
From: Merrill, Robert C [Robert.Merrill@bp.com]
Sent: Wednesday, July 21, 2010 5:20 PM
To: Merrill, Robert C; William Burch; Wulf, Gary T
Cc: Albertin, Martin L.; Vinson, Graham (Pinky); Willson, Stephen SM; Last, Nigel (Sunbury); Baker, Kate H (Swift); Tooms, Paul J
Subject: RE: Revised Depletion Values for Well Control Calculations
Attachments: Macondo Technical Note - Depln for Well Control 21Jul vB.ZIP

Bill, Gary:

Somebody noticed that I had mislabelled the "M56E" and the "M56F" as the "M57E" and "M57F"; their location in the table however is correct and this typo has been corrected in the following note:

Bob

Bob Merrill

Senior Advisor
Reservoir Engineering Community of Practice
BP EPT, Houston
Phone: +1 281-366-2049
Cell: [REDACTED]
email: merrillrc@bp.com

From: Merrill, Robert C
Sent: Wednesday, July 21, 2010 7:47 AM
To: 'William Burch'; Wulf, Gary T
Cc: Albertin, Martin L.; Vinson, Graham (Pinky); Willson, Stephen SM; Last, Nigel (Sunbury); Baker, Kate H (Swift); Tooms, Paul J
Subject: Revised Depletion Values for Well Control Calculations
Importance: High

Bill:

You asked for revised depletion values for kill operations. I hope that the enclosed meets your needs, contact me if you need more information.

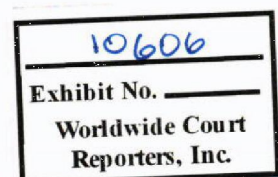
The enclosed note incorporates the observations at the BOP and updates values from my 2-July note.

Bob

Bob Merrill

Senior Advisor
Reservoir Engineering Community of Practice
BP EPT, Houston

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WW-MDL-00059524

WWC012-012683

TREX 010606.0001

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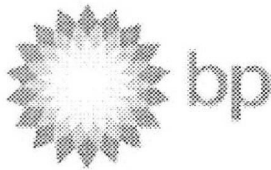
Phone: +1 281-366-2049
Cell: [REDACTED]
email: merrilrc@bp.com

WW-MDL-00059525

WWC012-012684

TREX 010606.0002

TREX-010606.0002



Macondo Technical Note

Title:	Depleted Pressure for Well Control Planning
Contributors:	Bob Merrill
Issued by:	Bob Merrill
Date:	July 21, 2010
Version:	B – DRAFT

Question Addressed in this Technical Note:

The team planning the relief well has requested a revised estimate of the pressures which they may encounter at the reservoir interval.

Key Conclusions

The likely pressure in the M56E (main oil sand) is approximately 10,100 psia. This value is based on the pressure observed at the BOP, corrected for static head. This new estimate lies within the previously estimated range for this sand, 9,360 – 10,550 psia (ref. note: “Depleted Pressure for Relief Well Planning” vA, 2-July-2010, by Bob Merrill)

The following table provides a pressure uncertainty range, the initial pressure and the most likely pressure for the M57 and M56 horizons. The most likely values are calculated from the observed BOP pressure.

Calculated Reservoir Pressures on 20-July

	Most Likely Pressure	Initial P	Extreme Cases	
			w/Aquifer 35 mbd	No Aquifer 70 mbd
	(psia)	(psia)	(psia)	(psia)
M57B	11,091	12,847	11,181	10,014
M57C	11,261	13,017	12,832	12,702
M56A	10,282	12,038	9,139	5,619
M56B	10,282	12,038	10,447	8,390
M56C	10,282	12,038	11,401	8,901
M56D	10,082	11,838	11,374	10,302
M56E	10,100	11,856	10,914	8,701
M56F	10,119	11,875	11,323	10,015

The most likely results and main oil sand are highlighted. Simulated pressures have been manually adjusted to reflect 20 days additional production.

Assumptions / Discussion

1. The most likely pressure is based on observations from the pressure gauge on the cap, adjusted to reservoir conditions assuming a static liquid head (3,300 psi).
2. Reservoir Parameters for simulation (unchanged from previous note):
 - Oil B_{oi} : 2.345 rb/stb
 - c_f : 6×10^{-6} psia⁻¹
 - c_w : 3×10^{-6} psia⁻¹
 - GOR: 2993 SCF/stb
 - OOIP: 109.9 mmstb
 - Reservoir Volumes: Oil: 257.8 mmrb, S_{wc} : 9.7% (in M56E, varies in other zones), Aquifer: 991.6 mmrb (excludes connate water, 3.8x oil volume)
3. Average depletion for each case (psi/day) from 20-April to 1-July were calculated. This factor was applied to the simulation results (through 1-July) to update them to 20-July.
4. The model is a stylized representation of the reservoir, with each layer homogeneous, and no dip.
5. Reservoir sands' properties and depths were modelled per spreadsheet "MC252 – 1 Sand Description v2.xls", (24-May, email Kelly McAughan, attached). The sands without permeability but calculated porosity were assigned a nominal permeability (see table).

Reservoir Properties

Bottom of Top of Sand MD Depth Feet	Bottom of Sand MD TVDS Depth Feet	Bottom of Sand MD TVDS Depth Feet	Fluid Content	Expected to flow (Used in Modeling)	Sand Name	Gross Sand Feet	Net Sand Feet	Pay Sand Feet	Average Gross Porosity %	Average Net Porosity %	Average Pay Porosity %	Average Net Sw %	Average Pay Sw %	Arithmetic Air Perm mD	Geometric Air Perm mD	Geometric Perm converted to Oil (85%) mD	Perm Used in Model mD	Temperature Degrees F	Pressure psia	Pressure Depth Column Feet TVDSS
12030.0	12244.0	11845.0	Gas	Yes if Linear Leak	S023	2	2	2								1000	N/A	162	7081 psia (based on 11.3 ppg pore pressure)	12653
13227.2	13230.2	13141.6	Gas	Yes if Linear Leak	S026	3	3	3								1000	N/A	178	8406 psia (based on 12.3 ppg pore pressure)	13143
17467.0	17466.0	17381.1	Gas	Yes	M57B	2	2	2	17.95	17.95	17.95	51.58	51.58	15.08	7.5	7.50	7.5	234	12847 psia (based on post well 14.2 ppg pore pressure)	17382
17700.0	17708.5	17614.1	Uncertain	No	M57C	8.5	0	0	8.95								0.1	237	13017 psia (Geo tap @ 17713' tvdss) (MDT 3 attempts no seal)	17713
17804.0	17806.5	17719.1	Oil or Gas	Yes	M56A	2.5	2.5	2.5	22.48	22.48	22.48	24	24	1702.97	467.39	397.28	397.3	239	12038 psia (one MDT pressure at 17721' tvdss)	17721
17975.5	17985.5	17899.6	Brine	No	M56B	5	3	0	14.18	16.99	22.48	57.85	24	7.43	3.12		3.0	241		
18030.0	18032.0	17944.1	Brine	No	M56C	2	2	0	17.28	17.28		64.2		4.73	4.05		4.0	241		
18067.0	18086.0	17981.1	Oil	Yes	M56D	22	22	22	20.67	20.67	20.67	17.17	17.17	257.87	101.8	86.53	86.5	242	11838 psia (MDT & Geotap)	17893
18120.0	18191.0	18034.1	Oil	Yes	M56E	69.5	64.5	64.5	21.42	22.08	22.08	9.7	9.7	514.04	323.79	275.32	275.2	243	11866 psia (MDT)	18095
18217.5	18238.5	18131.5	Oil	Yes	M56F	6.5	6.5	6.5	21.09	21.09	21.09	21.85	21.85	1440.58	129.87	110.39	110.4	244	11875 psia (based on fluid gradient 0.588 g/cc)	18142

Vsh=0.4 Para=0.14 Sw=0.5 Vsh=0.4 Para=0.14 Sw=0.5

If Density log is not corrected to match core porosity
18067.0 18086.0 17981.1 18003.1 Oil No Use Other M56D 22 22 22 18.32 18.32 18.32 18.55 18.55 26.98 10.46 26.96

1. From core in M56D and M56E: K (Klinkenberg air core at net confining stress = 2000 psi) is a function of core porosity at net confining stress
2. Log porosity is calibrated to core porosity at net confining stress in M56D & M56E
3. Log perm is calculated from core derived equation (from #1)

Gross has Vshale cut off Vsh=0.4
Net has a Porosity cut off Para=0.14
Pay has a Sw cut off Sw=0.5

Water Depth = 4892 feet