

From: William Burch
Sent: Sat May 22 21:11:08 2010
To: Wellings, James S
Subject: RE: Reservoir Engineering Support
Importance: Normal
Attachments: MC252 Blowout Rates (OLGA-WellKill).ppt

So which flow path do you think is happening? And is there any down hole choking? The rates attached in the PPT assumes no restrictions – just choked at the subsea BOP.

Bill

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From: Wellings, James S [mailto:James.Wellings@bp.com]
Sent: Saturday, May 22, 2010 3:49 PM
To: William Burch
Subject: RE: Reservoir Engineering Support

Okay, so to keep the well at 8000 psi we need to flow 20,000 BOPD. The well is currently flow at 3100 psi, so what is the flow rate now?

From: William Burch [mailto:bburch@wildwell.com]
Sent: Thursday, May 20, 2010 2:08 PM
To: Wellings, James S; Holt, Charles A; Thierens, Harry H
Cc: Miller, Richard A; Pattillo, Phillip D; Sprague, Jonathan D; McAughan, Kelly; Kercho, Debbie A; Bodek, Robert; Rygg, Ole (Unknown Business Partner); Mix, Kurt; Girlinghouse, Kerry (UNKNOWN BUSINESS PARTNER); Barnett, David (UNKNOWN BUSINESS PARTNER); Moody, David (UNKNOWN BUSINESS PARTNER); Murphy, Christopher (Wild Well Control, Inc); Dicky J. Robichaux; Ng, Fred (Contractor)

TREX-130097.0001

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BP-HZN-2179MDL02200421

Subject: RE: Reservoir Engineering Support
Mr. Wellings,

I hope this helps to give some guidance for the flow back question below.

The maximum shut-in pressure (with a full column of reservoir fluid) is estimated between 8,400 psi (~5.3 ppg) and 8,900 psi (~4.34 ppg). (05/13 meeting)

From the email trail below, the M57C and the M56A sands are not expected to contribute quickly to the shut in and cross-flow potential between zones (M57C, M56A, and the main sand lobes of M56B-F – see attached diagram) is highly likely. Therefore, until sufficient time has passed (>several hours), there is believed to be no significant change in the shut-in pressure.

Since the shut-in pressure is greater than the various estimated bubble points (6,300 – 6,550 psi), any free gas will be completely in solution. Any flow back which doesn't drop the pressure below the bubble point will be as a single phase oil.

For calculation purposes, it is assumed that the following are valid:

- Molecular composition is from the fluid sample at 18,124 ft.
- The reservoir deliverability (PI) is still 50 bbl/d/psi drawdown, no water cut, and the original reservoir pressure of 11,835 psi @ 18,055 ft is still present.
- There is no significant elevation difference between the subsea BOP outlet, manifold, or choke.
- The oil can be assumed to behave like a Newtonian fluid for frictional pressure losses calculations
- The flow path is unrestricted annular flow from the reservoir to the choke (~maximum flow potential 69,500 bbl/d to the seafloor); there is no low/high choke effects.
- The oil viscosity can be averaged across the entire wellbore as 0.25 cp (some thickening due to the flowing wellhead temperature ~180 deg F.)

It is very difficult to reach critical velocities with single phase liquids across any choke. Therefore, it is assumed that any gas would be liberated downstream of the choke (<bubble point) and there is no resulting back pressure of the system due to sonic (or choked) flow being reached upstream of the choke.

So, in a nutshell, if a 200' 3" ID line was tied back from the subsea BOP to subsea manifold (all 3" ID) and a seafloor choke and dump line were installed, what is the maximum desired operating pressure & therefore resulting flow back required if the worst-case shut-in pressure was realized?

Q_{oil} (bopd)	100	500	1,000	5,000
Q_{oil} (gpm)	2.9	14.6	29.2	145.8
Pressure Loss (psi)	0	1	4	72
FBHP (psi)	11835	11834	11831	11763
FWHP (psi)	8900	8899	8896	8828

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10,000	15,000	20,000	25,000	30,000
291.7	437.5	583.3	729.2	875.0
241	491	812	1200	1651
11594	11344	11023	10635	10184
8659	8409	8088	7700	7249
32,503				
948.0				
1900				
9935				
7000				

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From: Pattillo, Phillip D [mailto:Phillip.Pattillo@bp.com]
Sent: Thursday, May 20, 2010 12:26 PM
To: William Burch
Cc: MC252_Email_Retention
Subject: RE: Reservoir Engineering Support

Bill,

I just want to make sure I don't mislead you. The numbers I sent you earlier today have NO SAFETY FACTOR.

Let me know if this is unclear.

Thanks,

Phil

TREX-130097.0003

Tubular Problem? Try the Tubular Technology website
<https://epti.bpglobal.com/C10/C7/Tubular%20Technology/default.aspx>
BP America
501 Westlake Park Blvd., Houston, TX 77079
O: +1.281.366.2133
C: +1.713.501.7753

From: Pattillo, Phillip D [mailto:Phillip.Pattillo@bp.com]
Sent: Thursday, May 20, 2010 10:30 AM
To: William Burch
Cc: Miller, Richard A
Subject: RE: Reservoir Engineering Support

Bill,

I'm assuming static shut-in.

The answer to #4 is 9,059 psi, that is, we have a 159 psi margin between maximum shut-in at 8,900 psi and the rating of the 16 in. seal assembly.

If we can accept damage to the seal assembly and slight yielding of the 16 in. casing, we can go to 9,999 psi before rupturing the uppermost burst disk.

Thanks,

Phil

Tubular Problem? Try the Tubular Technology website
<https://epti.bpglobal.com/C10/C7/Tubular%20Technology/default.aspx>
BP America
501 Westlake Park Blvd., Houston, TX 77079
O: +1.281.366.2133
C: +1.713.501.7753

From: William Burch [mailto:bburch@wildwell.com]
Sent: Thursday, May 20, 2010 10:01 AM
To: Pattillo, Phillip D
Subject: RE: Reservoir Engineering Support
Phil,

Please see question #4 – I appreciate your guidance on the final limits. Thanks,

TREX-130097.0004

Bill

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From: Ole B. Rygg [mailto:Ole.Rygg@addenergy.no]
Sent: Wednesday, May 19, 2010 5:16 PM
To: William Burch
Cc: Mix, Kurt
Subject: RE: Reservoir Engineering Support

Bill,
see below:

regards,
Kurt and Ole

From: William Burch [mailto:wburch@wildwell.com]
Sent: 19. mai 2010 22:58
To: Mix, Kurt
Cc: David Barnett; Sprague, Jonathan D; McAughan, Kelly; Kercho, Debbie A; robert.bodek@bp.com; Ole B. Rygg
Subject: RE: Reservoir Engineering Support

Kurt,

I met with Mr. Wellings about the request below. In order to answer it, we need to know the following:

1. Are we *officially* honoring the M57C GeoTap 14.15 ppg pore pressure (@ 17,723 ft MD – driller's tally) for the shut-in condition?

No, but we are honoring it as the upper limit for the balancing the wellbore after final kill. From reservoir department, the understanding was that

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the gas stringer was small and would have been substantially depleted during the time period of the open flow.

2. Are we willing to accept cross-flow from the M57C (if #1 is true) reservoir into either the M56B-M56F or M56A packages? If so, then the maximum shut-in pressure will be driven by the PI of the M57C reservoir and the injectivity of the M56A-F sands.

Yes, we accept cross flow potential, but not as the primary for shut-in conditions

3. Are we willing to accept cross-flow from the M56A reservoir into any of the M56B-M56F packages?

Yes, we accept cross flow potential, but not as limit for surface pressure. Also in accordance with reservoir department

4. Most importantly, what is the *absolute maximum operating pressure* on the original MC252 #1 well that we can approach without failing the casing(s)/burst disks/16" liner top packer?

Please revert to Phil Patillo for that pressure estimate. Last we know was around 8600psi.

Thanks very much,

Bill

William Burch

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From: Wellings, James S [mailto:James.Wellings@bp.com]

Sent: Wednesday, May 19, 2010 7:42 AM

To: Kerry L. Girlinghouse

Subject: FW: Reservoir Engineering Support

Please have bill work this.

From: Sprague, Jonathan D

Sent: Wednesday, May 19, 2010 7:40 AM

To: Holt, Charles A; Wellings, James S; Thierens, Harry H

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Cc: McAughan, Kelly; Kercho, Debbie A; Rygg, Ole (Unknown Business Partner);
bburch@wildwell.com

Subject: RE: Reservoir Engineering Support
Jim,

Here are the contacts

Reservoir
Kelly McAughan
Debbie Kercho

For Dynamic Kill Modelling
Ole Rygg - Add Energy
Bill Burch - Wild Well Control

Kurt can probably help tomorrow. Today he is chasing casing design issues.

Regards,

Jon

From: Holt, Charles A

Sent: Wednesday, May 19, 2010 7:08 AM

To: Wellings, James S; Thierens, Harry H

Cc: Sprague, Jonathan D

Subject: RE: Reservoir Engineering Support

Jim, most of the numbers you are requesting have been generated, some additional modeling will be required...simply need to get those folks plugged into your team.

Jon, I suggest we get Kurt Mix plugged into Jim's team...if not, then who?

From: Wellings, James S

Sent: Wednesday, May 19, 2010 6:48 AM

To: Thierens, Harry H; Holt, Charles A

Subject: Reservoir Engineering Support

Charlie, we need a reservoir engineer to look at our bleed options to determine the following:

Max. Shut Pressure well is likely to build to when shut in
Pressure we want to maintain to keep from rupturing the burst discs in the 16"

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Volume to bleed to maintain that pressure to avoid bursting the discs

Bleed through a 3" ID hose 200' long to a choke and calculate the pressure at the choke

My fear is that the volume will be too high to be able to bleed off enough pressure through a wide open choke.

Jim Wellings
Wells Team Leader
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