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From: William Burch
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Subject: Dual Relief Well Strategy (Due by Noon)
RFI Well Kill Timing_Burch.doc

Here's my take on the RFI regarding the dual relief well strategy and I know it's got teeth. Appreciate the quick peer review to make it more palatable.

Status of 7.2 Item 04 – Request for Information (RFI)

9

An assessment of the feasibility of, and the possible advantages and disadvantages of waiting for the second relief well before initiation of kill efforts.



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Well Kill – Timing

Note: This paper assesses the feasibility of, and the possible advantages and disadvantages of waiting for the second relief well before initiation of kill efforts to the MC252 #1 well.

While waiting for the second relief well before initiating the dynamic kill efforts to the MC252 #1 well is feasible, the advantages are outweighed by the disadvantages. Doing so should not be recommended as a prudent course of action to the scientific communities of Sandia National Laboratories, the United States Geological Survey, United States Coast Guard, Dept of Energy, or the Dept of the Interior.

The second relief well option probably will require at least 30 more days past the Development Driller 3 (DD3's) 9 7/8-in liner setting point, which is expected by July 25, 2010, and therefore moves the well control operation deeper into the heart of hurricane season. This alone should be enough to nullify any reason to delay the well kill until after the second relief well. And, the delay does not come cheaply, either—it will be at the expense of the environment without 100% containment (there may be as much as 40,000 bopd currently bypassing the Top Hat #4—or another 1,200,000 bopd to the GoM); continued media scrutiny; political pressure from Washington, D.C.; additional fuel to the fire against the deepwater industry to provide adequate protection for well control; further damage to BP's and its partners' reputations; increased spill cleanup costs; and further reduction to BP and its partners' stock prices. The additional delay challenges the very integrity of BP and the United States Coast Guard (USCG) to provide clear and distinct milestones for ultimate resolution to the Deepwater Horizon well control event.

If the Macondo MC252 #1 well is capped before the intercept date of July 28, 2010, it is hoped that there will be 100% oil containment which should greatly reduce the above mentioned knock-on effects. However, if a major hurricane develops and takes a projected path towards Mississippi Canyon, would and could the blowout be successfully shut-in with the capping assembly without venting to the mudline? There is significant fear that shutting-in the well during a hurricane period could cause a broach to the seafloor via the failed rupture disks and therefore jeopardize the final outcome of the relief well efforts. As of now, the most likely scenario for a hurricane situation would be to vent the capping assembly and, when deemed safe, return to the production process while resuming the relief well efforts. This scenario assumes that there are no major issues with operational performance of the capping assembly, reattaching the various vessels, and resuming flowback.

There is no technological challenge anticipated that the second relief well being drilled by the DD2 cannot be drilled to another intercept point and provide a dual dynamic kill. Vector Magnetics' active ranging technology can be used to hone in on both wells and, geologically speaking, there are no known failure points that have been encountered that would prevent the DD2 from providing a second conduit. Waiting for the second relief well may improve the chances of optimal intercept but there is very little chance that the first relief well will miss completely and require a major plug back and sidetrack.

If the first relief well does not have direct intersection, it is most likely that the relief well was not aligned adequately to penetrate the 7-in production casing. In this case, the current plan includes a contingency to scrape alongside the 7-in production casing, set a



7-in liner and perforate to establish hydraulic communication between wells. (Note that there is no cementing required between the two wells.) The biggest advantages of the dual relief well strategy are to:

- Reduce the time between intercepts (if the first relief well were to fail to directly intercept by milling or perforating)
- Allow for intersecting shallower or deeper if there are significant wellbore stability issues (or drill into the reservoir)
- Provide for higher kill rates with less surface pressures

The wellbore stability issue is related more around the possibility of hole collapse after the dual-gradient dynamic kill operation during shut down (where a 12.65 ppg Equivalent Mud Weight (EMW) would be against a 13.8 ppg EMW collapse pressure) before cementing than for the dynamic kill operation. And, while a second relief well would also provide a dual cementing option where flash setting cements can be pumped simultaneously, the same could be said if the well was cemented after the re-entry and fishing operations were completed.

The original fundamental requirement for the second relief well was solely as a redundancy—a true contingency in case the first relief well did not reach the targeted intercept point due to some unforeseen circumstances. There was never any modeled requirement for hydraulic purposes that indicated a dual-relief well strategy was necessary for restoring well control to MC252 #1. As a result, the directional plan of the DD2 is for the same intercept point as the DD3, which would need to be revisited for either a shallower or deeper intercept.

The possible depletion might make it even more feasible to intercept shallower—say 17,000 ft TVDss—and still be able to establish a 12.0 ppg EMW or better at the M-56 sand even if kill weight mud isn't bullheaded all the way to bottom. Bringing a second relief well into the dynamic kill operation will do the following:

- Make the diagnosis of the dynamic kill much more complicated (although it does provide two opportunities to measure bottom hole pressure)
- Require significant additional logistical planning (i.e., there is no existing plan for an independent mud plant and pumping vessel for the DD2—it was assumed that the same vessels could be used from the failed DD3 relief well)
- Would be difficult to time two intercepts within hours of each other
- Will add significant communication challenges to coordinate operations between rigs, thus increasing complexity to Simultaneous Operations (SIMOPS)
- May add further challenges for cement isolation since there would be three conduits to isolate for Plug and Abandon (P&A)

In summary, although a dual-relief well strategy may seem a viable option, the few technical advantages do not even come close to the continued environmental damage and the risk of pushing the kill and isolation operations deeper into hurricane season. None of the few scenarios that present difficulty (such as combined/separated flow where there is communication between the annulus and casing, e.g., the production casing has failed at the crossover) would benefit from having a second relief well intercepted and are more likely better resolved with the capping stack in place.

The second relief well should remain a contingency and should not change into a dual relief well strategy. The additional time required to get the second relief well to the intercept point (plus the uncertainty involved, i.e., the DD3 might spend three weeks



waiting to make the intercept only to find that the DD2 relief well encounters operational problems such as getting stuck) is not warranted in terms of the expected ability to kill the blowout well.

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