From: George Birch [birchgeo@gmail.com]
Sent: Tuesday, September 28, 2010 12:27 PM
To: Roller, Perrin (DWH Proj)
Subject: O&GJ - Halliburton Article - 27 Sept

Attachments: CommentsOGJArticleSep27.docx

Perrin

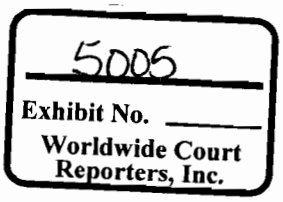
Please find comments attached.

George

----- Original Message -----
From: HYPERLINK "mailto:Perrin.Roller@deepwater.com"Roller, Perrin (DWH Proj)
To: HYPERLINK "mailto:birchgeo@gmail.com"George Birch
Sent: Tuesday, September 28, 2010 3:25 AM
Subject: FW: File

George,

Any comments on the Halliburton article in O&GJ?



Comments on Oil & Gas Journal Article
Halliburton officials defend Macondo well's cement job (27 Sept 2010)

1 *"..did not have access to all the information..." "We knew the mechanics of the well and its depth, but not specific reservoir information."*

Their design report HAL_000010998 noted:

- pore pressures of 13.81 ppg at 17,163 ft, 14.01 ppg at 17,700ft and 13.96 ppg at 18,305ft.
- frac pressures of 14.51ppg at 17,163 ft, 14.51ppg at 18,200 ft and 15.0 ppg 18,305ft .

Pore pressures (reference BP-HZN-CEC022125 – log depth measurements not too clear on my copy) should have read 14.1 ppg (not 14.01) at ~17700 ft, 13.1 ppg at 17800 ft and 12.5 to 12.6 ppg over pay section ~18080 ft to ~18200 ft.

Since the Halliburton Engineer was officed with BP, it surprising that his data was not better than it was. It is equally surprising that the BP Engineers did not correct it, and ask for a re-run of the OptiCem program.

The frac pressures of 14.5 ppg appear to be essentially correct though I understand from Rachael the maximum ECD should not have exceeded 14.7 ppg. If so, then their 14.5 ppg was on the conservative side. 15 ppg would appear to be too high.

2. *"Problems with the cement could have been traced to its possible contamination, incomplete laboratory testing beforehand, or use of an unstable foam slurry... resulted in N2 breakout, none of which occurred he (Roth) explained". "Roth said Halliburton supplied the cement based on BP's specifications".*

How Roth can rule out possible contamination is unclear.

He claims that the cement was based on BP's specifications. What was the specification? There is no mention of any specification in BP's report, nor in Halliburton's report.

3. *"Tests took more than 400 hours and indicated that the foam system was stable on delivery"*

Of the test results we have seen, test time was under 200 hours (this includes 48 hours for a 48-hour UCA test where the lab technician's time is certainly under 4 hours for the slurry preparation, monitoring of the test, and post-test cleanup.

The only foamed stability test was run with a foam quality of ~13.6% (for the crush strength test). No tests were run at foam qualities of 50% to 60%, the quality at which the foamed cement was initially generated, i.e. "on delivery".

4. *"When cement is prepared on location, we go through the actions of foaming, starting with the base slurry," Roth said."We measure the density to determine the cement-water ratios are appropriate for the design and the foam system is consistent over the cement. We also monitor the nitrogen pressure and nitrogen rate to provide assure that the job is executed according to the design. The material balance is*

identified ahead and after the job to identify what's used in the job. This analysis shows that the materials used followed the plan at the Macondo well."

Although the design and degree of testing were probably inadequate, it appears from the job report and supporting graphs of rates pressures, cumulative volumes, etc. that the execution was good.

Regarding the material balance before and after the job, I have not seen any evidence that one was made (or maybe it's in the illegible Tally Book HAL_CG0000515), nor regarding the addition of the retarder, how it was added and who apart from the operator witnessed the addition.

5. *Halliburton performed three tests on the cement which would be used in the Macondo well and discussed the results with BP, Roth said. The foam stability test used a sample of the cement slurry, which was mixed in a high-speed Waring blender to compare it to test specifications, then cured in a water bath for 48 hr, where the cement hydrated. A specimen was gathered and examined to see if there is any separation, settling or breakup. "On the identified specimen, there was good stability," Roth said.*

Halliburton performed three tests which took over 400 hours – unlikely!

The crush strength test referred to above (Test ID 806069) was of a 14.5 ppg foamed slurry (13.6% foam quality) which was cured at 180°F for 48 hours. Halliburton reported 0 psi after 12 and 24 hours and 1590 psi after 48 hours. This confirmed that a foamed sample of 13.4% foam quality (the foamed cement in the well was foamed to a foam quality of ~19% but this was not tested) was stable, and had good compressive strength.

To correctly estimate the down-hole compressive strength, the surface sample should have been mixed at 13.6 ppg (foam quality ~19%).

The fact that the cement had not set after 24 hours at 180°F seems to have been overlooked when attempting the negative test, around 21 hours after cement placement. Did Halliburton point this out to BP?

6. *"BP said in the report of its investigation that it had to simulate the cement's condition because Halliburton would not provide samples. Roth said that the independent laboratory's conclusions were inaccurate because of this, and because the lab used a 3-blade blending system instead of one with 5 blades as specified in American Petroleum Institute standards."*

Roth's comment was correct on the formulation used (completely different additives – not from Halliburton - from those used on location) but incorrect regarding the effect of the blade used.

It is true that CSI used the Single Blade for result Tables 1 to 28, and most of their conclusions were based on these results.

Tables 29 and 32 compared the Single Blade mixer with the Multi Blade mixer. The results were similar except when the foam quality was at 60%, when the Multi Blade was generally better.

Tables 33 to 36 were with the Multi Blade mixer with base oil contamination for two different cement slurry formulations at 110°F and 140°F.

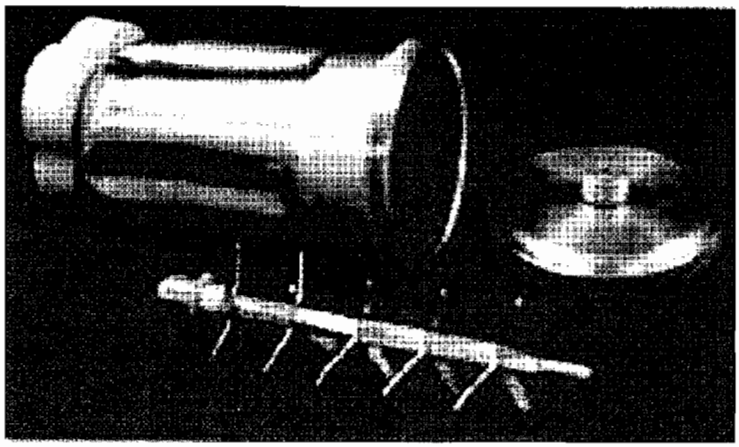
However, the American Petroleum Institute standard, API Spec 10B-4 Section 5.2, states that "Testing to date has not identified a significant difference in slurries mixed with the two different blade assemblies using the sealed blender."

API does not recommend one over the other

The API statement was largely borne out by CSI's results.

The Multi-Blade blender is shown in Fig 1. The Single Blade operates in a near identical container but has just the lower blade, and no shaft above the blade.

Fig. 1 Multi-Blade Assembly and Blending Container



7. Indications of channeling from using only six centralizers did not cause alarm at the Macondo well, he said. "We end up with channeled cement jobs in many instances, which are not inherently unsafe in the Gulf of Mexico," said Roth. "They commonly exist on work provided in the field. It's not seen as a red flag going forward."

From our own evaluation with a simulator, the indications are there should have been practically no channelling that over the centralized interval, where we had six centralizers.

Halliburton OGJ Article
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