hole for a new BHA. At this point, the team was faced with a tough decision. We had drilled to 18,260' (MD). At this depth, we were unsure if we had drilled through the reservoir in its entirety. It appeared as if we had drilled out of the base of the reservoir, but there was no way to be certain. Additionally, the approximately 50' of rat hole we had beneath the main sand package was insufficient for both wireline evaluation and completion. It was unanimously accepted amongst the team that approximately 100 more feet would allow us to 1) make sure we had drilled through the entire reservoir package, 2) provide sufficient rat hole for wireline evaluation operations, and 3) provide ample rat hole for completion procedures. We had one major problem however: The sand that we took the initial GeoTap pressure in was measured at 14.15ppg. The absolute minimum surface mud weight we could use to cover the pore-pressure in this sand was 14.0ppg. This would give us approximately a 14.2ppg ESD over the aforementioned sand. If we were to drill ahead with a 14.0 surface mud weight / 14.2 ESD, our equivalent circulating density (ECD) would be approximately 14.4-14.5ppg. We had already experienced static losses with a 14.5ppg ESD! It appeared as if we had minimal, if any, drilling margin. It was decided to trip back into the hole with a simplified BHA (no underreamer) and very slowly and cautiously drill the requisite 100 additional feet of formation. We drilled ahead at a reduced pump rate and ROP in order to manage our ECD values below the 14.5ppg equivalent mud weight where we experienced losses. In this additional 100', we observed no additional pay intervals. We firmly believed that we were at the base of the target reservoir package. It was decided that the primary target had been reached, and we were able to conduct a comprehensive, efficient wireline evaluation. Having drilled and evaluated the entire reservoir interval would fulfill the two primary objectives of the well. Drilling ahead any further would unnecessarily jeopardize the wellbore. Having a 14.15ppg exposed sand, and taking losses in a 12.6ppg reservoir in the same hole-section had forced our hand. We had simply run out of drilling margin. At this point it became a well integrity and safety issue. TD was called at 18,360' (MD).
Regards,

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