

To: William Burch[bburch@wildwell.com]
From: Quitzau, Robert
Sent: Fri 6/18/2010 7:57:13 PM
Importance: Normal
Sensitivity: None
Subject: RE: M56E Post-Blowout Fracture Pressure Question
Categories: urn:content-classes:message

Nice!

From: William Burch [mailto:bburch@wildwell.com]
Sent: Friday, June 18, 2010 2:42 PM
To: Quitzau, Robert
Subject: FW: M56E Post-Blowout Fracture Pressure Question

From: William Burch
Sent: Thursday, June 17, 2010 5:43 PM
To: 'Merrill, Robert C'; Vinson, Graham (Pinky)
Cc: Cecil, Chris; Mix, Kurt; Albertin, Martin L.; Rygg, Ole (Unknown Business Partner); David Barnett; Willson, Stephen SM; Baker, Kate H (UNKNOWN BUSINESS PARTNER); Sprague, Jonathan D
Subject: RE: M56E Post-Blowout Fracture Pressure Question

Bob,

Thanks for the speedy reply.

So if I'm following this correctly,

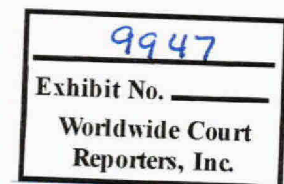
11 days April

31 days May

30 days June

31 days July

103 days total if intercept is Aug 1



CONFIDENTIAL

ANA-MDL-000244564

ADR039-004091

TREX 009947.0001

At 8 psi/day, that's 824 psi - leaving 11,014 psia @ 17,993 ft TVDss (11.77 ppg EMW)

At 13 psi/day, that's 1,339 psi – leaving 10,499 psia @ 17,993 ft TVDss (11.22 ppg EMW)

If I make a terrible assumption of a linear shift of FG (yes, Poisson's Ratio has to be included so I know this is low), I've potentially got a sand FG remaining of:

At 11.77 ppg, FG = 13.62 ppg EMW

At 11.22 ppg, FG = 13.07 ppg EMW

Conclusion:

· Building a 14.2 ppg EMW (and maybe as high as 14.4 ppg with compression) at TD will most likely cause fracturing of the M56 formation because of the depletion.

Thanks,

Bill

William Burch

Wild Well Control, Inc.

Well Control Engineer

wburch@wildwell.com • www.wildwell.com

281.784.4700 phone • 281.784.4750 fax

"Experience Makes The Difference"

CONFIDENTIAL

ANA-MDL-000244565

ADR039-004092

TREX 009947.0002

The contents of this message are provided for informational purposes only. Wild Well Control, Inc. does not guarantee the accuracy or completeness of the contents and assumes no liability whatsoever for loss or damage arising out of recipient's reliance on or use of the information provided herein. This message contains confidential information and is intended solely for the named recipient(s). If you are not the intended recipient, please immediately contact the sender by return e-mail and destroy all copies of the original message. Thank you.

From: Merrill, Robert C [mailto:Robert.Merrill@bp.com]
Sent: Thursday, June 17, 2010 5:24 PM
To: William Burch; Vinson, Graham (Pinky)
Cc: Cecil, Chris; Mix, Kurt; Albertin, Martin L.; Rygg, Ole (Unknown Business Partner); David Barnett; Willson, Stephen SM; Baker, Kate H (UNKNOWN BUSINESS PARTNER); MC252_Email_Retention
Subject: RE: M56E Post-Blowout Fracture Pressure Question

Bill:

I've cc'd Steve Willson on this, as he'd be the one who can speak authoritatively regarding geomechanics.

I have performed reservoir depletion calculations for flowrates between 20 mbd and 80 mbd. I was looking for consistency with the pressure measurements at the BOP. The observed depletion at the wellhead is 8 - 13 psi/day. If we assume that the flowpath within the wellbore isn't changing (no burst disks, etc), this is consistent with flowrates between 24 and 70 mbd.

The wide range is due to uncertainty regarding the size and strength of the aquifer.

A quick check of the M56E sands for a 40mbd case with a 2x aquifer suggests that a 7 psi/day depletion rate at the well head is equal to a 11 psi/day depletion (averaged from 20-April to 21-June). For a 60mbd case with a 4x aquifer, a 10 psi/day depletion at the

CONFIDENTIAL

ANA-MDL-000244566

ADR039-004093

TREX 009947.0003

BOP translates into a 13.8 psi/d depletion in the M56E.

There is a draft note for discussion out which considers some of these issues; it doesn't include the reservoir depletion numbers, but I have them.

Bob

Bob Merrill

Senior Advisor
Reservoir Engineering Community of Practice
BP EPT, Houston
Phone: +1 281-366-2049
Cell: +1 713-409-7340
email: merrilrc@bp.com

From: William Burch [mailto:bburch@wildwell.com]
Sent: Thursday, June 17, 2010 4:32 PM
To: Vinson, Graham (Pinky)
Cc: Cecil, Chris; Mix, Kurt; Albertin, Martin L.; Merrill, Robert C; Rygg, Ole (Unknown Business Partner); Barnett, David (UNKNOWN BUSINESS PARTNER)
Subject: M56E Post-Blowout Fracture Pressure Question

I appreciate your time so if you're busy with other projects, this isn't important. But my curiosity has me thinking (which can be quite dangerous...)

If we assume that the M56 sand package is the main flow source and depending on the flow path:

· Production casing annulus to the seafloor, the OLGA simulations are suggesting approximately 43,000 bopd to the seafloor

CONFIDENTIAL

ANA-MDL-000244567

ADR039-004094

TREX 009947.0004

- Production casing only through a failed float, 63,000 bopd and,
- Both production casing and annulus, 87,000 bopd.

The simulations are giving:

- Production casing flowing bottom hole pressure is 10,570 psi (11.3 ppg EMW)
- Production casing annulus flowing bottom hole pressure is 10,960 psi (11.7 ppg EMW)
- Production casing and annulus flowing bottom hole pressure is 10,095 psi (10.8 ppg EMW)

If we assume that the reservoir has had constant flow rate since the rig went over (obviously not correct because flow has changed relative to the various activities but it might be a low-end estimate of total production), we might have an idea of the total depletion of the M56.

What might the static reservoir pressure be after we dynamically kill the well (let's say August 1) if we assume:

- a. Volumetric depletion
- b. Water drive
- c. Other drive mechanism?

Second question as it relates to above is what might the sand fracture pressure be if the M56 has experienced the above fracture pressure?

Where I'm going with this is that if the original M56E sand fracture where the losses occurred while circulating the trip margin was approximately 14.5 ppg EMW, is it really a safe assumption that we still would have the same fracture pressure after the blowout? It's not going to change my static or dynamic kill mud weights (unless something dramatic pops out of this inquiry) but I'm wondering if we are going to re-open the

original fractures again while circulating the well.

Why this might be important is whether or not I'm going to see the 16.5 ppg SOBMs back at the seafloor. I wouldn't expect the 14.2 ppg SOBMs (my dynamic kill mud weight) to exceed the fracture pressure because it should give me 12.65 ppg (maybe 12.85 ppg with compression) and my fracture pressure should be larger than this. But when I start pumping the 16.5 ppg SOBMs (my static mud weight), I should have a 14.21 ppg (maybe 14.41 ppg with compression) which puts me right up to my original fracture pressure limit. So if my fracture pressure of the weakest point at 18,260 ft has dropped relative to the depletion, am I going to ever see 16.5 ppg back to the seafloor?

Secondary to this concern above is if we get the riser margin back with the containment riser. If we can circulate 14.2 ppg all the way back to the surface on whatever vessel is collecting the oil, I'd end up with a 14.4 ppg at TD. Would I expect to see 14.2 ppg actually make it to surface (assuming, of course, that the burst disks aren't exposing a flow path to the 18" casing shoe.) Obviously, if the 18" liner shoe is open, I'll never see the 14.2 ppg back to surface.

In a more scientific sense, since the reservoir near wellbore stress regime has changed relative to the flowing bottom hole pressure, will the post-blowout fracture gradient follow a return to the original fracture gradient or will there be a hysteresis where the recharging (if it is back to original reservoir pressure) has altered the fracture gradient?

Thanks for your input,

Bill

William Burch

Wild Well Control, Inc.

Well Control Engineer

wburch@wildwell.com • www.wildwell.com

CONFIDENTIAL

ANA-MDL-000244569

ADR039-004096

TREX 009947.0006

281.784.4700 phone • 281.784.4750 fax

“Experience Makes The Difference”

The contents of this message are provided for informational purposes only. Wild Well Control, Inc. does not guarantee the accuracy or completeness of the contents and assumes no liability whatsoever for loss or damage arising out of recipient's reliance on or use of the information provided herein. This message contains confidential information and is intended solely for the named recipient(s). If you are not the intended recipient, please immediately contact the sender by return e-mail and destroy all copies of the original message. Thank you.

CONFIDENTIAL

ANA-MDL-000244570

ADR039-004097

TREX 009947.0007