From: LeBleu, John B
Sent: Mon Feb 14 22:20:26 2011
To: Heironimus, Mark B (LEWCO INTEGRATED TECH SYSTEMS); Diaz, Andres; Wilton, Bonsall (CLOVER SOLUTIONS)
Subject: RE: Details of Lost Return Events.xls
Importance: Normal
Attachments: Kodiak II mud loss incident @ 23000.doc

Thanks, here one I have generated for your reference. I have three I have generated for Macondo but do not want to forward without BP legal's approval.

John LeBleu
Drilling Fluids Engineer
BP GOM - Drilling Excellence
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Cell: 713-503-2257
lebleujb@bp.com

From: Heironimus, Mark B (LEWCO INTEGRATED TECH SYSTEMS)
Sent: Monday, February 14, 2011 4:00 PM
To: Diaz, Andres; Wilton, Bonsall (CLOVER SOLUTIONS); LeBleu, John B
Subject: Details of Lost Return Events.xls

FYI,

This documents attempts to capture the relevant details of the Lost Circulation event we had on the MC 778 #22 well. I think we need to start documenting and sharing our experiences in detail with respect to these events.

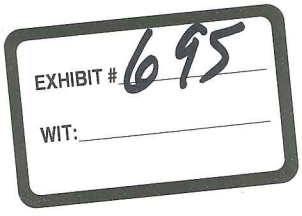
What happened, what was pumped and what were the results. If y'all have a better format, let me know along with any ideas for improvements.

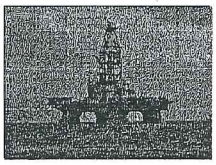
I'd like to see the details added regarding Macondo and NaKika as well.

The well specific LC details have not been captured in detail and I think they need to be included in future end of well reports.

Best regards,

Mark



bp	Event Summary OSC-G 24102 – MC 727 #02 Deepwater Horizon Kodiak II Appraisal J4 Mud Loss Event	

J4 23,000' Mud Loss Event Summary

Title: Kodiak II J4 Mud Loss Event Summary

To: Nick Lirette, Rodolfo Rivera, Brett Cocales, John Guide

CC:

From: John Lebleu – Drilling Excellence Group

Date: January 13, 2010

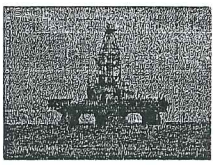
Objective: To summarize and review the mud loss event on Kodiak II and attempt to determine the cause and corrective actions for future wells.

Background: During the planning phase of the Kodiak II Appraisal well the stress cage evaluation was performed and the recommendation was that the normal background concentration of LCM should be sufficient. The base of salt (17.5" hole) was drilled with 22 ppb of background LCM as per the wet sieve tests. Two days later the concentration was down to 16 ppb and held there for 5 days of drilling where the LCM concentration was allowed to drop to 14 ppb and remained 14 ppb for the remainder of the interval. The drilling of the interval was executed without mud losses. The interval ended with 13.7 ppg mud weight and the mud weight was not increased before pulling out to run pipe. The 13 5/8" long string was run with 106 bbls of mud lost and cemented with 2664 bbls lost and 466 bbls left behind pipe. These mud losses during the cement job were comparable to cementing losses in the original Kodiak well.

Pre Event: Because of the mud losses while cementing the 13 5/8" casing and because of a sand just below the 13 5/8" shoe, the team decided to raise the concentration of LCM for the 13 5/8" shoe test to 21-22 ppb and run our normal background concentration thereafter. The concentration was raised by adding 1500 pph and was 22 ppb for the shoe test and allowed to drop to 16 ppb for the remainder of the interval (the original plan was to allow the LCM to decrease to 14 ppb by lowering the rate of background additions). The 13 5/8' casing was drilled out with 13.7 ppg mud weight and a LOT was performed to 15.03 ppg EMW and the mud weight was increased to 13.9 ppg before drilling ahead. Geo Tap pressures were taken while drilling the interval and the lowest pressure was 12.72 ppb in the J4.

The mud weight was increased to 14.0 ppb at 23,350' md, 14.1 ppb at 23,845' md, and 14.2 ppg at 26,299' md. There were no losses while drilling, and T.D. for the interval was reached at a depth of 26,720' md with 14.2 ppg mud weight. (The interval started at 20,300' md and ended at 26,730', and required a three bit trips to drill the hard formation, no mud losses noted on those trips or upon resuming drilling operations after these trips) The original plan was to allow the background LCM to drop to 14 ppg and after experiencing some slight rheology increase at the 40 degree temperature and the background LCM additions were reduced but the background concentration never dropped lower than 16 ppb while drilling the interval. This rheology increase at cold temperatures was also seen on the original Kodiak well and the Tiber well when adding LCM and drilling slow in hard formation. The mud weight was raised to 14.3 ppg before POOH to e-log and there were no mud losses while circulating or POOH.

The well was e-logged for 8 days, and tested BOPs for an extra day. Logs showed under gauge hole in two spots one just below the middle of the open hole (below the J4 sand) and one under gauge section near bottom. The plan was to go in with no MWD so there was a discussion about the concern of having the extra tenth of mud weight while reaming without the PWD in the hole and background LCM for the reaming was also discussed. These team discussions included old fashioned methods of watching for pack offs or reduced flow and these concerns were mentioned to the rig. The team also discussed tripping in carefully and breaking circulation often and frequent updated mud properties input into Virtual Hydraulics until the mud was



warmed up.

Event Summary: On the trip in after e-logging the mud circulated at different points without problems. Bottoms up was circulated above wellhead, circulated 30 minutes @ 19,739' and TIH to 23,860' where the reamer was opened and bottoms up was circulated to the top of the BOPs. Then the pump rate was staged up to our drilling rate of 800 gpm (ECD modeling with Virtual Hydraulics showed no appreciable difference in circulating 500-800 gpm in this 14" hole size while reaming).

Reaming commenced and continued for 608' (24.5 hours) without mud losses to 24,468'. Upon picking up to make connection before shutting the pumps down, circulation was lost with the bit at 24,338'. Losses were100 bbls/ hour, and the pipe was detained until rotated free. Five stands were pulled to 23,748' losing 104 bbls. The premixed 84 ppb emergency LCM was pumped. 155 bbls of 84 ppb LCM containing (10 ppg graphite, 54 ppb mixed calcium carbonate, 10 ppb fine fiber and 10 ppb, Kwik-seal). Five more stands were pulled to 23,081' with flow-back decreasing each stand pulled. The pumps were staged up to 424 gpm losing mud slowly. The background LCM concentration was raised from 14 ppb to 17 ppb and the mud weight was reduced from 14.3 to 14.2 ppg. When 14.2 came out of the bit losses went to zero. When the 14.2 ppg was 1200' into the casing returns dropped to zero and losses increased to 300 bph. The rig team started reducing the mud weight in riser to 14.1 ppg. Another 334 bbls of 84 ppb pill of the same LCM concentrations as before was pumped and the well was static 5 minutes. The drill string was pulled to 19,196' and the well was monitored well with decreasing losses. The drill string was tripped in to 24,028' with good displacement and attempted to established circulation. The annular was closed and the riser boosted to finished cutting the mud weight to 14.1 ppg in the riser. Then a 175 bbl Form-a-squeeze pill was pumped with no returns up to 2600 strokes whereupon the returns gradually increased to 85-90%. Pumped out of hole to 22,719' and closed lower annular and hesitation squeezed a total of 106.5 bbls of the Form-a-squeeze pill at 1 bbl/min with max 220 psi.

The drill string was pulled and the MWD/PWD and two reamers to evaluate where losses occurred and to continue reaming. Total mud lost while tripping (24 hour period) was 10 bbls. The drill string was tripped in to a depth of 10,000' and the pumps were staged up to 540 gpm and the mud weight was reduced to 14.1 ppg with no losses. The drill string was tripped in to 15,000' and 20,026' to reduce the mud weight to 14.1 ppg. The heaviest mud weight seen was 14.3 and the highest ECD was 14.57 ppg. The well was MWD logged from 20,115' and noted the mud lost was at 23,000' J4 sand and below to 23,300' in sand and shale. A tight spot was noted at 23,000' which detained pipe and packed off, probable site of LCM. The reamer was opened at 24,000' and reaming continued in the second, lower, under gauged section. Reamed and washed to 26,561' without losses. POOH and ran 11 7/8" liner with no losses. Circulated with 24 bbls lost and cemented the liner losing 1203 bbls, leaving 376 bbls behind the liner. On the original Kodiak well the mud losses for the 11 7/8" liner run were 176 bbls and 1252 bbls were lost while cementing.

The total mud losses for the mud loss event were 2995 bbls.

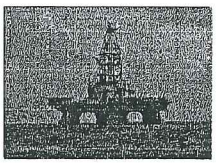
Highlights:

14.75" x 17.5" Section – 13 5/8" set at 20,103'

- Maintained 800 pph mixed calcium carb/graphite, ended the interval with 14 ppb stacked sieve background LCM.
- Finished drilling the interval to 20,285' with 13.7 ppg mud weight and did not weight up to run 13 5/8" casing.
- Hole deviation at that point was 0.67 degrees.
- Set 13 5/8" casing at 20,103' and got a 15.03 ppg LOT upon drill out with 13.7 ppg.

12.25" x 14" Section – 11 7/8" set at 26,584'

- Started interval with 22 ppb and ended drilling the interval with 16 ppb with no losses.
- After drilling the interval, weighted up one tenth of a pound before e-logging.
- TIH to ream under gauge hole without PWD and allowed LCM to drop to 14 ppb.
- Reaming started below eventual mud loss point.
- After reaming 24.5 hours (608') returns diminished while picking up to make connection with pumps on.
- No spikes in pump pressure were noted on the rig or on the insight data.
- Combination of large LCM pills and large Form-a-squeeze pill, hesitation squeezed into formation cured losses.



- Reaming continued and 11 7/8" liner was run without further losses.

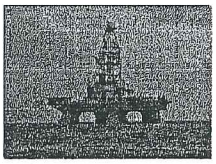
Post Discussion Points:

- When comparing the lowest LCM background numbers, It is questionable whether a reduction of 2 ppb from 16 ppb (drilling) to 14 ppb (reaming) contributed to the mud losses.
- It is uncertain whether the mud weight increase at the end of the drilling contributed to the loss event because there was no PWD in the hole at the time and the Virtual Hydraulics modeling showed ECD no higher than that of the drilling phase.
- EPT will look at the data and into the rock mechanics issues and give their assessment.
- The area that had the losses was not reamed, the reaming occurred below that point, so disturbance of the plugging or stressing of the sands should not be a factor.
- Because the formation was subjected to cooling while drilling and 24.5 hours of cooling during the reaming before failing, it is doubtful cooling is an issue.
- The Insight log shows no pump pressure spikes.
- It is curious that the losses occurred while pulling up to make a connection especially when the rig feedback is there were no pump pressure spikes and no spikes were seen on the Insight log.
- We have engaged Wally Worthington and Charlie Jay, we can re-evaluate when we have heard back from EPT.

Stacked Sieve Data:

bp

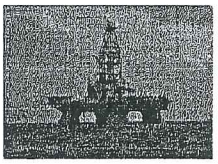
Event Summary
OSC-G 24102 – MC 727 #02
Deepwater Horizon
Kodiak II Appraisal
J4 Mud Loss Event



Raising LCM concentration to drill ahead.	Drilling Ahead.	Drilling Ahead.	Drilling Ahead	Drilling Ahead	POOH to P/U new BHA.	Drilling Ahead	Drilling Ahead.	Drilling Ahead	Reaming to bottom
6	7	8	9	10	11	12	13	14	15

11/22/2009		11/23/2009		11/24/2009		11/25/2009		11/26/2009		11/27/2009		112/28/09		11/29/2009		12/1/2009		12/17/2009	
100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL
0.25	1.0	0.2	0.8	0.135	0.5	0.125	0.5	0.125	0.5	0.05	0.2	0.075	0.3	0.125	0.5	0.25	1.0	0.1	0.4
0.4	1.5	0.4	1.5	0.25	1.0	0.25	1.0	0.25	1.0	0.2	0.8					0.125	0.5	0.1	0.4
1.25	4.8	1.25	4.8	1.25	4.8	1	3.9	1	3.9	0.75	2.9	0.5	1.9	0.5	1.9	0.25	1.0	0.3	1.2
1.5	5.8	1.5	5.8	1.5	5.8	1.25	4.8	1.25	4.8	1.25	4.8	1.25	4.8	1	3.9	1	3.9	1	3.9
2.25	8.7	2	7.7	2.5	9.6	2.25	8.7	2	7.7	2.25	8.7	2	7.7	2.5	9.6	2.5	9.6	3	11.6
22 ppb 75		21 ppb 75		22 ppb 75		19 ppb 75		18 ppb 75		17 ppb 75		15 ppb 75		16 ppb 75		16 ppb 75		17 ppb 75	
Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size	
micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb
710	1.0	710	0.4	710	1.0	710	0.5	710	0.5	710	0.2	710	0.3	710	0.5	710	1.0	710	0.4
500	2.1	500	1.5	500	1.9	500	1.4	500	1.4	500	1.0	250	2.2	250	2.4	500	1.4	500	0.8
250	6.0	250	12.3	250	5.8	250	5.3	250	5.3	250	3.9	106	7.0	106	6.3	250	2.4	250	1.9
106	14.4	106	13.9	106	11.6	106	10.1	106	10.1	106	8.7	75	14.7	75	15.9	106	6.3	106	5.8
75	17.5	75	14.8	75	18.3	75	18.8	75	17.8	75	17.3					75	15.9	75	17.3

Event Summary
OSC-G 24102 – MC 727 #02
Deepwater Horizon
Kodiak II Appraisal
J4 Mud Loss Event

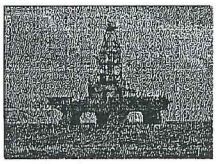


Stacked Sieve Data: (continued)

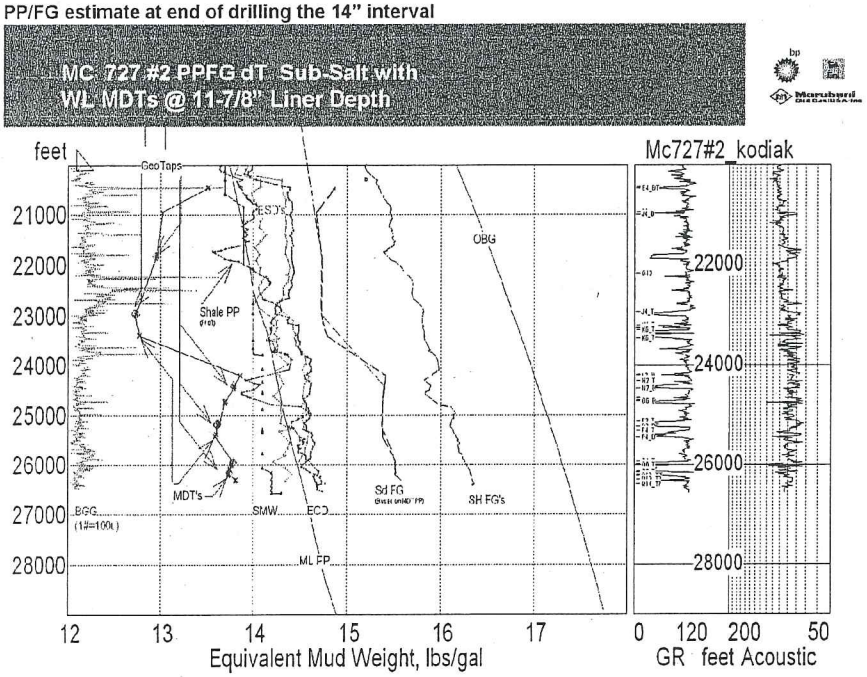
Reaming to bottom	Reaming to bottom	Monitor Well	Monitor Well	Wash and log	Reaming to bottom	Reaming to bottom	Reaming to bottom	Reaming to bottom	Run Casing
2	3	4	5	6	7	8	9	10	11
12/18/2009	12/19/2009	12/19/2009	12/20/2009	12/24/2009	12/25/2009	12/26/2009	12/27/2009	12/28/2009	12/30/2009
100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL	100.0 ml	LBS/BBL
0.1	0.4	0.1	0.4	0.2	0.8	0.05	0.2	0.02	0.1	0.1	0.4	0.2	0.8	0.2	0.8	0.2	0.8	0.1	0.4
0.1	0.4	0.1	0.4	0.2	0.8	0.15	0.6	0.02	0.1	0.1	0.4	0.2	0.8	0.2	0.8	0.2	0.8	0.1	0.4
0.15	0.6	0.1	0.4	1.1	4.2	1	3.9	1	3.9	1	3.9	1.5	5.8	1	3.9	1.5	5.8	1	3.9
0.75	2.9	0.75	2.9	1.7	6.5	1	3.9	2	7.7	2	7.7	1.8	6.9	1.7	6.5	1.8	6.9	1.5	5.8
2.75	10.6	2.5	9.6	2.5	9.6	2.5	9.6	2.5	9.6	2.5	9.6	2	7.7	2	7.7	2	7.7	2	7.7
15 ppb 75		**14 ppb 75**		**22 ppb 75**		**18 ppb 75**		**21 ppb 75**		**22 ppb 75**		**22 ppb 75**		**20 ppb 75**		**22 ppb 75**		**18 ppb 75**	
Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size		Conc > micron size	
micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb	micron	ppb
710	0.4	710	0.4	710	0.8	710	0.2	710	0.1	710	0.4	710	0.8	710	0.8	710	0.8	710	0.4
500	0.8	500	0.8	500	1.5	500	0.8	500	0.2	500	0.8	500	1.5	500	1.5	500	1.5	500	0.8
250	1.3	250	1.2	250	5.8	250	4.6	250	4.0	250	4.6	250	7.3	250	5.4	250	7.3	250	4.6
106	4.2	106	4.0	106	12.3	106	8.5	106	11.7	106	12.3	106	14.2	106	11.9	106	14.2	106	10.4
75	14.8	75	13.7	75	21.9	75	18.1	75	21.3	75	21.9	75	21.9	75	19.6	75	21.9	75	18.1

Insight Data:

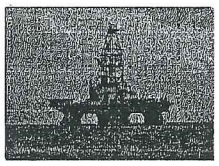
The insight data is contained in XXX.PDF

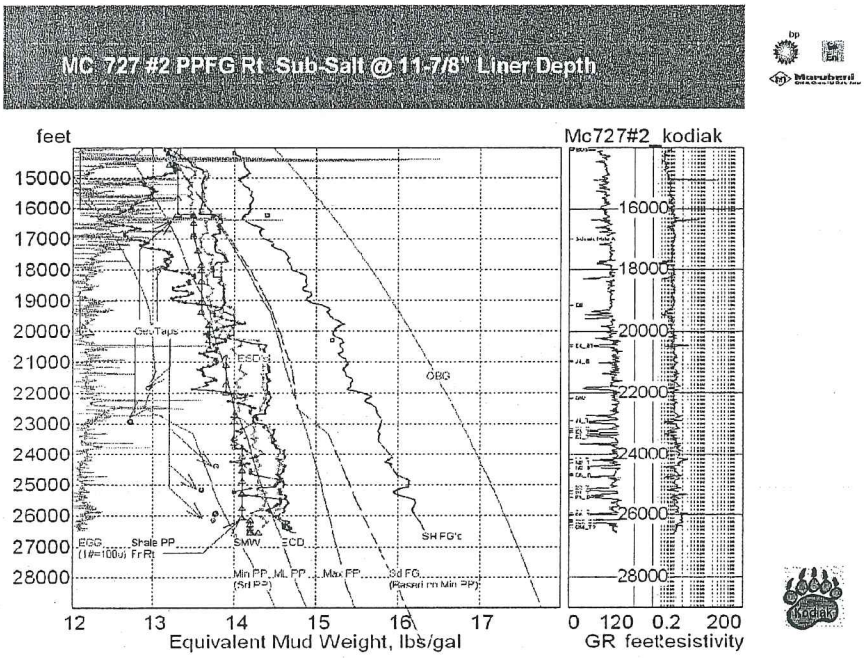


PP/FG estimate at end of drilling the 14" interval

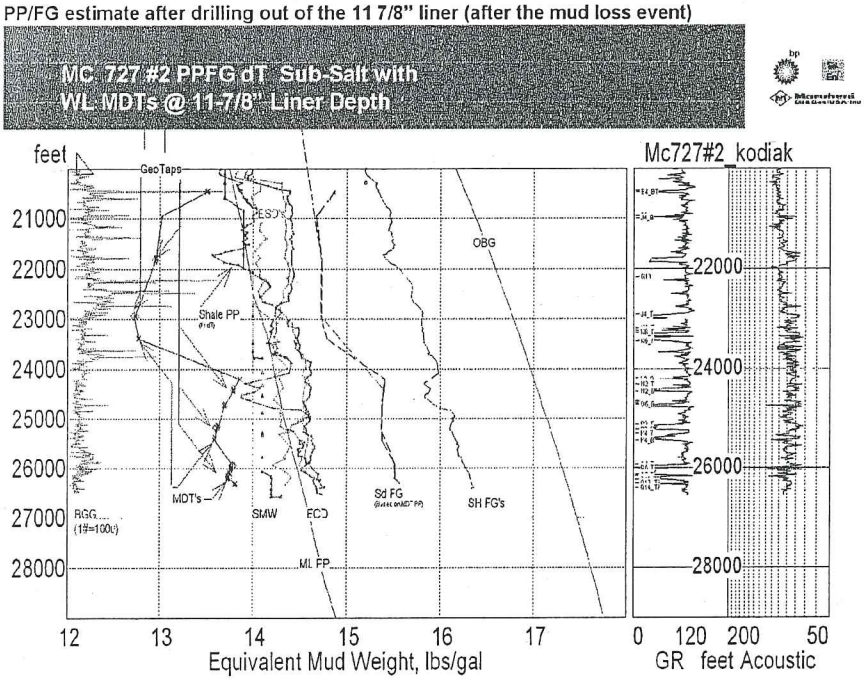


Event Summary
OSC-G 24102 – MC 727 #02
Deepwater Horizon
Kodiak II Appraisal
J4 Mud Loss Event





PP/FG estimate after drilling out of the 11 7/8" liner (after the mud loss event)



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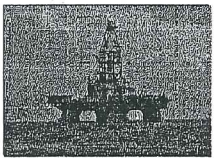

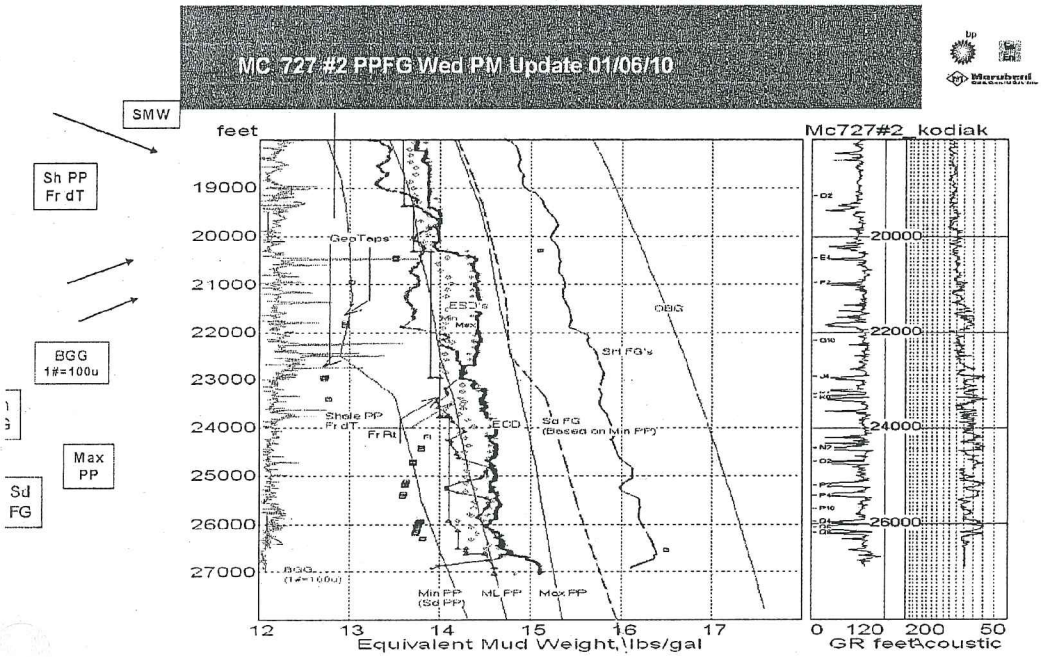

Pore throat data:

John,
So the losses appear to be mostly in the J4 sand.
Unfortunately we have no whole core, rotary core or percussion core in the J4 sand (eventhough is pay at Tbells).
So the next best thing is to offer some pore throat data via rotary sidewall cores from the K series sands from the
Tbells 2ST1BP1 well (MC70226#1ST1BP1).
The K series is the next sand package below the J4 sands.
We only have 6 plugs with MICP or mercury injection cap pressure data.
Data is summarized below. Let me know if you want the actual data.
All pore throat data is radii and in microns.

Plug# Sand Range of Pore Throats Median Pore Throat Size Mode Pore Throat Size

2-1R K4 0-6.8 2.1 3.3
2-5R K6A 0-10.5 6.1 8.87
2-6R K6A 0-7.7 2.8 5.7
2-30R K6C 0-5.7 2.85 4.0 & 0.5 (bimodal - two equally occurring peaks of same magnitude)
2-31R K6C 0-4.55 1.65 4.15
2-48R K6C 0-9.14 4.6 8.55
Ramsey