

BOTTOM KILL AND CEMENTING REVIEW

RESPONSE TO REQUEST FOR INFORMATION

July 20, 2010

Updated September 10, 2010

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Background

- BP held and external Peer Review on June 29 , 2010 of their planned Well Killing and Cementing Procedures.
 - Attendees included representative from several different oil & gas operating companies, the USGS, DOE National Laboratories, and expert consultants to the DOE.
- RFI 3.2 Item 04 RFI (Bottom Kill) 2 JUL 1300 was prepared and issued to BP on July 2, 2010.
- BP provided responses to the RFI, which included questions from the previous Peer Review, on July 8, 2010
- A Review of the BP response to the RFI response was held on July 11, 2010.
 - Attendees included representative from several different oil & gas operating companies, the USGS, DOE and DOE National Laboratories, expert consultants to the DOE, and the White House OSTP.
- The RFI response and the output of the two aforementioned meetings formed the basis of the opinion discussed in this presentation
- **Additional information was submitted by BP on July 28, 2010 to respond to each action and each consideration. Disposition of each action is summarized in this document.**

Response to RFI

- **BP was fully responsive to this Request for Information (RFI) Item 04 Bottom Kill**
 - As a result of the Bottom Kill and Cementing Review discussions, seven requested actions will be presented to BP. These are primarily in the form of providing documents of new and upcoming tests.
 - Considerations are also noted.

Action #1

- **Send Operational Procedures after BP Line-by-Line review scheduled for Tuesday, July 13**
 - BP will be converting their general procedures to line by line procedures, which will fill in the details
 - A review of these final procedures will determine if there are any gaps
- **Disposition of Action:**
 - BP provided hardcopies of “MC-252 #3 - Macondo Relief Well 8 ½ -in Intercept Interval” Rev. L dated July 21, 2010, excerpted from “MC-252 #3 Relief Well Early Intercept Recovery and Well Kill Plan”

Action #2

- **Develop ~5 key decision points / external hold points with required input data for Government review.**
 - The review team wants clearly identified and agreed external hold points (for Government consultation), prior to starting the well kill, so there would not be any ambiguity
- **Disposition of Action:**
 - **BP provided five draft control points and acknowledged a handful of other “potential complexities”**
 - **BP documented their Roles & Responsibilities in *RACIE* chart (*Responsible, Accountable, Consulted, Informed, Endorses*) included in response to Action Request #3**

Action #3

- **Provide clarity on real-time data collection and dissemination.**
 - There were delays in data dissemination during the Top Kill, which should be eliminated
 - The review team would like to know how data will be collected and disseminated during the bottom kill, so they can be confident that the key decision-makers will have the data needed for timely decisions
- **Disposition of Action:**
 - BP provided “Technical File Note for MC252 Bottom Kill Pressure Measurement and Data Collection” dated July 23, 2010 (Doc. No. 2200-TR-DO-RP-4225) including provisions for real-time data feeds to Federal Science Team

Action #4

- Provide the internal BP decision points, possible paths forward and decision diagnostics (e.g. where is the data coming from and how will the decision be made) for critical decision points. The critical decisions should at least include these items:
 1. How do we know if the well is dead?
 2. When do you cement?
 3. Under what conditions do you cement the annulus if it is dead, and how do you know where the cement will go?
- **Disposition of Action:**
 - BP provided “Data Collection Decision Rights Office and Field Interaction Protocol for MC252 Relief Wells” defines these key decision points:
 - Is the annulus flowing and has it been killed?
 - Should the annulus be cemented now or later?
 - After milling into the casing has it been killed?
 - Should the casing be cemented now or later?
 - These criteria were defined for an envisioned dynamic kill scenario and should be reassessed in light of circumstances existing after BOP replacement on MC252-1.

Action #5

- **Formal request for technical note - pumping capacities through the drill pipe.**
 - The review team was given verbal responses about the capability of pumping only through the drill pipe (equipment changes required and maximum capability), but we would like this documented in a technical note so the required changes in equipment and the limitations are understood
- **Disposition of Action:**
 - BP provided “Technical File Note on Upper Limit of Drill Pipe on Current MC252-3 Pump Rate Capacity” dated July 14, 2010 (Document No. 2200-T2-DO-RP-4216)
 - Documents maximum capacities for 14.0 ppg mud
 - DDIII: 30.2 bbl/min at 6,200 psi
 - Blue Dolphin: 41.2 bbl/min at 11,000 psi (limited by surface piping)

Action #6

- **Before a "momentum kill" is undertaken, the Government will be consulted**
 - The review team is concerned that the definition of a "momentum kill", and when it may be applicable, is not well constrained. This process has not had an adequate review at this point and it should, if it becomes a potential option for the well kill.
- **Disposition of Action:**
 - BP "Acknowledged and Agreed"
 - **Comment: This scenario is of diminished relevance with current static condition of MC252-1.**

Action #7

- **Provide any revised procedures on the killing and cementing activities, which are developed as a result of the installation of the Capping Stack and the wellbore integrity test.**
 - The review team needs to understand potential changes in the killing and cementing operations that will occur as a result of the wellbore integrity test, which will be done after the capping stack is installed
- **Disposition of Action:**
 - BP defined multiple benefits for the relief well arising from ability to intersect the Macondo shut-in well (not killed with mud or cement), including:
 - Ability to flow hydrocarbons to surface during kill
 - Ability to apply backpressure allowing for reduced kill pumping rates
 - Ability to better control hesitation squeeze during cementing
 - Ability to minimize flow-back and contamination after cementing

Considerations

- Arose from discussions during the RFI response review
- Divided into three groups
 - Wellbore Issues
 - Well Kill
 - Cementing

Considerations - Wellbore Issues

- Ensure that the well control risks on the DDIII have been assessed for each phase of remaining operations.
- Clarify procedures for quick action to pull into shoe at first sign of losses in relief well.
- Develop procedures that utilize the full capabilities and diagnostics advantages of the capping stack to optimize the killing and cementing operations, particularly to minimize the pressure difference between the relief well and flowing well at intercept.
- Consider development of specific procedures to utilize light displacement fluids for maintaining positive surface pressures in each phase of the kill and cementing operations. An example is described in SPE 112657.

Considerations - Wellbore Issues, Cont'd

- Develop a range of diagnostics to prevent penetration of casing when drilling into the annulus. During the review, there were several anecdotal cases of drilling through casing with mud motors.
- If calcium chloride / sodium silicate treatments become necessary, decrease the number of stages to decrease risks.
- How and under what conditions would loss circulation material (LCM) or the "stress cage" be used to allow mud pressures over the frac pressure? Review rationale for using LCM during kill ops - section 3.4.4.1.8.a.

Considerations - Well Kill

- Ensure that hydrocarbons are swept back into formation at the end of kill operation. Consider exceeding the frac pressure at the bottom of Macondo to accomplish this.
- Ensure wellbore below intercept point is displaced to a mud density equal to that of the cement that will be pumped.
- Ensure that contingency procedures for failure of mission critical pieces of equipment are documented and available.

Considerations - Cementing

- Develop a procedure to measure actual fracture closure at end of kill operation and incorporate it into the well diagnostics and cementing procedures.
- Assess the relative advantages of squeezing through the bit, tripping for retainer, or other options.
- Consider whether there should be more stages in hesitation squeeze.
- Consider additional strategies to minimize difficulty with re-intercept after cementing annulus (e.g. lower strength cement).

Conclusions and Recommendations

- BP was fully responsive to the RFI, was engaged in the discussion with the reviewers, and actively sought out the review and advice from peer subject matter experts.
- Seven Action Items were provided to BP, primarily developed from discussions after the peer review and generally with respect to development of new procedures. As applicable, new procedures will be made available to the industry and government reviewers for comment
- BP will be developing their line-by-line procedure and a number of Considerations were provided to BP for their benefit.
- **BP also responded to the 14 “Considerations” in their 28 July response to RFI 3.2 Item 04.**