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Since several of you have asked for the final version of the Dynamic Kill Technical Fact Note, please see attached.

Thanks very much,

Bill

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Dynamic Kill Technical File Note

A	**15-Jun-10**	**Draft--For Review and Comment**	**Kurt Mix**	**Pat O'Bryan**
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AMENDMENT RECORD

Amendment Date	Revision Number	Amender Initials	Amendment

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1 Executive Summary

Table 1-1: Dynamic Kill at the Shallow Intercept (15,914-ft TVDss) with 11-7/8-in Liner Set and 14.2-ppg SOBM

Case	Description	Kill Rate (bpm)	Maximum Pressure (psi)	Maximum EMW (ppg)	Volume to Stop Influx (bbls)	Total Volume (bbls)
1	Production Casing Annulus	28	12,003	14.42	1,400	8,500
2	Production Casing	39	11,730	14.10	2,100	12,000
3	Production Casing + Annulus	62	11,570	13.90	3,700	18,000

Table 1-2: Dynamic Kill at the Intermediate Intercept (17,032-ft TVDss) with 11-7/8-in Liner Set and 14.2-ppg SOBM

Case	Description	Kill Rate (bpm)	Maximum Pressure (psi)	Maximum EMW (ppg)	Volume to Stop Inflow (bbls)	Total Volume (bbls)
4	Production Casing Annulus	22	12,680	14.24	1,100	4000
5	Production Casing	35	12,325	13.84	1,900	6,000
6	Production Casing + Annulus	55	12,504	14.05	2,800	10,000

Table 1-3: Dynamic Kill at the Deep Intercept (17,132-ft TVDss) with 9-7/8-in Liner Set and 14.2-ppg SOBM

Case	Description	Kill Rate (bpm)	Maximum Pressure (psi)	Maximum EMW (ppg)	Volume to Stop Inflow (bbls)	Total Volume (bbls)
7	Production Casing Annulus	21	12,963	14.48	1,000	2,500
8	Production Casing	33	12,499	13.96	1,800	4,000
9	Production Casing + Annulus	50	12,265	13.70	2,500	6,000

2 Introduction

The blowout and dynamic kill simulator used for the primary determination of the production and kill rate was OLGA-WELL-KILL and was run by *add wellflow AS*. The simulator is powered by

OLGA and has been tailor-made for well kill modeling applications. The results and graphs included in the Appendix were also developed by *add wellflow AS*.

A custom PVT file was developed by *add wellflow AS* and is based on the molecular composition of the reservoir fluid sample collected during the formation evaluation logging program of the M56E formation. No flow was modeled from the M57 formation nor the M56A, M56B, or M56C intervals.

The Statement of Requirements (SoR) objective for the dynamic kill is to successfully bring the producing formations under control by achieving an equivalent mud weight greater than 12.60 ppg at the top of the M56D formation by using 14.20-ppg SOBM (the virgin M56D formation was measured with MDT at 11,838 psia at 17,993-ft TVDss). The SoR also states that for the successful isolation of the producing formations, 14.20-ppg-equivalent bottom-hole pressure must be achieved in order to control the highest possible virgin pore pressure observed in the MC 252 #1 well (the virgin M57C formation was measured with GeoTap at 13,017 psia at 17,713-ft TVDss.)

For the purposes of calculating the equivalent mud weights, only TVD depths are taken into consideration. Measured Depths are only of concern when calculating frictional pressure losses. To convert between TVDss and the TVD of the various datum,

- DD3 has 88 ft of RKB above the mean sea level.
- Horizon had 75 ft of RKB above the mean sea level.
- There is 13 ft of TVD difference.
- *To simplify, all depths are referenced to TVDss to help clarify and unify discussions.*

The reservoir productivity data (PI) was supplied by BP to be approximately 50 bbl/psi/day. Based on the estimated bubble point of the oil and calculated flowing bottom-hole pressure, a linear inflow performance relationship was used in the modeling to analytically describe the reservoir's delivery. The reservoir injectivity data (EI) was assumed as 1/10 of the productivity (~5 bbl/psi/day).

The simulations are based on the most likely flow path up the production casing annulus to the seafloor exit. For these models, flow exiting through the 16-in casing rupture disks or various liner tops was not taken into consideration. To define the worst-case scenarios, no flow restrictions were placed on the annulus or at the subsea BOP for the dynamic kill modeling – i.e. flow is unrestricted from the reservoir to the seafloor. Since there is significant uncertainty with the blowout flow path, production rate, and flow path restrictions, additional simulations were performed for the production casing to the seafloor exit as well as a combination of the production casing and annulus to the seafloor exit to establish the range of rates required to kill the well.

In order for the dynamic kill to be successful, it is assumed that when the relief well intersects the MC 252 #1 wellbore, the wellhead has not been capped or the flow has not been shut-in – whether by mechanical means or bridging off by produced solids. If a subsea capping operation does occur prior to the intersection, a dynamic kill cannot be performed and the relief well may experience significant well control issues due to the shut-in pressure most likely exceeding the maximum kick tolerance. This Dynamic Kill Technical File Note is focused only on the dynamic kill modeling results and required static mud weights as outlined in the SoR.

There is also significant possibility that, prior to the relief well intersecting the MC 252 #1 wellbore, a wellhead pressure seal may be installed providing a flow conduit to a surface production vessel. There is a separate document, entitled "Production Riser Effect of the Hydraulic Kill Operation," which discusses the changes to the dynamic kill operation, requirements, and procedures.

The biggest unknown variable of all of the dynamic kill assumptions is the possibility that the Macondo MC 252 #1 well is currently flowing through the failed casing burst disks into the exposed formation just below the 18-in liner shoe. It is believed that the casing burst disks most likely failed by collapse during the initial blowout at the rotary table. There is no evidence to suggest that the Top Kill operations had compromised the disks during the various stages of the pumping operations. Although a very remote possibility, simulations were run nevertheless to evaluate the possible rate of the underground blowout and required pressure at surface necessary to sustain two exit conditions. In all simulations with unrestricted flow at the seafloor, it is not possible for the two flow path scenarios to exist simultaneously (i.e. the path of least resistance is to the seafloor and not the exposed formation at the 18-in liner shoe).

In order to have two exit points, the subsea BOP pressure needs to be approximately 4,500 psi, which is higher than any pressure data that has been recorded to date. Although the subsea BOP pressure has varied several times since the start of the well control event, it has not exceeded 4,000 psi to date. If one were to assume that the subsea BOP pressure were to increase for some reason to 4,500 psi, the effect would reduce the production rate and therefore the required dynamic kill rate. The simulations indicate that approximately 31,000 bopd would be produced at the seafloor and approximately 3,300 bopd would be exiting in the underground blowout. In order to dynamically kill the well, 18 bpm of 14.2-ppg mud would be required to be pumped. The higher the subsea BOP pressure, the less oil would be produced at the seafloor and the lower the kill rate required. Ultimately, if the well was shut-in and the entire flow was to exit out the exposed 18-in liner shoe, the production rate would be relative to the fracture propagation pressure and fluid leak-off until possible broaching occurred, which is discussed in detail in the EPT Technical Memo entitled "Potential for a broach at the 18-inch casing shoe in the Macondo well during top-kill operations," by Dr. Stephen Willson.

If the 4,500-psi scenario described above is valid, then once the well is brought back under control, a static mud column of 16.5-ppg SOBM from the mud line to TD is not possible without exceeding the fracture pressure of the 18-in liner shoe (12.10-ppg-equivalent mud weight or 5,644 psi with the riser margin.) The 18-in liner shoe had a measured leak off of 11.55-ppg equivalent mud weight (5,386 psi). When corrected for the air gap removal, the 18-in liner shoe is good for 11.65-ppg-equivalent mud weight. If the planned static mud weight of 16.5-ppg SOBM is pumped after the dynamic kill with 14.2-ppg SOBM and mud is able to exit out of the 18-in liner shoe, the M57C formation will be left underbalanced. In order to balance the underground blowout and the M57C with the seawater column, 17.11-ppg SOBM is required behind the 14.2-ppg dynamic kill mud. The underground blowout is not part of the SoR.

The blowout rate estimations by *add wellflow as* indicated a maximum rate up the production casing annulus of 43,000 bopd, up the production casing of 63,000 bopd, and up a combination of production casing and annulus of 87,000 bopd was possible at the seafloor. Again, all simulations are run for worst-case dynamic kill requirements, which means no restrictions in the flow path (i.e. downhole gravel pack, the effects of the wash string, flow choking across the subsea BOP rams, etc.) and no underground blowout.

3 Simulation Results

3.1 Shallow Intercept

The earliest anticipated shallow intercept is the first "pass-by" of the original Macondo MC 252 #1 wellbore at 15,914-ft TVDss (15,989-ft TVD Horizon / 16,002-ft TVD DD3). In this scenario, an unanticipated intersection would occur while drilling the 10-5/8-in hole for the 9-7/8-in casing point at 17,032-ft TVDss (17,107-ft TVD Horizon / 17,120-ft TVD DD3). The open hole will be enlarged to 12-1/4-in after the initial bit run. It is anticipated that the 11-7/8-in liner set at 15,112-ft TVDss (15,187-ft TVD Horizon / 15,200-ft TVD DD3) will achieve a downhole LOT equal to the Most Likely Shale Frac Gradient of 14.6-ppg-equivalent mud weight (11,540 psi). This fracture pressure at the 11-7/8-in liner shoe is assumed to be the weakest formation exposed during the dynamic kill. Since the pressure during the kill is estimated at the intersection point, the maximum equivalent fracture gradient at the intersection point which corresponds to the fracture pressure at the shoe is used for comparison. For the shallow intercept, there is 802-ft TVD difference between the liner shoe and the shallowest intercept point. Therefore, 592 psi (the hydrostatic contribution of a 14.2-ppg column of SOBM) was added onto the 11,540-psi fracture pressure to yield a maximum-allowable pressure of 12,132 psi (or a 14.58-ppg equivalent).

Although the probability of shallow intercept is extremely low, there is a remote possibility of early collision. There is no possibility of shallower intercept on the first relief well (MC 252 #3) due to the directional path currently planned and the cone of uncertainty around the target well.

In order to displace the hydrocarbons below the intersection point, additional pumping time (after the inflow has been stopped) will be required. During this period, the hydrocarbons left in the wellbore above the intersection point will be displaced out to the seafloor and the hydrocarbons below the intersection point will be bullheaded back into the formation. The pumping time required to push the remnant hydrocarbons into the formation will depend on the injectivity of the formation. For the base case, it was assumed that the EI (injectivity data) is approximately equal to 1/10 of the PI (productivity data). Please note that it is assumed in the simulations that the pump rate after the initial dynamic kill (stopping the influx from the reservoir) will continue at the same rate. This most likely will be adjusted to a reduced pump rate as guided by the downhole pressure measurement.

3.1.1 <u>Case 1 – Production Casing Annulus</u>

28-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the Production Casing Annulus flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,003 psi, which indicates that no fracturing of the 11-7/8-in liner shoe was initiated. The pumping time to stop the reservoir influx took 50 minutes. The volume required to displace all hydrocarbon in the wellbore was 8,500 bbls.

3.1.2 Case 2 – Production Casing

39-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the Production Casing flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 11,730 psi, which indicates that no fracturing of the 11-7/8-in liner shoe was initiated while circulating the casing. The pumping time to stop reservoir inflow took 55 minutes. The volume required to displace all hydrocarbon in the wellbore was 12,000 bbls.

3.1.3 Case 3 – Production Casing + Annulus

62-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the Production Casing + Annulus flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 11,570 psi, which indicates that no fracturing of the 11-7/8-in liner shoe was initiated while circulating the casing and the casing annulus. The pumping time to stop reservoir inflow took 60 minutes. The volume required to displace all hydrocarbon in the wellbore was 18,000 bbls.

3.2 Intermediate Intercept

An intermediate intercept case was run assuming the 11-7/8-in liner shoe was still exposed, but the intercept point occurred right at the end of the 10-5/8-in x 12-1/4-in section at 17,032-ft TVDss. In similar fashion as above, the fracture pressure was moved down to the intercept point, which is 2,020-ft TVD deeper. Therefore, 1,491 psi was added onto the 11,540-psi fracture pressure, giving a maximum-allowable pressure of 13,031 psi (or an equivalent of 14.64 ppg.)

3.2.1 Case 4 – Production Casing Annulus

22-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the annular flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,680 psi, which indicates that no fracturing of the 11-7/8-in liner shoe was initiated. The pumping time to stop reservoir inflow took 50 minutes. The volume required to displace all hydrocarbon in the wellbore was 4,000 bbls.

3.2.2 Case 5 – Production Casing

35-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the casing flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,325 psi, which indicates that no fracturing of the 11-7/8-in liner shoe was initiated while circulating the casing. The pumping time to stop reservoir inflow took 55 minutes. The volume required to displace all hydrocarbon in the wellbore was 6,000 bbls.

3.2.3 Case 6 – Production Casing + Annulus

55-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the casing flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,504 psi, which indicates that no fracturing of the 11-7/8-in liner shoe was initiated while circulating the casing and the casing annulus. The pumping time to stop reservoir inflow took 50 minutes. The volume required to displace all hydrocarbon in the wellbore was 10,000 bbls.

3.3 Deep Intercept (Planned)

The planned deep intercept of 17,132-ft TVDss (17,207-ft TVD Horizon / 17,220-ft TVD DD3) has been modeled assuming the DD3 has successfully drilled the 10-5/8-in x 12-1/4-in hole section and cemented the 9-7/8-in liner in place. In this scenario, the planned intersection would occur while drilling the 8-1/2-in section towards the original MC 252#1 9-7/8-in open hole and into the 7-in production casing. This intercept depth is above any exposed hydrocarbon formations that may or may not have been originally isolated. It is anticipated that relief well 9-7/8-in liner set at 17,032-ft TVDss (17,107-ft TVD DD3) will achieve a downhole leak off test equal to the Most Likely Shale Frac Gradient of 15.1-ppg-equivalent mud weight (13,442 psi). This fracture pressure at the 9-7/8-in liner shoe is assumed to be the weakest formation exposed during the dynamic kill. In similar fashion as above, the fracture pressure was moved down to the intercept point, which is 100-ft TVD deeper. Therefore, 74 psi was added onto the 13,442-psi fracture pressure giving a maximum allowable pressure of 13,516 psi (or an equivalent of 15.09 ppg.)

3.3.1 Case 7 – Production Casing Annulus

21-bpm dynamic kill rate with 14.2-ppg SOBM can be pumped into the annular flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,963 psi, which indicates that no fracturing of the 9-7/8-in liner shoe was initiated. The pumping time to stop reservoir inflow took 50 minutes. The volume required to displace all hydrocarbon in the wellbore was 2,500 bbls.

3.3.2 Case 8 – Production Casing

33-bpm dynamic kill rate with 14.2 ppg SOBM can be pumped into the casing flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,499 psi, which indicates that no fracturing of the 9-7/8-in liner shoe was initiated while circulating the casing. The pumping time to stop reservoir inflow took 55 minutes. The volume required to displace all hydrocarbon in the wellbore was 4,000 bbls.

3.3.3 Case 9 – Production Casing + Annulus

50-bpm dynamic kill rate with 14.2 ppg SOBM can be pumped into the casing flow path and result in a successful dynamic kill of the producing formations. The maximum pressure at the intercept point was 12,265 psi, which indicates that no fracturing of the 9-7/8-in liner shoe was initiated while circulating the casing and the casing annulus. The pumping time to stop reservoir inflow took 50 minutes. The volume required to displace all hydrocarbon in the wellbore was 6,000 bbls.

3.4 Contingency Modeling with Seawater

A contingency case was also established addressing the very unlikely event that seawater would have to be pumped down the relief well due to lack of SOBM mud availability on the DD3. Simulations were performed to determine the dynamic kill requirement using seawater as a kill fluid and are shown in the table below.

Case	Description	Deep Intercept (bpm)	Intermediate Intercept (bpm)	Shallow Intercept (bpm)
1	Production Casing Annulus	44	46	60
2	Production Casing	82	84	90
3	Production Casing + Annulus	120	125	150

As expected, the loss of hydrostatic pressure by using seawater vs. 14.2 ppg SOBM resulted in significantly higher kill rates. The results show that while the dynamic kill with seawater is possible for some of the cases from the primary kill vessel (DD3), the seawater alone is not sufficient for establishing the equivalent mud weight as outlined in the SoR. In essence, pumping seawater is only an intermediate step prior to follow up with a SOBM to balance the reservoir pressure.

Please note: Seawater will only be used to temporarily reduce the flow from the reservoir and fill up the relief well to prevent hydrocarbons from propagating up the relief well. A minimum pump rate to avoid gas migration is in the order of 15 bpm depending on the current relief well configuration and BHA.

3.5 Contingency 7-5/8-in Liner

3.5.1 Rationale

A 7-5/8-in contingency liner has been made optional for the unlikely event that the 9-7/8-in liner does not reach its anticipated setting depth of 17,032-ft TVDss (17,107-ft TVD DD3) either because of mechanical difficulty or because the 11-7/8-in liner does not reach its anticipated setting depth, or that the 7-5/8-in contingency liner is required in order to perforate into the existing 7-in production casing. The downsizing of the casing has no impact on the required dynamic kill rate for any of the three scenarios described above. In order to drill out of the

7-5/8-in contingency liner for hydraulic communication, a 4-3/4-in BHA with 6-1/2-in bit size and 3-1/2-in x 5-in x 5-7/8-in drillstring will most likely be used and therefore result in significantly higher surface pressures to deliver the same dynamic kill rate.

Note: The resulting increase in surface pressure will also greatly affect the casing load, which may need to be revisited prior to starting the dynamic kill.

If the 7-5/8-in liner is required to create hydraulic communication by perforating into the 7-in production casing, it is believed that a tubing-conveyed perforating (TCP) system of 4-in-high shot density (HSD) perforating guns would be run on a 3-1/2-in x 5-in x 5-7/8-in drillstring. Again, the downsizing of the casing has no impact on the required dynamic kill rate for any of the three scenarios described above. However, the resulting increase in surface pressure because of the perforation tunnels and reduction in annular capacity will also greatly affect the casing load, which may need to be revisited prior starting the dynamic kill.

3.5.2 Static Mud Weight Requirements

3.5.2.1 Macondo MC 252 #1 and #3 Well Data

The following data has been incorporated into the hydrostatic pressure calculations that follow:

- MC 252 #1 mudline at 5,067-ft TVD Horizon, 4,992-ft TVDss
- MC 252 #1 water depth 4,992-ft TVD (75-ft air gap)
- Sea water density is 8.55 ppg or 0.445 psi/ft
- MC 252 #1 top of BOP stack at 4,926-ft TVDss (66 ft above ML)
- MC 252 #1 M57C Geotap 14.20 ppge (13,017 psi) at 17,639-ft TVDss
- MC 252 #1 M56D MDT 12.65 ppge (11,838 psi) at 17,993-ft TVDss
- MC 252 #1 M56 reservoir fluid density 5.3 ppge (OLGA-WellKill)
- MC 252 #1 M56A MDT 13.06 ppge (12,038 psi) at 17,721-ft TVDss
- MC 252 #1 M56E base loss zone 14.56 ppge at approximately 18,174-ft TVDss
- MC 252 #1 TD at 18,274-ft TVDss
- MC 252 #1 LOT at 18-in shoe at 8,894-ft TVDss is 11.65 ppge (5,387 psi)
- MC 252 #3 estimated LOT at 11-7/8-in shoe at 15,112-ft TVDss is 14.6 ppge (11,473 psi)
- MC 252 #3 estimated LOT at 9-7/8-in shoe at 16,912-ft TVDss is 15.1 ppge (13,279 psi)

3.5.2.2 *Macondo MC 252 #1 - Hydrostatic Pressure Calculations for Deep Intercept (17,132-ft TVDss)*

Case A – Assumes that 5.3-ppg hydrocarbons remain below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, without consideration to M57C 14.2-ppge pore pressure; a 17.12-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	17.12	4,926	8,894	3,532	5,722	**12.37**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	17.12	8,894	17,132	7,332	13,054	14.65	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	5.30	17,132	18,005	241	13,295	**14.20**	M56E loss zone has 14.5-ppge FG

Case B – Assumes that 14.2-ppg mud has displaced the hydrocarbons below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, without consideration to M57C 14.2-ppge pore pressure; a 16.48-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	16.48	4,926	8,894	3,400	5,591	**12.09**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	16.48	8,894	17,132	7,060	12,650	14.20	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	14.20	17,132	18,005	645	13,295	**14.20**	M56E loss zone has 14.5-ppge FG

Case C – Assumes that 5.3-ppg hydrocarbons remain below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 14.2-ppge pore pressure; a 16.85-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	16.85	4,926	8,894	3,477	5,667	12.25	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	16.85	8,894	17,132	7,218	12,885	14.46	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	5.30	17,132	17,639	140	13,025	**14.20**	M57C has 14.2-ppge pore pressure
Hydrocarbon	5.30		18,005	101	13,126	14.02	M56E loss zone has 14.5-ppge FG

Case D – Assumes that 14.2 ppg mud has displaced the hydrocarbons below the 17,132 ft TVDss intercept to the M56D at 18,005 ft TVDss, with consideration to M57C 14.2 ppge pore pressure; a 16.48 ppg kill weight mud is required to reach static conditions. This case is the same as Case B – but focused on the M57C, which also honors the M56E.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	16.48	4,926	8,894	3,400	5,591	12.09	18-in shoe at 8,894-ft TVDss with 11.65 ppge LOT.
SBM	16.48	8,894	17,132	7,060	12,650	14.20	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	14.20	17,132	17,639	374	13,025	**14.20**	M57C has 14.2-ppge pore pressure
Hydrocarbon	14.20	17,639	18,005	270	13,295	14.20	M56E loss zone has 14.5-ppge FG

3.5.2.3 *Macondo MC 252 #1 - Hydrostatic Pressure Calculations for Shallow Intercept (15,914-ft TVDss)*

Case E – Assumes that 5.3-ppg hydrocarbons remain below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, without consideration to M57C 14.2-ppge pore pressure; an 18.43-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	18.43	4,926	8,894	3,802	5,992	12.96	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	18.43	8,894	15,914	6,726	12,719	15.37	Intercept at 11-7/8-in shoe with 14.6-ppge LOT. Shoe breaks down.
Hydrocarbon	5.30	15,914	18,005	576	13,295	**14.20**	M56E loss zone has 14.5-ppge FG

Case F – Assumes that 14.2-ppg mud has displaced the hydrocarbons below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, without consideration to M57C 14.2-ppge pore pressure; a 16.73-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	16.73	4,926	8,894	3,453	5,643	12.20	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	16.73	8,894	15,914	6,108	11,751	14.20	Intercept at 11-7/8-in shoe with 14.6-ppge LOT.
Hydrocarbon	14.20	15,914	18,005	1,544	13,295	**14.20**	M56E loss zone has 14.5-ppge FG

Case G – Assumes that 5.3-ppg hydrocarbons remain below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 14.2-ppge pore pressure; an 18.13-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	18.13	4,926	8,894	3,741	5,931	12.82	18-in shoe at 8,894-ft TVDss with 11.65 ppge LOT.
SBM	18.13	8,894	15,914	6,618	12,549	15.16	Intercept at 11-7/8-in shoe with 14.6-ppge LOT. Shoe breaks down.
Hydrocarbon	5.30	15,914	17,639	475	13,025	**14.20**	M57C has 14.2-ppge pore pressure
Hydrocarbon	5.30	17,639	18,005	101	13,126	14.02	M56E loss zone has 14.5-ppge FG

Case H – Assumes that 14.2-ppg mud has displaced the hydrocarbons below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 14.2-ppge pore pressure; a 16.73-ppg kill weight mud is required to reach static conditions. This case is the same as Case F – but focused on the M57C, which also honors the M56E.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	16.73	4,926	8,894	3,453	5,643	12.20	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	16.73	8,894	15,914	6,108	11,751	14.20	Intercept at 11-7/8-in shoe with 14.6-ppge LOT.
Hydrocarbon	14.20	15,914	17,639	1,274	13,025	**14.20**	M57C has 14.2-ppge pore pressure
Hydrocarbon	14.20	17,639	18,005	270	13,295	14.20	M56E loss zone has 14.5-ppge FG

3.5.2.4 Macondo MC 252 #1 - Hydrostatic Pressure Calculations for Deep Intercept (17,132-ft TVDss) assuming that the M57C is depleted

Case I – Assumes that 5.3-ppg hydrocarbons remain below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 12.6-ppge depleted pore pressure; a 14.76-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.76	4,926	8,894	3,045	5,235	**11.32**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	14.76	8,894	17,132	6,321	11,556	**12.97**	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	5.30	17,132	17,639	140	11,696	12.75	M57C has 12.6-ppge pore pressure
Hydrocarbon	5.30	17,639	18,005	101	11,797	**12.60**	M56E loss zone has 14.5-ppge FG

Case J – Assumes that 14.2-ppg mud has displaced the hydrocarbons below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 12.6-ppge depleted pore pressure; a 14.17-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.17	4,926	8,894	2,923	5,113	**11.06**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	14.17	8,894	17,132	6,069	11,183	**12.55**	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	14.20	17,132	17,639	374	11,557	**12.60**	M57C has 12.6-ppge pore pressure
Hydrocarbon	14.20	17,639	18,005	270	11,827	12.63	M56E loss zone has 14.5-ppge FG

3.5.2.5 *Macondo MC 252 #1 - Hydrostatic Pressure Calculations for Shallow Intercept (15,914-ft TVDss) assuming that the M57C is depleted*

Case K – Assumes that 5.3-ppg hydrocarbons remain below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 12.6-ppge depleted pore pressure, a 15.80-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe breaks down.
SBM	15.80	4,926	8,894	3,261	5,451	**11.79**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	15.80	8,894	15,914	5,769	11,221	**13.56**	Intercept at 11-7/8-in shoe with 14.6-ppge LOT.
Hydrocarbon	5.30	15,914	17,639	475	11,696	12.75	M57C has 12.6-ppge pore pressure
Hydrocarbon	5.30	17,639	18,005	101	11,797	**12.60**	M56E loss zone has 14.5-ppge FG

Case L – Assumes that 14.2-ppg mud has displaced the hydrocarbons below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 12.6-ppge depleted pore pressure, a 14.16-ppg kill weight mud is required to reach static conditions.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.16	4,926	8,894	2,923	5,113	**11.05**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	14.16	8,894	15,914	5,171	10,283	12.43	Intercept at 11-7/8-in shoe with 14.6-ppge LOT.
Hydrocarbon	14.20	15,914	17,639	1,274	11,557	**12.60**	M57C has 12.6-ppge pore pressure
Hydrocarbon	14.20	17,639	18,005	270	11,827	12.63	M56E loss zone has 14.5-ppge FG

3.5.2.6 Macondo MC 252 #1 - Hydrostatic Pressure Calculations for Deep Intercept (17,132-ft TVDss) with Underground Blowout

Case M – Assumes that 5.3-ppg hydrocarbons remain below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, without consideration to M57C 14.2-ppge pore pressure, a 17.89-ppg kill weight mud is required to reach static conditions with the 14.20-ppg dynamic kill weight mud still in the hole.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.20	4,926	7,505	1,904	4,094	10.49	
SBM	17.89	7,505	8,894	1,293	5,387	**11.65**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	17.89	8,894	17,132	7,665	13,052	**14.65**	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	5.30	17,132	17,639	140	13,192	14.38	M57C has 12.6-ppge pore pressure
Hydrocarbon	5.30	17,639	18,005	101	13,293	**14.20**	M56E loss zone has 14.5-ppge FG

Case N – Assuming 14.2-ppg mud has displaced the hydrocarbons below the 17,132-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 14.2-ppge pore pressure, a 16.96-ppg kill weight mud is required to reach static conditions with the 14.20-ppg dynamic kill weight mud still in the hole.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.20	4,926	7,036	1,558	3,748	10.24	
SBM	16.96	7,036	8,894	1,639	5,387	**11.65**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	16.96	8,894	17,132	7,266	12,653	**14.20**	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	14.20	17,132	17,639	374	13,027	**14.20**	M57C has 12.6-ppge pore pressure
Hydrocarbon	14.20	17,639	18,005	270	13,297	14.20	M56E loss zone has 14.5-ppge FG

3.5.2.7 *Macondo MC 252 #1 - Hydrostatic Pressure Calculations for Shallow Intercept (15,914-ft TVDss) with Underground Blowout*

Case O – Assumes that 5.3-ppg hydrocarbons remain below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, without consideration to M57C 14.2-ppge pore pressure, a 20.08-ppg kill weight mud is required to reach static conditions with the 14.20-ppg dynamic kill weight mud still in the hole.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.20	4,926	8,022	2,286	4,476	10.73	
SBM	20.08	8,022	8,894	911	5,387	**11.65**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	20.08	8,894	15,914	7,330	12,717	**15.37**	Intercept at 9-7/8-in shoe with 15.1-ppge LOT breaks down.
Hydrocarbon	5.30	15,914	17,639	475	13,192	14.38	M57C has 12.6-ppge pore pressure
Hydrocarbon	5.30	17,639	18,005	101	13,293	**14.20**	M56E loss zone has 14.5-ppge FG

Case P – Assuming 14.2-ppg mud has displaced the hydrocarbons below the 15,914-ft TVDss intercept to the M56D at 18,005-ft TVDss, with consideration to M57C 14.2-ppge pore pressure, a 17.43-ppg kill weight mud is required to reach static conditions with the 14.20-ppg dynamic kill weight mud still in the hole.

FLUID	PPG	TOP DEPTH TVDSS	BOTTOM DEPTH TVDSS	INTERVAL STATIC PSI	CUMULATIVE STATIC PSI	PPGE	COMMENTS
Seawater	8.55	0	4,926	2,190	2,190	8.55	Assuming rupture disks in 16-in casing have failed, 18-in shoe survives.
SBM	14.20	4,926	7,306	1,758	3,948	10.39	
SBM	17.43	7,306	8,894	1,439	5,387	**11.65**	18-in shoe at 8,894-ft TVDss with 11.65-ppge LOT.
SBM	17.43	8,894	15,914	6,363	11,750	**14.20**	Intercept at 9-7/8-in shoe with 15.1-ppge LOT
Hydrocarbon	14.20	15,914	17,639	1,274	13,024	**14.20**	M57C has 12.6-ppge pore pressure
Hydrocarbon	14.20	17,639	18,005	270	13,294	14.20	M56E loss zone has 14.5-ppge FG

Appendix A: Figures and Plots

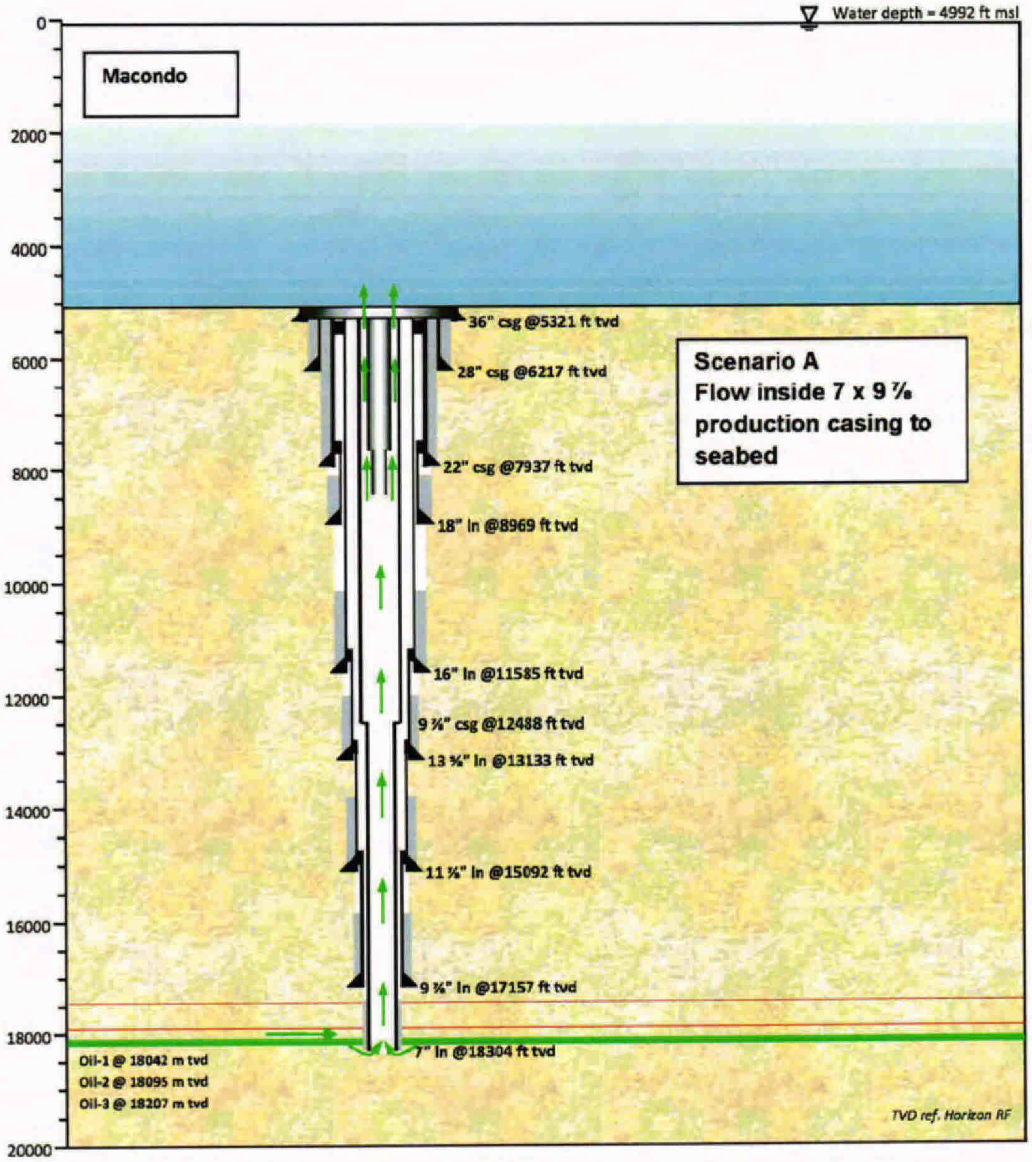

Figure 1: Sketch of flow path for flow inside production casing to seabed

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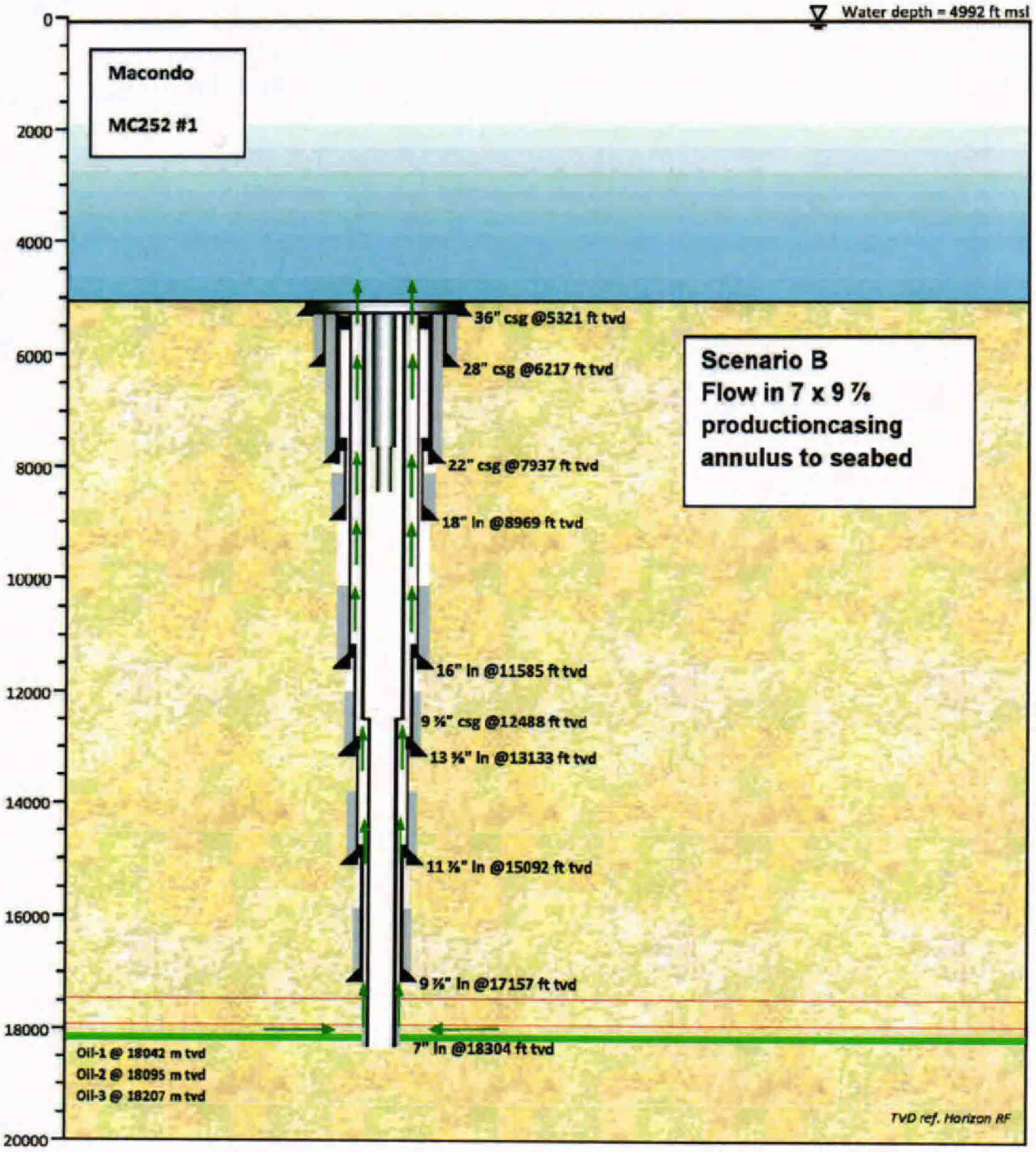

Figure 2: Sketch of flow path for flow in production casing annulus to seabed

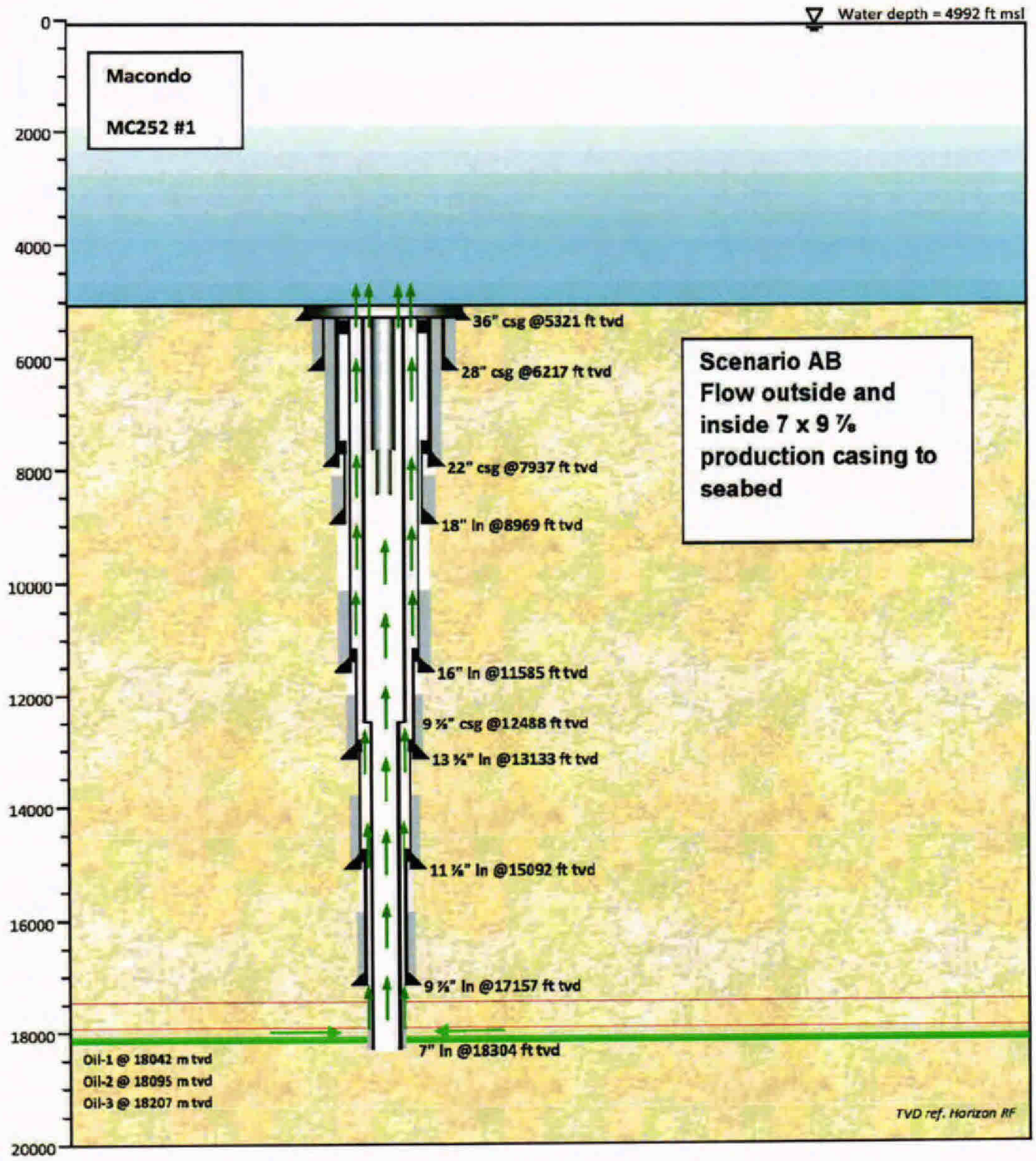

Figure 3: Sketch of flow path for flow inside and outside production casing to seabed

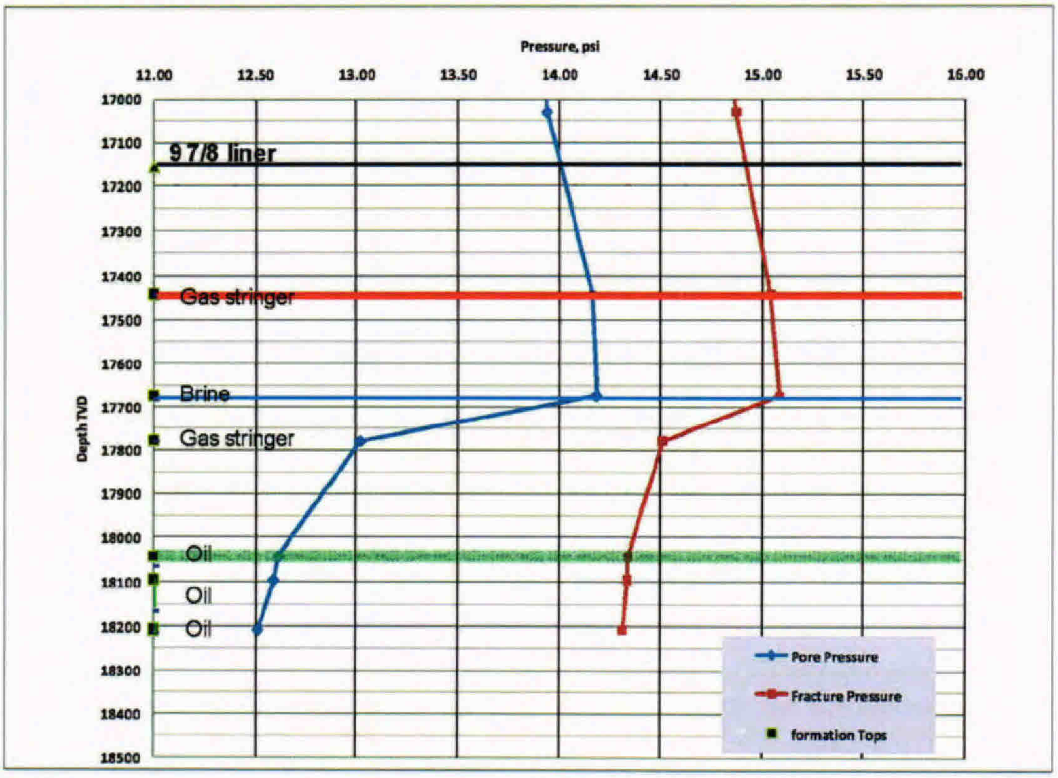

Figure 4: Pore pressure and fracture pressure across openhole section below 9-7/8-in casing of MC252 #1 well

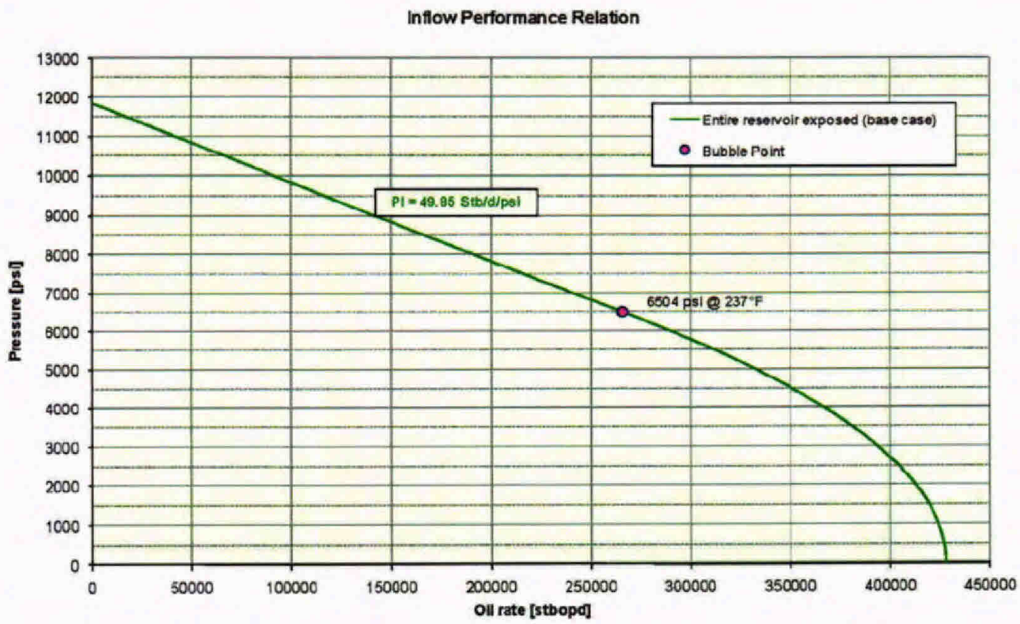

Figure 5: inflow from the three oil zones as a function of flowing bottom hole pressure. Permeability= 300 mD, 86-ft Net Pay, Oil GOR= 3000 SCF/STB, Oil density 35 API

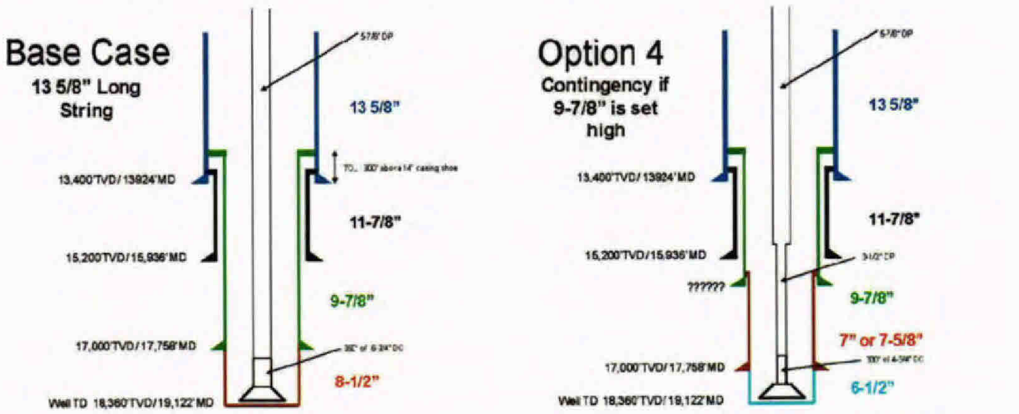

Figure 6: Relief well configurations at intersection with 13-5/8-in set or 9-7/8-in liner set prior to intersection

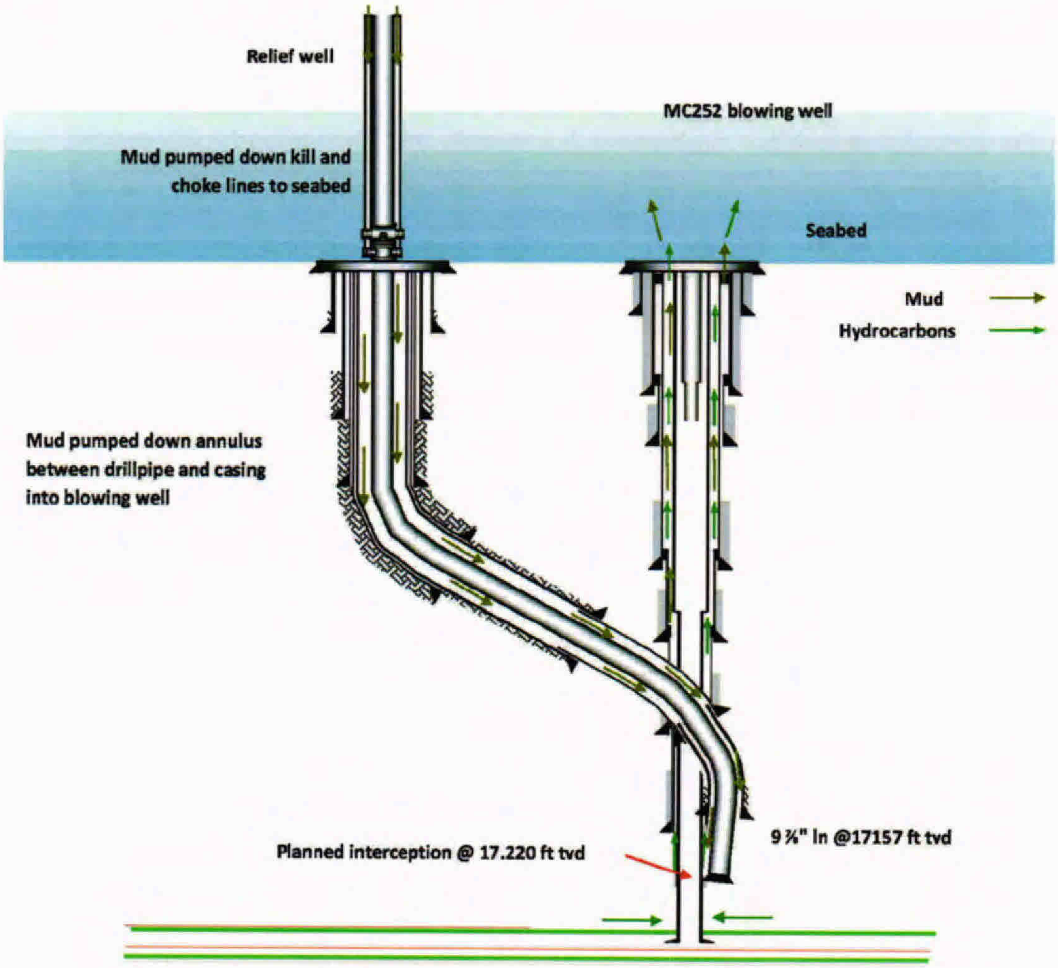

Figure 7: Sketch of relief well pumping operation

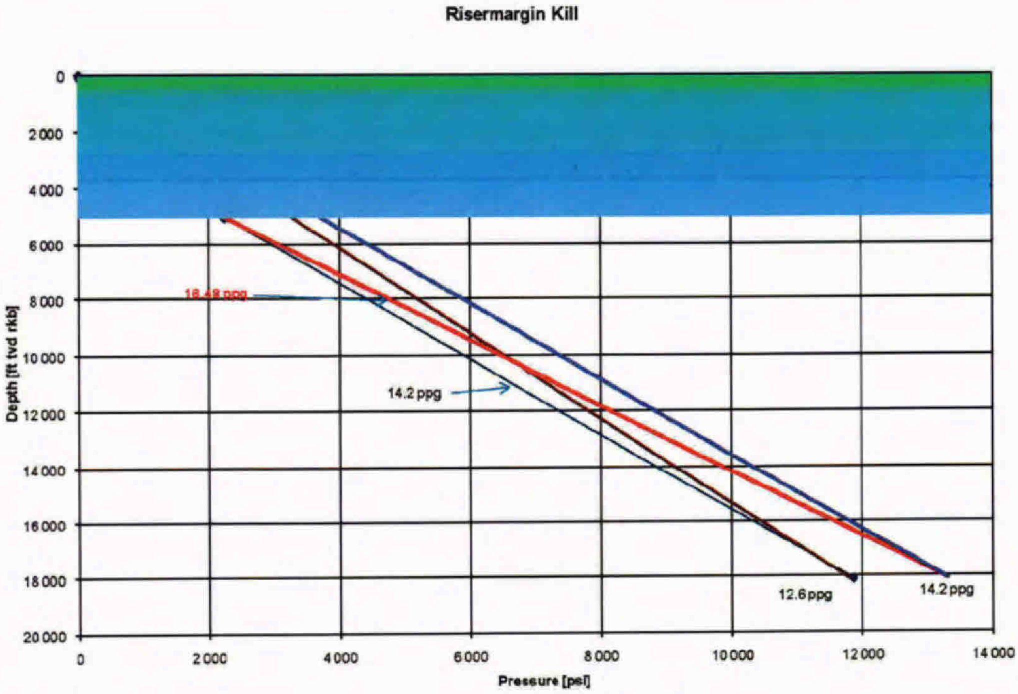

Figure 8: Riser margin – density required for static kill

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Appendix B: Macondo Log

Macondo Sand Identification

5/18/2010 Gulf of Mexico SPU

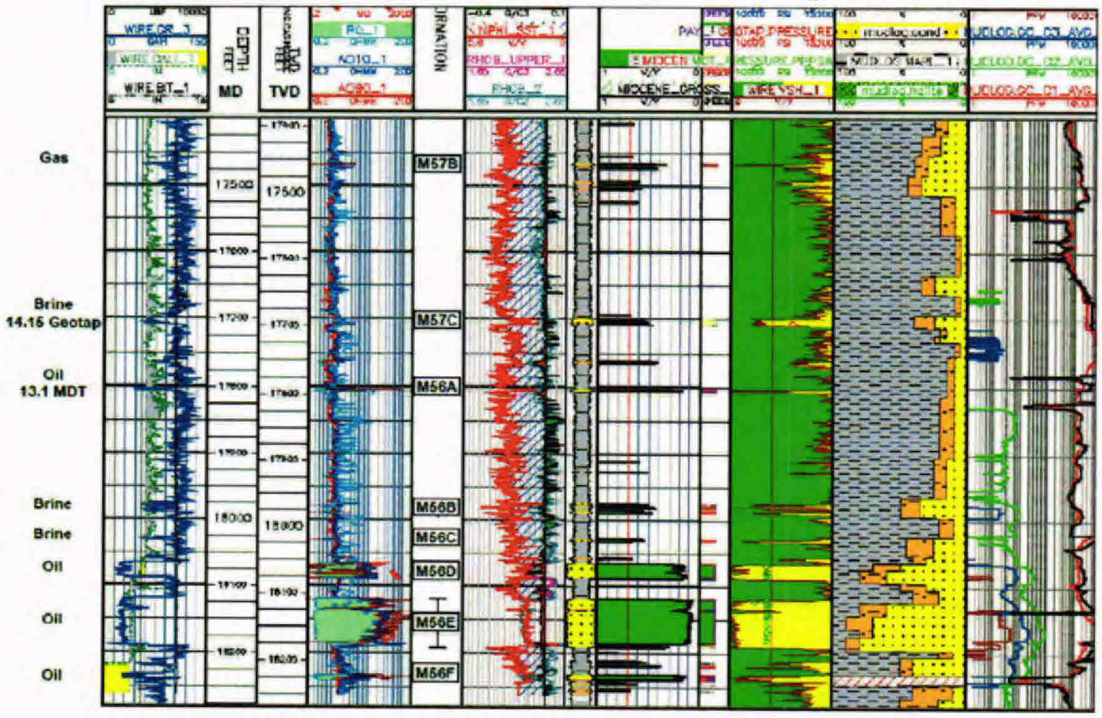

Figure 9: Macondo Sand Identification Log

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