FUSION PETROLEUM TECHNOLOGIES INC.

IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF LOUISIANA

IN RE: OIL SPILL BY THE OIL RIG MDL NO. 2179 "DEEPWATER HORIZON" IN THE GULF OF MEXICO, ON APRIL 20, 2010

EXPERT REPORT OF DR. ALAN R. HUFFMAN SUBMITTED ON BEHALF OF THE THE UNITED STATES DEPARTMENT OF JUSTICE

This report discusses the expert findings of Dr. Alan R. Huffman relating to the drilling margins for the BP Mississippi Canyon 252 #1 well (Macondo prospect) following a review of materials provided by the U.S. Department of Justice (DOJ).

DATED: August 26, 2011

Alan R. Huff

Signature: Dr. Alan R. Huffman

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ABBREVIATIONS

APD	Application for Permit to Drill
bbls	Barrels
CIT	Casing integrity test
ECD	Equivalent circulating density
ELOT	Extended leak off test
ESD	Equivalent static density
FG	Fracture gradient
FIT	Formation integrity test
ISIP	Initial shut in pressure
LOP	Leak off point
LOT	Leak off test
MMS	Minerals Management Service
MS	Minimum stress
MW	Mud weight
OB	Overburden
PIT	Pressure integrity test
PP	Pore pressure
PPFG	Pore pressure/fracture gradient
ppg	Pounds per gallon
psi	Pounds per square inch
psi/ft	Pounds per square inch per foot
WAR	Well Activity Report, formerly known as Weekly Activity Report

INFORMATION REQUIRED BY THE FEDERAL RULES OF CIVIL PROCEDURE

The following is a list of the items required by the Federal Rules of Civil Procedure:

1. This report contains my opinions, conclusions and the reasons therefore;
2. A statement of my qualifications is contained in Section I, below;
3. My compensation for the preparation of this report is included in Appendix A;
4. The data or other information I considered in forming my opinions is listed in the Documents Reviewed and References sections of Appendix B;
5. In the last four years I have not testified as an expert witness in any case.

I understand that fact discovery in this case is ongoing. In light of that, or should relevant information otherwise become available to me, I reserve the right to revise or supplement these conclusions.

I. SUMMARY OF CREDENTIALS

My formal education includes a Bachelors degree in Geology from Franklin & Marshall College in 1983, and a Ph.D. in Geophysics from Texas A&M University in 1990. In 1986-87, I was privileged to perform the seismic hazard analysis for the successful proposal for the Superconducting Supercollider in Waxahachie, Texas. During my years at Texas A&M, I performed fundamental research involving the integration of rock mechanics, rock physics and seismology to solve complex problems in fluid-rock interactions. This research included experimental and theoretical studies in high pressure/high temperature rock mechanics including ultra-high pressure deep earth processes such as mantle convection and shock wave research on deformation of silicates under extreme loading conditions that occur in nuclear blasts, meteor impacts and volcanic explosions. I was recognized for my research in ultra-high pressure regimes when I was awarded the Excellence in Doctoral Research Award by Texas A&M University in 1989. In 1989-1990, I served as Science Manager of DOSECC, the U.S. Continental Drilling Program.

From 1990 to 1997, I was employed by Exxon Corporation, where I worked as a technology specialist on exploration and production projects in the United States, West Africa and the Far East, and was also actively involved in technology and software development. My technical areas of responsibility included pore pressure and fracture pressure prediction (global designated expert in this specialty), rock physics and physical properties analysis, specialized seismic data processing (2D and 3D, controlled amplitude and phase), direct detection of hydrocarbons using DHI and AVO technology, geophysical modeling and inversion, velocity analysis and time-depth conversion. I also provided technical leadership and project management for global technology development programs in abnormal pressure prediction, 3D AVO technology, seismic modeling, and completion and management of the Exxon Global Physical Properties Database. I also taught pore pressure and fracture pressure prediction schools for the company's geosciences and drilling department training programs.

From 1997-2002, I was Manager of the Seismic Imaging Technology Center (SITC) with Conoco, Inc. In this role, I managed the geophysical technology division of Conoco, with responsibility for worldwide technology development and technical services. I personally led an integrated team of geoscientists and engineers for 4 years to develop a unique 3D platform for the prediction and analysis of pore pressure, fracture pressure and other rock properties that resulted in the award of 4 patents. I also led and supervised the application of this technology in Conoco's global exploration and production business, and also developed and taught Conoco's geopressure technology school for the company worldwide. I also led an integrated team that developed new methods for the prediction and assessment of shallow water flow hazards in deepwater environments which also led to patented technology.

I was appointed as the Lyssa & Cyril Wagner Professor of Geology and Geophysics in the School of Geology and Geophysics at the University of Oklahoma in Norman, OK in 2003 and 2004. In this role, I taught graduate level courses in Advanced Reservoir Characterization that included the theory and application of seismic methods, rock physics and rock mechanics to the practice of pore pressure and fracture pressure prediction.

From 2003 until the present, I have been an owner and executive with Fusion Geophysical LLC and its subsidiaries. At Fusion, my duties include direct supervision and management of all technical projects involving pore pressure and fracture pressure prediction and shallow marine drilling hazards worldwide. At Fusion, I have worked on pore pressure and fracture pressure projects in over 40 countries including land, marine and deepwater settings that include both pre-drill prediction and real-time monitoring and detection of pressures and analysis of leak-off tests during drilling. I have also taught Fusion's geopressure technology school for multiple clients worldwide.

I am active in industry and professional affairs, having chaired numerous technical conferences and having served on organizing committees for the Society of Exploration Geophysicists (SEG), American Association of Drilling Engineers (AADE), American Association of Petroleum Geologists (AAPG) and Society of Petroleum Engineers (SPE). I was the recipient of the 2004 Robert H. Dott Sr. Memorial Award from the AAPG for the publication of AAPG Memoir 76 (Pressure Regimes in Sedimentary Basins and Their Prediction), and also received the 2002 Best Paper Award from the SEG for my publication on the origins of shallow water flows. I have published numerous papers in refereed journals and articles in international publications, and 40 abstracts. I have 9 U.S. patents in the field of geophysics, including 4 patents in the field of pore pressure and fracture pressure prediction. I have also designed and implemented new technologies in pore pressure and fracture pressure prediction for over 20 years.

During my career, I have done pre-drill pore pressure and fracture pressure prediction and/or pore pressure and fracture pressure monitoring while drilling in the onshore USA, offshore USA (Gulf of Mexico including deepwater), offshore Canada deepwater, offshore and onshore Mexico, Guyana, Brazil, Norway offshore, United Kingdom (North Sea offshore), Morocco deepwater, Nigeria deepwater, Cote D'Ivoire offshore, Angola deepwater, Cameroon deepwater, Equatorial Guinea deepwater, India deepwater, Indonesia deepwater and onshore, Caspian Sea, China offshore, Alaska onshore, Libya onshore and offshore, Guinea deepwater, Trinidad offshore and deepwater, Barbados deepwater, Pakistan offshore, and offshore Papua New Guinea. This experience includes a large number of deepwater wells, sub-salt wells, and many high pressure/high temperature wells and narrow margin wells. My experience includes working with operators to monitor wells to assure safe drilling margins from real time drilling data and assisting operators in making decisions on mud program changes and setting of casing points.

I consider myself an expert in the fields of pore pressure and fracture pressure prediction and detection, and analysis of drilling windows and margins and their application to the drilling of oil wells.

For more information on my background, refer to the CV, which is attached as Appendix C to this Report.

II. OVERVIEW

Section 250.401 of the MMS regulations, 30 C.F.R. § 250.401, requires well operators to "take necessary precautions to keep wells under control at all times … [and use] the best available and safest drilling technology to monitor and evaluate well conditions and to minimize the potential for the well to flow or kick." Consistent with this requirement, prudent well operators control their mud weight in a well so that it is heavy enough to overbalance the fluid pressure in the rocks around the well (also known as the "pore pressure"), but not so heavy that it results in fracturing the formation (exceeding what is known as the "fracture gradient").

To ensure that they are able to manage and control potential influxes of formation fluids into a well, prudent well operators also maintain a cushion between the well's mud weight and its fracture gradient. This cushion is known as a "safe drilling margin."

Section 250.427(b) of the MMS regulations states that "While drilling, you must maintain the safe drilling margin identified in the approved APD [Application for Permit to Drill]. When you cannot maintain this safe margin, you must suspend drilling operations and remedy the situation." (In my experience, operators in the Gulf of Mexico understand that MMS requires at least a 0.5 ppg margin.) It is my interpretation that this requirement prohibits an operator from drilling forward without maintaining its "safe drilling margin," unless it has requested and obtained prior approval from MMS to drill ahead under those circumstances.

Section 250.428(a) of the MMS regulations tells operators that if you "encounter the … situation [in which you] have unexpected formation pressures or conditions that warrant revising your casing design, then you must [s]ubmit a revised casing program to the District Manager for approval." The casing design refers to the plan for setting casing – steel pipe – in a well, and each well segment is known as a casing interval. I interpret this requirement to mean that when an operator reaches the point where it cannot maintain a safe margin and has not received from MMS prior authorization to drill ahead under the circumstances, it is required to stop drilling, notify MMS of the situation and set casing.

To determine whether it is able to maintain a safe drilling margin, prudent well operators assess the weakest fracture gradient in an interval and compare that to its mud weight. At the outset of an interval, operators generally presume that the weakest fracture gradient is at the top of the interval, and it is there that operators are mandated by Section 250.427 of the MMS regulations to conduct tests of the fracture gradient (known as "pressure integrity tests"). As a general rule, prudent operators do not drill ahead based on a pressure integrity test when they are not confident in the validity of this test.

If, in the course of drilling the interval, however, the operator obtains hole-behavior observations (such as from lost returns) indicating that at some point in the interval the fracture gradient is less than it was at the top of the interval, operators must adjust their assessment of the fracture gradients appropriately to determine whether they can maintain a "safe drilling margin." As stated in Section 250.427(a), operators are required to "use the pressure integrity test and related hole-behavior observations ... to adjust the drilling fluid program and the setting depth of the next casing string ..."

With those guiding principles in mind, I have been asked to opine on the following issues:

(1) Did BP maintain a "safe drilling margin" while drilling the Macondo well?

(2) Did BP falsely report drilling margin information to MMS?

(3) Did BP fail to disclose information to MMS that it was required to disclose before drilling ahead?

(4) Were BP's drilling margin activities consistent with those of prudent operators?

My general conclusions are as follows:

(1) On multiple occasions, BP failed to maintain a "safe drilling margin" while drilling the Macondo well. Under my interpretation of the MMS regulations, BP's failure to maintain this margin violated §§ 250.401, 250.427(a), 250.427(b), and 250.428(a).

(2) On multiple occasions, BP falsely reported its fracture gradients and pressure integrity test results to MMS. Under my interpretation of the MMS regulations, BP's false reporting conduct violated §§ 250.409, 250.413 and 250.428(a).

(3) By drilling ahead without a "safe drilling margin" and without seeking prior MMS approval, BP failed to disclose information to MMS that it was required to disclose. Under my interpretations, BP's failure to disclose violated §§ 250.401, 250.427(a), 250.427(b), and 250.428(a).

(4) On multiple occasions, BP failed to adhere to prudent drilling practices and thereby failed to ensure well control and the safe exploration of the Outer Continental Shelf, in violation of §§ 250.401, 250.427(a), 250.427(b), and 250.428(a).

III. DRILLING MARGIN PRINCIPLES AND COMPONENTS

The Concept of a Safe Drilling Margin

Section 250.401 of the MMS regulations, 30 C.F.R. § 250.401, requires well operators to "take necessary precautions to keep wells under control at all times … [and use] the best available and safest drilling technology to monitor and evaluate well conditions and to minimize the potential for the well to flow or kick." In order to minimize the potential for a well to flow or kick, prudent operators maintain their mud weight in the well so that it is heavy enough to overbalance the fluid pressure in the rocks around the well, but not so heavy that it creates excessive stress on the walls of the wellbore that results in fracturing the rock formations. Prudent operators also build in a cushion so that in the event that potentially dangerous gas or liquid hydrocarbons enter into the well from the rock formations, the operator can increase its mud weight to prevent those fluids from flowing into the well without fracturing the wellbore, which can itself result in a kick. In my experience, operators who work in the Gulf of Mexico understand that MMS will require them to maintain at least a 0.5 ppg drilling margin between their mud weights and their fracture gradients (or, to be more precise, the weakest fracture gradient in a particular interval). This is known as the "safe drilling margin."

The idea of a "safe drilling margin" is incorporated into the MMS regulations in § 250.427(b), which provides that "While drilling, you must maintain the safe drilling margin identified in the approved APD. When you cannot maintain this safe margin, you must suspend drilling operations and remedy the situation." My interpretation of §250.427(b) is that "remedying" the situation contemplates that the operator will be able to regain its safe drilling margin before drilling further.

Operators are required to submit in their Application for Permit to Drill (APD) the information needed to establish that the pressure exerted by the mud in the well remains within a safe drilling margin. Section 250.413 of the MMS regulations sets forth this information. One type of information that the operators must report to MMS is the *mud weight* used in the well. Another type of information that the operator must report is the well's *fracture gradient*. That refers to the pressure at which the mud in the well will initiate a fracture of the walls of the wellbore, causing the mud to begin flowing out of the well and into the formation. A third type of information that operators must report are *pore pressures* in the rock formations– or to be more precise, the pore pressure gradients in pounds per gallon (ppg). Operators must not only report predicted pore pressures, mud weights and fracture gradients in their APDs, but they also are expected to update these data when they file subsequent drilling permit applications that revise the APD (such as an application to bypass or to change the casing program).

Section 250.428(a) tells operators that if you "encounter the … situation [in which you] have unexpected formation pressures or conditions that warrant revising your casing design, then you must [s]ubmit a revised casing program to the District Manager for approval." (The casing design refers to the plan for placing casing – steel pipe – in a well. Each well segment is known as a casing interval.) My interpretation of this regulation is that when the operator reaches the point where it cannot maintain a safe margin, it is required to stop drilling, notify MMS of the situation and, unless it is authorized by MMS to drill ahead, set casing.

Section 250.409 of the MMS regulations provides that MMS "may approve departures from the drilling requirements specified in this subpart. You may apply for a departure from drilling requirements by writing to the District Manager." In my experience, operators who work in the Gulf of Mexico understand that MMS frequently grants such departures (also known as "waivers") if the operator can make a case that it is safe to do so. Also, to the extent that operators request waivers of the "safe drilling margin," they will be asked to report certain relevant margin data – such as mud weights and tests that attempt to determine the fracture gradients.

The Components that Factor into the Safe Drilling Margin

Mud weights refer to the density of the mud in the hole. The density can be expressed as a gradient in psi/ft, but in the Gulf of Mexico, it is typically expressed in terms of pounds per gallon (ppg).

The mud in the well serves not only to control the pressures of the fluids in the rocks outside of the well, but also as a conveyor belt to bring to the surface the formation cuttings, gas and other things that the drillers want to remove from the well. The mud circulates through a conditioning system that removes these undesirable materials. When the mud is being circulated down the drill pipe, the flow of the mud across the rock formations causes an additional pressure that needs to be accounted for. Because of these factors, the industry has adopted some basic definitions that are used broadly in describing the mud weight. These definitions include (1) surface mud weight, (2) equivalent static density and (3) equivalent circulating density. The *Surface MW* (MW) is the actual mud weight that is mixed on the rig and is pumped into the well as described above. The *Equivalent Static Density* (ESD) is the density of the mud in the well when the pumps are turned off and no circulation of the mud is occurring. The ESD includes the effects of the rock cuttings, liberated gas, connection gas and any other things that have become entrained in the mud during the drilling operation. Normally, because of the cuttings load in the mud, the ESD will be heavier than the MW at surface. Finally, the *Equivalent Circulating Density* (ECD) is the density that acts on the well during drilling when the mud is circulating. The ECD is usually heavier than the ESD, and can be anywhere from 0.1 to 0.5 ppg heavier than the MW at surface because of the added weight of the rock cuttings that are carried by the mud along with the additional pressure caused by the pump pressure on the circulating mud and the weight of the mud above. The MW is typically called a surface pressure while the ESD and ECD are called downhole pressures. BP's practice was generally to report mud weights, pore pressures and fracture gradients to MMS in the form of surface (rather than downhole) mud weight equivalents. This is perfectly acceptable, provided that each result is consistently reported in the same way (i.e. all surface or all downhole numbers) to allow for an "apples to apples" comparison.

The pore pressure (also known as the "formation pressure"), is understood to mean the pressure exerted by the fluids in the pore space of a rock formation. In other words, this is the pressure exerted on the well from the fluids in the rocks around the well. If any such pore pressure exceeds the pressure of the mud inside the well, there is a risk that the saturating fluid in the formation (gas, oil or brine) will seep into the wellbore and thereby cause what is known as a "kick," which can result in loss of control of the well including blowout and loss of life and property. The information that is provided to MMS – the pore pressure gradient – is defined as the ratio of the formation pressure to the depth. It is conventionally furnished to MMS as equivalent mud weight units in pounds per gallon (ppg).

Pore pressures and fracture gradients are monitored in order to avoid fluid influxes from reservoirs (called influxes or kicks) and losses of mud returns through induced fractures during drilling. Influx or kick events occur when the formation pore pressure of a reservoir in the open hole exceeds the ECD during drilling, or exceeds the ESD while not drilling. These events are particularly dangerous because they typically displace the drilling mud which results in rapid changes in the ECD and ESD that can jeopardize the safety of the drilling operation. While influx events containing oil or gas are the most dangerous because of the flammable nature of the fluids, brine events can also be dangerous because once a brine flow starts to change the ECD or ESD, the changes in the well can trigger other problems that would not otherwise have occurred.

In contrast, lost returns indicate that either the ECD or ESD (or both) is too high and that it has exceeded the formation fracture gradient somewhere in the open hole. When losses occur, they are telling the drillers that the mud weight is beginning to penetrate into the formation somewhere through induced fractures in the well. In one type of lost return event, losses are small and recoverable when circulation is stopped. The term *ballooning* has also been used to describe this type of event. In other cases, the event can become so severe that large volumes of mud are lost into the formation. Lost returns – also known as "lost circulation" – can lower the pressure of the mud inside a well and potentially cause the well to become underbalanced, resulting in an extremely dangerous kick.

This is not to say that every time a well operator takes a kick or fractures a wellbore it must cease drilling and set casing. If the drilling window in the interval – meaning the difference between the pore pressure and fracture gradient is large enough, the operator could either increase or decrease its mud weight to the point where it is able to control the kick or stop the fracture and still continue to drill ahead with sufficient margin. But if the window is so small that there is no way to maintain the "safe drilling margin" set forth in the APD, it is my understanding that an operator must request and obtain a waiver from MMS of the required margin before drilling deeper into the well, or cease drilling and revise its casing program.

General Principles in Determining Fracture Gradients for Safe Drilling Margin Purposes

Since BP reports mud weights as surface, rather than downhole equivalents, it need not engage in calculations or estimates to determine its mud weight for drilling margin purposes – it simply notes the weight of the mud that it is mixing on the rig and pumping in the well. The issue then, in determining whether it is operating within a safe drilling margin, revolves around determining the well's operative fracture gradient for whatever interval is being drilled or is about to be drilled.

In his deposition, Martin Albertin, BP geophysicist, and the Macondo well's "Single Point of Accountability" for pore pressure fracture gradient matters, stated that the drilling margin refers to the difference between the pore pressure and the weakest fracture gradient in the open hole interval. (Albertin Depo., p. 74). When asked whether there was a point in pounds per gallon below which one does not want the drilling margin to go, he responded "We would tend to begin looking . . . [to end] a hole section when the mud weight required to balance formation pressure was approaching the fracture gradient of the weakest formation exposed in the open hole." (Ibid. pp. 74-76). As I interpret the MMS regulations, Albertin is 100 percent correct that, for purposes of determining whether a well is maintaining a safe drilling margin, the driller must compare its mud weight to the weakest fracture point exposed in the open hole of the interval. An interval's weakest fracture gradient is relevant for well control purposes because the wellbore will fracture at that weak spot if the mud weight exceeds the fracture gradient – even if the driller has drilled passed that point and is now drilling a deeper part of the interval with a higher fracture gradient.

The general presumption is that the lowest fracture gradient in an interval – the weakest rock, in other words – would be at the top of an interval, since formation pressures tend to increase with depth. This is generally true, but variations in rock types can result in certain rocks being significantly weaker than other adjacent formations. This fact can result in weaker rocks in the open hole that will fracture even though the rocks above them are much stronger.

Pressure Integrity Tests: Their Purpose and How to Interpret Them

Section 250.427 of the MMS regulations discusses the requirements for conducting pressure integrity tests or "PITs" (which MMS also refers to as "formation tests"):

> **§ 250.427 What are the requirements for pressure integrity tests?**
>
> You must conduct a pressure integrity test below the surface casing or liner and all intermediate casings or liners. The District Manager may require you to run a pressure-integrity test at the conductor casing shoe if warranted by local geologic conditions or the planned casing setting depth. You must conduct each pressure integrity test after drilling at least 10 feet but no more than 50 feet of new hole below the casing shoe. You must test to either the formation leak-off pressure or to an equivalent drilling fluid weight if identified in an approved APD.

My interpretation of Section 250.427 is that it is not merely a requirement that the operator conduct a PIT at the proper part of each open hole (10-50 feet below the shoe), but that they have confidence in the validity of their test. If an operator is not confident that they have conducted a valid test, it is necessary to conduct a re-test of the formation. If the operator suspects it may have tested steel casing or cement by mistake, for example, it is appropriate to re-test after drilling a few additional feet of formation to ensure that they are truly testing new formation confirmed by cutting and lithology information beyond the casing shoe.

Pressure integrity tests have been used for decades to ensure the safe drilling of exploration and production wells. Operators are required in their APD and other drilling permit applications to include PITs – or predicted PITs, in situations when the test has yet to be taken – for each interval in a well. These applications additionally require operators to identify a "fracture gradient" figure for each such interval.

The purpose of PITs are to test the strength of the casing, the *casing shoe* (which refers to the bottom of an interval that has been set in casing) and cement job, and the rock formations in the open hole. Each variant of the PIT involves a pressurization of the well to determine the pressure limits for key components of the well. These tests are usually done in a sequence with consistent testing procedures to assure that the information gathered from the tests are reliable and will provide the drilling engineers with consistent information from which robust drilling decisions can be made.

Prior to conducting a PIT for a given casing shoe, an operator will conduct a *casing integrity test* (CIT) in order to ensure that the casing placed in the well and tied back to previous casing strings presents a completely impermeable barrier to the flow of fluids into or out of the annulus between the casing and the formation. This type of test is characterized by a linear pressurization curve followed by a shut in period where the mud pressure stays static and shows no evidence of leakage from within the casing. An example of a casing test is reproduced below at Figure 1.

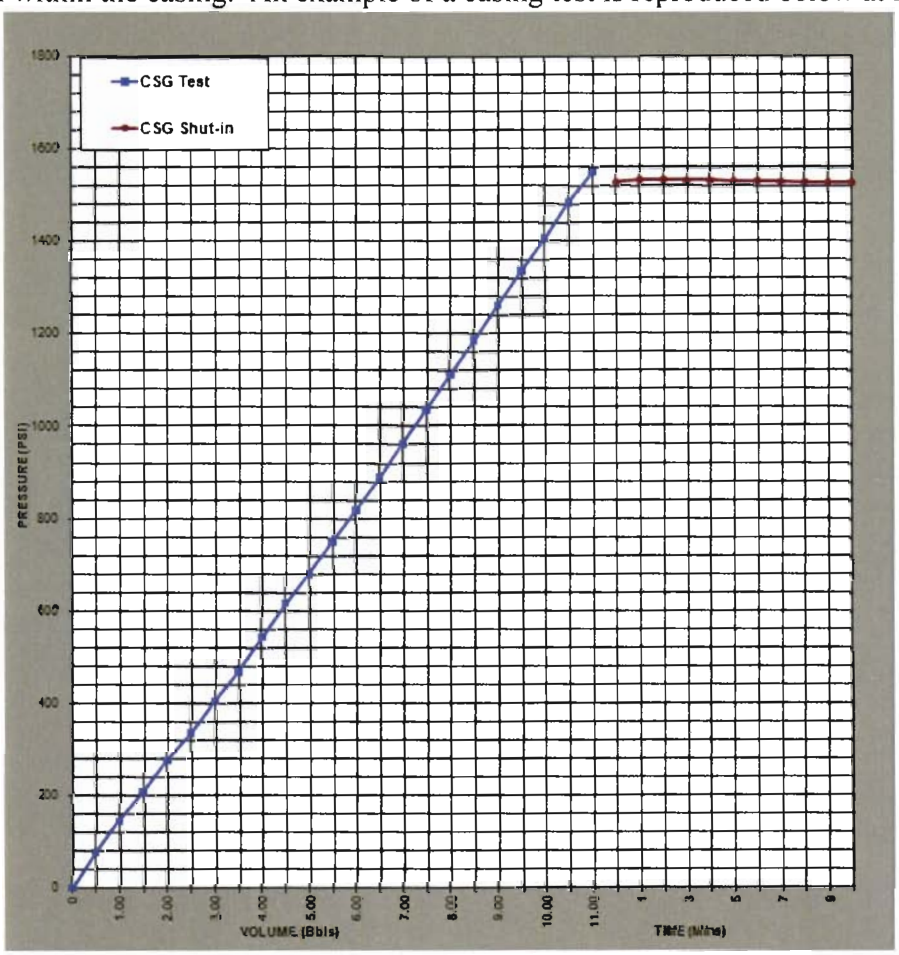

Fig. 1: Reproduction of Casing Test Performed at 9 7/8" Casing Shoe, Bates No BP-HZN-2179MDL00005669

Once the CIT is determined to be successful, the next step is to drill out the cement along with a short section of new formation (10-50 feet) below the preceding casing shoe and then conduct the formation (pressure integrity) test.

This test can take different forms:

The Leak Off Test (LOT) (See Figure 2) is designed to test the strength of the formation in the small 10-50 ft segment of open hole below the casing shoe and also confirm that the casing shoe and cement are not weaker than the formation itself. The LOT is not intended to cause large volumes of fluid to be pumped into the formation due to fractures that are opening up and allowing fluid to escape away from the well. The actual point on the LOT where the leak off occurs is called the Leak Off Point (LOP) and is a measurement of the fracture initiation pressure in the formation being tested, which is the point at which very small fractures start to open in the rocks.

The Formation Integrity Test (FIT) is essentially a LOT that is not taken completely to the LOP. In this test, the same process for the LOT is used, but the test is only taken to a pressure that is high enough to assure a sufficient fracture gradient to allow safe drilling of the next open hole segment while maintaining the applicable safety margin below the FIT value. In a FIT, the pressurization curve should show a linear increase in pressure like the LOT shows, but the curve will not break over before the pumps are shut off. The FIT was originally developed and implemented in cases where the LOT was known to be much higher than the pore pressure, and so there was no need to push the test completely to the LOP.

The *Extended Leak Off Test* (ELOT) is a variant of the traditional LOT that is designed to measure more accurately the LOP and the fracture closure pressure (which refers to the pressure at which the small induced fractures created at the LOP begin to close up and squeeze the mud back into the well). This procedure is accomplished by cycling the LOT through several repeat pressurization, leak off and bleed down cycles to determine through repeated measurement what the values are at a given interval in the subsurface. ELOTs are typically not done in wildcat exploration wells like Macondo because they are intended to gather rock mechanics information typically required for production purposes.

Figure 2 shows a standard form of the LOT with critical points in the life of the test. A proper LOT should be performed with a constant pump rate to produce a linear pressurization curve. The pumping continues until the linear curve displays a change to a lower slope that indicates that small fractures have opened in the formation at the wellbore wall which slightly increases the volume of the system and causes the slope change at a constant pump rate. This point is marked as the LOP for the test. Because the pumping system includes a surface pump and plumbing systems that convey the mud into the hole, LOTs often show some non-linear pressure behaviors in the first barrel of fluid pumped. To assure that these non-linear issues do not affect the way the LOP is picked, the linear trend is usually picked to follow the majority of the linear trend points beyond the first few points on the curve. It is also noted that the pressurization curve should display a lower slope than the CIT for the same casing shoe, as the opening of the new formation makes the LOT volume slightly more compliant than the steel casing and cement that is tested in the CIT.

Once the LOP is picked on the test, the pumps are normally kept on for 1-2 barrels of additional fluid injection before they are stopped. The point where the pumps are stopped should always be higher than the selected LOP. BP's practice is to report the highest point on the test to MMS as the result of the pressure integrity test.

The shape of the curve between the LOP and the pump stopping point should continue to gradually decrease slope as more small fractures begin to open in the formation. At the point where the pumps are stopped, the pressure in the system should drop slightly. This point is called the *Initial Shut In Pressure* (ISIP), and should be slightly higher in pressure than the LOP pressure value. Following the determination of the ISIP, the pressure of the system should be monitored for a reasonable period of time to measure the pressure changes during shut in as the system slowly equilibrates (which should be reflected in a gradual decrease in pressure from the ISIP point). The last important point in the test is the point on the pressure decline curve where the slope first changes below the ISIP. This point is called the *Minimum Stress* (MS) and is associated with the fracture closure pressure as the small cracks induced by the LOT close up and push the fluid back into the well. There are several schools of interpretation on MS data, with some people picking the first slope break on the shut-in curve, while others pick the stable value achieved after a finite period of time.

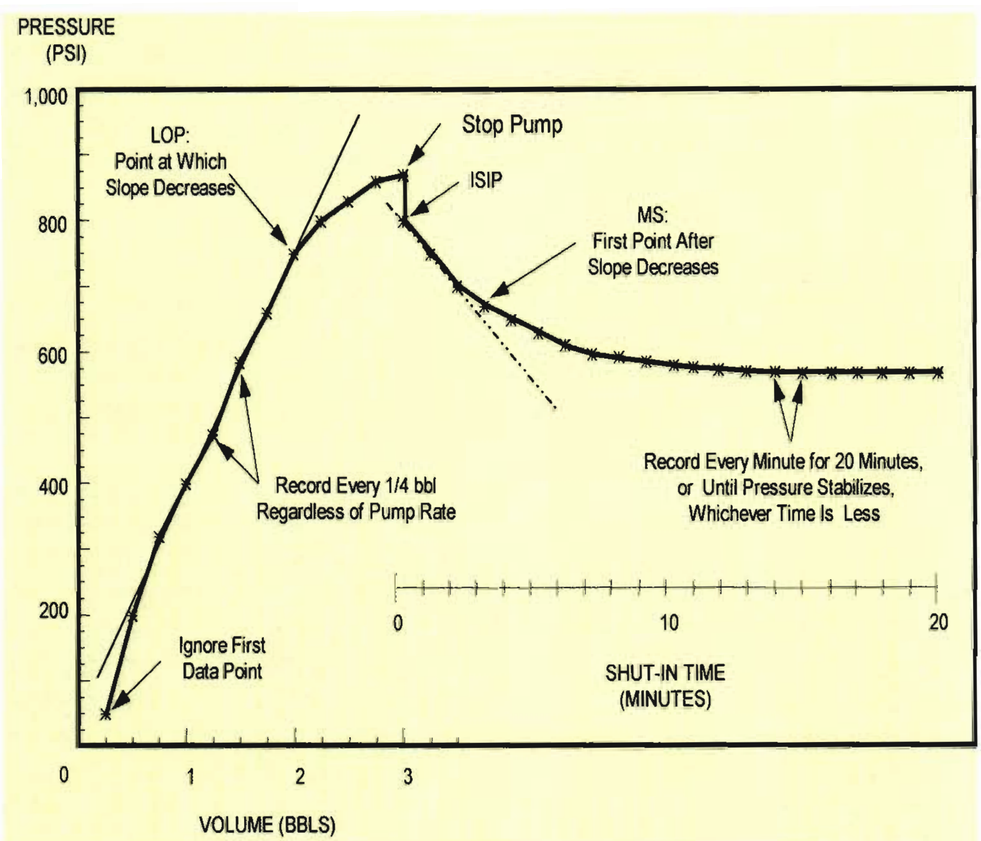

Fig. 2: Standard Leak Off Test Pressure Curve showing critical points on the test

Calculating Fracture Gradients Based on Hole-Behavior Observations Other Than PITs

Section 250.427(a) provides "You must use the pressure integrity test and related hole-behavior observations … to adjust the drilling fluid program and the setting depth of the next casing string …" I interpret this regulation to apply in situations in which an operator determines based on hole-behavior observations (e.g., well control events) that the weakest fracture gradient in the interval is lower than the shoe test result at the top of the interval. In these situations, operators must base their drilling margin assessments, and hence adjust their mud weight, to account for this decrease in formation strength. In other words, in order to maintain the "safe drilling margin" set forth in its APD, they must compare their mud weight to the lowest fracture gradient that they observe in the interval, even if it is lower than the result of their PIT.

For example, if an operator tests the fracture gradient at the top of an interval at 13.0 ppg, and determines based on an actual fracture of the well that the fracture gradient has dropped to 12.0 ppg within the same interval, it must not drill (without a waiver) with a mud weight of greater than 11.5 ppg. Also, even without an actual fracture event, if the operator obtains a reliable indication during drilling which indicates that the fracture gradient has dropped below the PIT value, the operator should use the lower fracture gradient for drilling margin purposes.

Another issue presented in this case is how to properly update fracture gradients based on observations of a hole while drilling the hole, and not simply while conducting PITs at the top of an interval. This is an important topic because a driller needs to maintain a certain cushion over and above its mud weight so that if it takes an unexpected kick, it can increase its mud weight by a significant amount in order to control the kick without fracturing any part, and especially the weakest part, of the formation.

The difference between a PIT taken at the casing shoe and an open-hole fracture initiation event (ballooning or lost returns) is very significant. Unlike the PIT which is performed in a controlled environment with a small interval of exposed formation, the open-hole ballooning or lost returns event introduces much greater variability and has a much greater chance of causing a serious well control event. Because of this risk, open-hole ballooning and lost returns events should be avoided.

It is also important to recognize that for the purpose of estimating fracture gradients, wellbores can be degraded by repeated leak-off testing in the same interval or by repeated lost returns in open hole fractures. BP's own documents acknowledge this fact. Specifically, a February 15, 2010 BP manual entitled "Standardization of Leak-Off Testing Procedures" (BP-HZN-2179-MDL03137901—23), in Section 4.1.2, warns against drilling with pressures in excess of the leak-off pressure "should unforeseen events (e.g., a kick)" occur while drilling in an interval. Loss-return incidents would presumably be another example of such an "unforeseen event." In the words of that manual, "the contingency excess pressure before formation breakdown occurs" – the difference between the breakdown pressure and the leak off pressure – "is now unavailable should unforeseen events … occur later in the interval."

Figure 4.1 in that manual – which is reproduced here as Figure 3 – shows why it is so important not to overestimate a fracture gradient while drilling in an open hole.

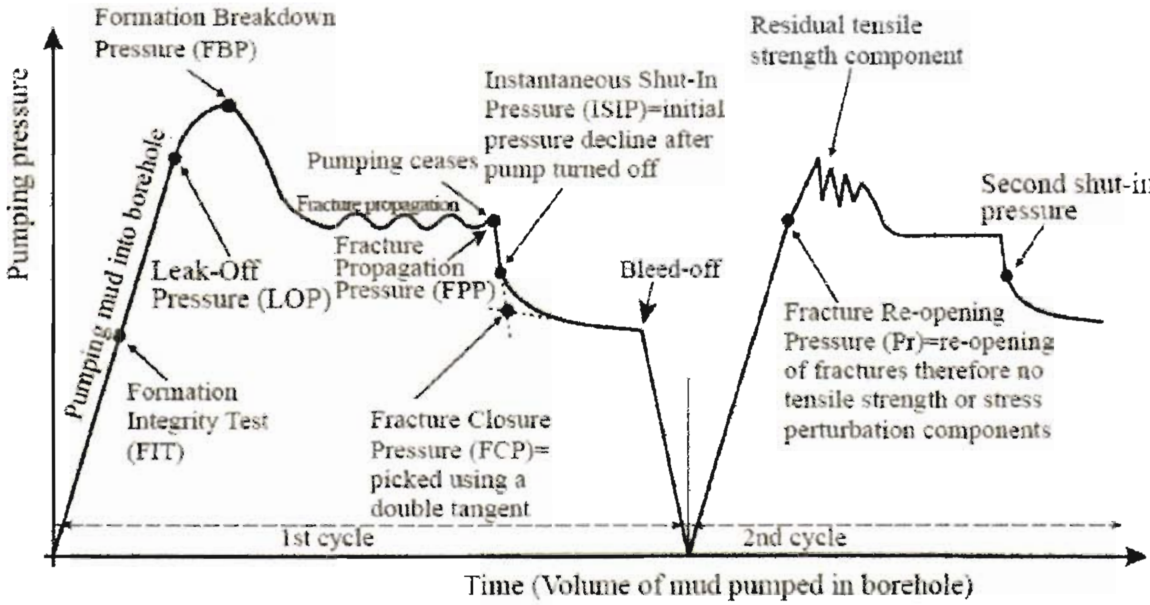

Figure 4.1 Schematic of an Extended Leak-Off Test

Fig. 3: Reproduction of Figure 4.1 Schematic of an Extended Leak-off Test from BP-HZN-2179-MDL03137915 .

As is apparent from that graph, the fracture re-opening pressure is typically observed to be lower than the leak-off pressure in the first test cycle, which is consistent with the concept that open-hole fractures induced by excessively high ECDs can compromise a wellbore if the ECD is allowed to repeatedly exceed the fracture initiation pressure.

There may actually be situations where operators can repair their fracture gradients at vulnerable points in a well. However, as BP's Standardization of Leak-Off Testing Procedures manual states, in Section 4.1.2., "the fracture created by breaking down the formation will also preclude strengthening the leak-off interval using StressCage approaches [i.e., efforts to increase a fracture gradient]." (BP-HZN-2179MDL03137915). I agree with this assessment. Thus, safe drilling practice requires that the operator accept that, in the face of a substantial mud loss incident, the fracture gradient will most likely be less than, not more than, the original leak-off pressure.

Operators like BP may be said to conduct an "open-hole LOT" – or effectively conduct a pressure integrity test – when they lose returns while drilling with an ECD that exceeds the LOP at the weakest point in the open hole. Other methods for estimating fracture gradients include making extrapolations from pore pressure measurements, overburden stresses and other well data. (We will see how, in the course of this well, BP estimated its fracture gradient as being less than its drilling mud weight, and then proceeded to drill ahead anyway at a significantly higher ECD, and then lost total returns.)

Submissions to MMS Other Than Drilling Permit Applications and Waiver Requests

Operators also report certain relevant information to MMS *after* they drill a particular interval. Specifically, operators will record mud weight, pore pressure, fracture gradient and other information relevant to drilling margins in weekly Well Activity Reports (WARs). Operators also make available information to MMS in daily drilling reports that are available on the rig.

V. THE MACONDO'S SAFE DRILLING MARGIN

As noted, it is my interpretation of the regulations that BP was required to maintain the drilling margin identified in its APD unless BP sought a waiver from MMS. In this case, BP sought and obtained waivers to reduce the margin for three of the Macondo's intervals. But BP never sought to alter its default margin from what was established in its APD.

BP's APD was filed on May 13, 2009, several months before drilling of the Macondo well began. (Exhibit 4021). The margin set forth in this document can be found in the worksheet entitled "Well Design Information." The Well Design Information worksheet in the APD sets forth expected data for the well one interval at a time. Attached as Figure 4 are the contents of the second through fifth intervals of the Well Design Information worksheet.[1]

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[1] Note that for the two shallowest intervals, the Mud Type is said to involve water, whereas the remaining intervals involve a "Synthetic Base" (commonly referred to as oil-based drilling mud). The analysis of drilling margins in this Report will not include the intervals that were drilled using water as the drilling fluid but only those that were drilled using synthetic mud. In other words, I will not be addressing BP's margins for the intervals prior to the one with the hole size of 22" and the casing size of 18".

Interval Number 2 — Type: Casing — Name: Surface

Section Number	Casing Size (in)	Casing Weight (lb/ft)	Casing Grade	Burst Rating	Collapse Rating (psi)	Depth (ft) MD	Depth (ft) TVD	Pore Pressure (ppg)
1	22.000	277.0	X-80	7955	6670	5181	5181	8.6
2	22.000	224.0	X-80	6363	3876	8000	8000	9.3

GENERAL INFORMATION		PREVENTER INFORMATION		TEST INFORMATION	
Hole Size (in)	26.000	Type	Blowout	Annular Test (psi)	5000
Mud Weight (ppg)	9.5	Size (in)	18.75	BOP/Diverter Test (psi)	6500
Mud Type Code	Water Base	Wellhead Rating (psi)	15000	Test Fluid Weight (ppg)	8.6
Fracture Gradient (ppg)	11.1	Annular Rating (psi)	10000	Casing/Liner Test (psi)	3400
Liner Top Depth (ft)		BOP/Diverter Rating (psi)	15000	Formation Test (ppg)	11.1
Cement Volume (cu ft)	3300				

Interval Number 3 — Type: Liner — Name: Intermediate

Section Number	Casing Size (in)	Casing Weight (lb/ft)	Casing Grade	Burst Rating	Collapse Rating (psi)	Depth (ft) MD	Depth (ft) TVD	Pore Pressure (ppg)
1	18.000	117.0	P-110	6680	2110	9900	9900	10.4

GENERAL INFORMATION		PREVENTER INFORMATION		TEST INFORMATION	
Hole Size (in)	22.000	Type	Blowout	Annular Test (psi)	5000
Mud Weight (ppg)	10.6	Size (in)	18.75	BOP/Diverter Test (psi)	6500
Mud Type Code	Synthetic Base	Wellhead Rating (psi)	15000	Test Fluid Weight (ppg)	10.6
Fracture Gradient (ppg)	12.3	Annular Rating (psi)	10000	Casing/Liner Test (psi)	2800
Liner Top Depth (ft)	7600.0	BOP/Diverter Rating (psi)	15000	Formation Test (ppg)	12.3
Cement Volume (cu ft)	1040				

Interval Number 4 — Type: Casing — Name: Intermediate

Section Number	Casing Size (in)	Casing Weight (lb/ft)	Casing Grade	Burst Rating	Collapse Rating (psi)	Depth (ft) MD	Depth (ft) TVD	Pore Pressure (ppg)
1	16.000	97.0	P-110	6920	2340	12500	12500	11.6

GENERAL INFORMATION		PREVENTER INFORMATION		TEST INFORMATION	
Hole Size (in)	20.000	Type	Blowout	Annular Test (psi)	5000
Mud Weight (ppg)	11.8	Size (in)	18.75	BOP/Diverter Test (psi)	6500
Mud Type Code	Synthetic Base	Wellhead Rating (psi)	15000	Test Fluid Weight (ppg)	11.8
Fracture Gradient (ppg)	13.6	Annular Rating (psi)	10000	Casing/Liner Test (psi)	3100
Liner Top Depth (ft)		BOP/Diverter Rating (psi)	15000	Formation Test (ppg)	13.6
Cement Volume (cu ft)	930				

Interval Number 5 — Type: Liner — Name: Intermediate

Section Number	Casing Size (in)	Casing Weight (lb/ft)	Casing Grade	Burst Rating	Collapse Rating (psi)	Depth (ft) MD	Depth (ft) TVD	Pore Pressure (ppg)
1	13.625	98.2	Q-125	10030	4800	15300	15300	12.8

GENERAL INFORMATION		PREVENTER INFORMATION		TEST INFORMATION	
Hole Size (in)	16.000	Type	Blowout	Annular Test (psi)	5000
Mud Weight (ppg)	13.1	Size (in)	18.75	BOP/Diverter Test (psi)	6500
Mud Type Code	Synthetic Base	Wellhead Rating (psi)	15000	Test Fluid Weight (ppg)	13.1
Fracture Gradient (ppg)	14.7	Annular Rating (psi)	10000	Casing/Liner Test (psi)	2000
Liner Top Depth (ft)	12200.0	BOP/Diverter Rating (psi)	15000	Formation Test (ppg)	14.7
Cement Volume (cu ft)	410				

Fig. 4 Reproduction of Well Design Information for Macondo Well's First Five Intervals Provided in May 13, 2009 Application for Permit to Drill – Exhibit 4021 of the MDL depositions (hereafter referred to as "Exhibit")

The "safe drilling margin" for an interval is determined by comparing two sets of figures. One is the Formation Test figure, the other is the Mud Weight figure. The difference between the two is the "safe drilling margin." The critical principle is that you do not compare the Formation Test and the Mud Weight for the same interval identified in the APD. Rather, you compare the Formation Test for the shoe at the bottom of one interval to the Mud Weight for the next interval to be drilled. The idea is that when you conduct a Formation Test, you test both the strength of the casing shoe for the interval that has just been drilled and estimate the fracture gradient for the interval you are about to drill. Even though the fracture gradient tends to increase with depth, if the mud weight in the well exceeds the fracture gradient at the top of the interval, it can be expected to fracture the wellbore at that depth even if the operator is in the process of drilling a deeper portion of the interval at which the fracture gradient is higher. Thus, when you are conducting the Formation Test for, say, the shoe of the 26" hole, though it will be identified on the APD as the Formation Test for the shoe of the 26" hole interval, what is most relevant for margin purposes is that you are also estimating the fracture gradient for the next open hole interval with the 22" hole. You then compare that figure to the highest mud weight for the interval with the 22" hole to determine the margin.

This is best illustrated by giving examples from Figure 4, above. To determine the safe drilling margin for the interval with the hole size of 22", begin by looking at the information for the hole size of 26" and going to the item identified as "Formation Test." In the case of the Macondo, you will see the number 11.1 ppg for that Formation Test (circled in red). That means that at the shoe just below the interval with a hole size of 26" – i.e., at the top of the 22" hole interval – BP expects to obtain a pressure integrity test result of 11.1 ppg. (This is also the number BP identifies as its expected fracture gradient for that interval.) Next, go to the box for the interval with the hole size of 22" and look for the item identified as "Mud Weight." You will see the number 10.6 ppg (circled in red). That means that BP is saying that the highest mud weight at which it will drill the interval is 10.6 ppg.

You will notice that the difference between the operative fracture gradient and the highest mud weight for the interval with a hole size of 22" is 0.5 ppg. This becomes the "safe drilling margin" for that interval. As you can see, each of the intervals drilled using the synthetic mud have the same margin.

The margin for the interval with the hole size of 20" is based on comparing the Formation Test figure for the previous interval of 12.3 ppg (circled in blue) with the 20" hole size highest mud weight of 11.8 ppg (circled in blue) – again, a difference of 0.5 ppg.

Similarly, the margin for the interval with the hole size of 16" is based on comparing the Formation Test figure (for the previous interval) of 13.6 ppg (circled in green) with the Mud Weight of 13.1 ppg (circled in green).

Frank Patton's deposition testimony was very clear that the above method is how he determines the margin of a well (Patton Depo., pp. 94-96, 142-47), and this is in line with the understanding in the industry. Mr. Patton was also clear that it is MMS's policy not to approve an APD that provides for less than a 0.5 ppg margin between mud weight and facture gradient. (Patton Depo., pp. 94, 463). Again, this 0.5 ppg safe margin is widely recognized and well understood in the industry.

BP included information about its expected pore pressures, mud weights and fracture gradients in different parts of its APD, including in a plot that depicted changes in these figures over the course of drilling the well. In the APD plot, the mud weights in the well were invariably greater than the pore pressures once the well was drilled past the shallowest intervals. The plot also showed the fracture gradients exceeding the planned mud weights by at least 0.5 ppg. Beginning in the drilling permit application dated March 15, 2010 and continuing in the drilling permit application dated March 26, 2010, BP introduced dotted lines in the plots to the right of the pore pressures and to the left of the fracture gradients. (Exhibits 1559, 4047) These plots are attached as Figures 5 and 6.

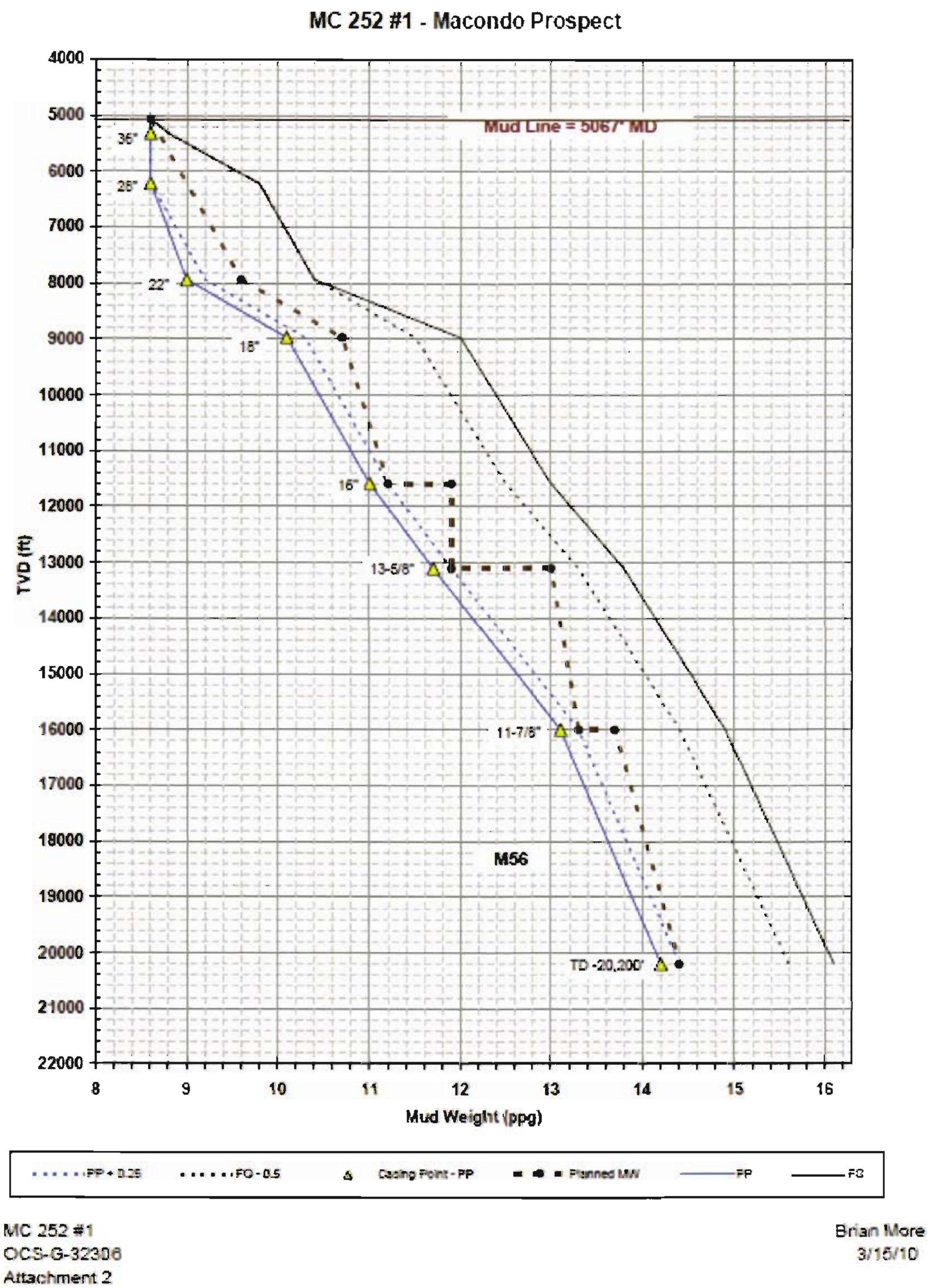


Fig 5: Reproduction of Attachment 2 to March 15, 2010 Drilling Permit Application – Exhibit 1559

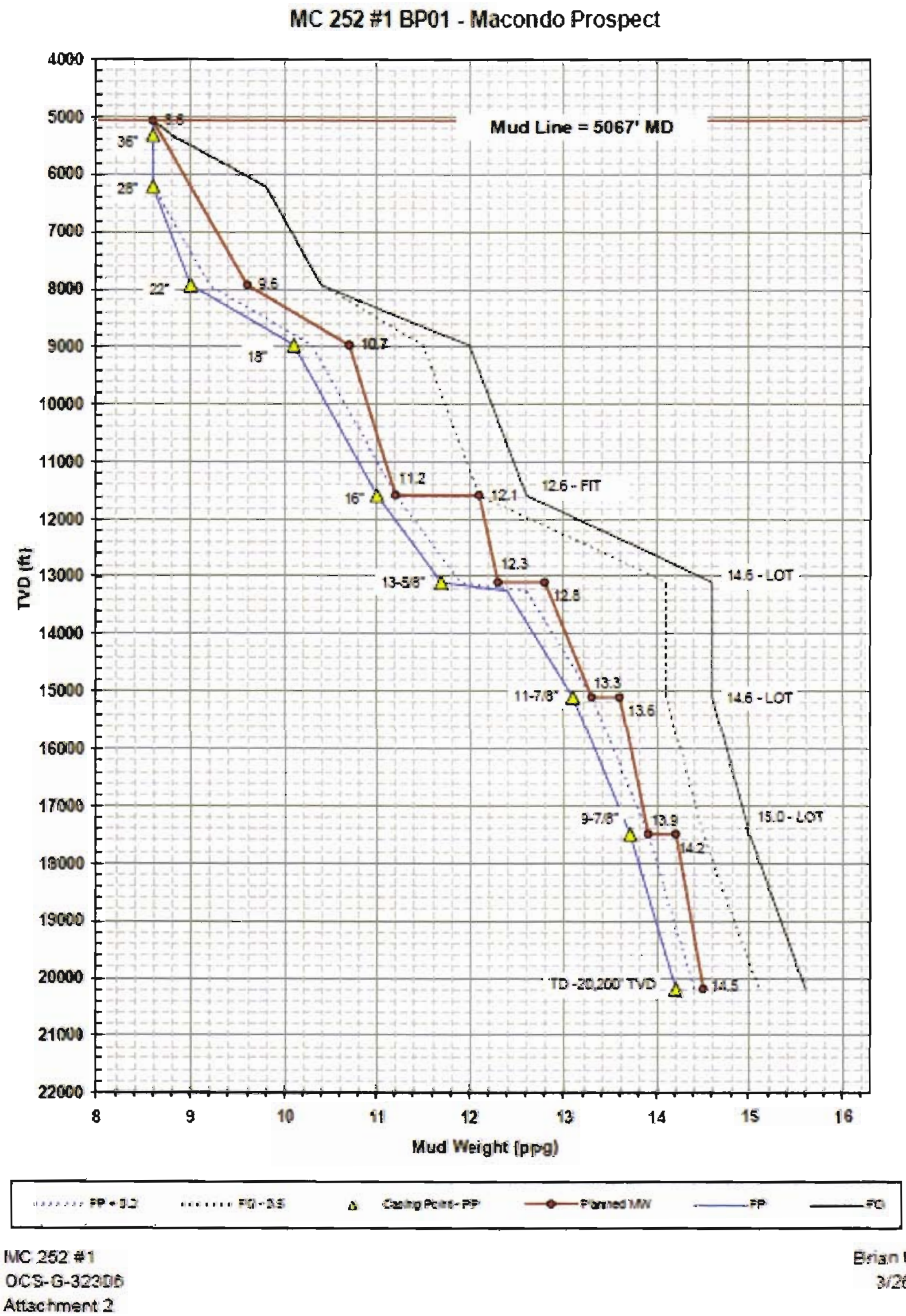


Fig 6: Reproduction of Attachment 2 to March 26, 2010 Drilling Permit Application – Exhibit 4047

Note that in each plot, the dotted line to the left of the fracture gradients provides a cushion of 0.5 ppg – and the mud weights in both plots never reach that dotted line. I take this as a further indication that BP is telling MMS that it will maintain a kick margin of 0.5 ppg while it is drilling its well.

Thus, BP represented to MMS that throughout the drilling of the Macondo well, absent a waiver, it would maintain a 0.5 ppg margin between its mud weight and fracture gradient throughout the course of the well. As discussed above, this requires BP to maintain the cushion between the mud weights used and the weakest fracture gradient encountered in an interval while drilling that interval of the well.

BP did seek and receive three waivers from MMS to drill with less than a 0.5 ppg margin between its mud weight and the weakest fracture gradient encountered in the interval pertaining to the 22" hole (casing size 18"), the interval pertaining to the 20" hole (casing size 16") and the interval pertaining to the 16" hole (casing size 13 5/8"). In no case did BP request a waiver to less than 0.3 ppg. This is consistent with the waiver policies implemented by Frank Patton, who testified that he granted waivers down to 0.3 ppg, though he would not grant waivers to depart from the 0.5 ppg margin in a hydrocarbon zone. (Patton Depo., pp. 94-95).

VI. INTERVAL-BY-INTERVAL ANALYSIS

On multiple occasions, BP failed to maintain the drilling margin in connection with the Macondo well, which I believe is required by the regulations. Not only did it drill without a permissible margin, but it also misrepresented relevant data when it filed drilling permit applications and other documents with MMS both before and after engaging in its improper drilling activities.

In this section of the Report, I will analyze BP's activities for various intervals in the Macondo well during which BP drilled without a legal margin. Then, in the final section of this Report, I will summarize my specific conclusions about BP's conduct.

Open Hole Interval from the 22" Shoe to the 18" Shoe

Reporting an Excessive Fracture Gradient in a Request for an MMS Waiver

BP drilled this interval in the latter part of October 2009. Before the bulk of the interval was drilled, it conducted eight different PITs. BP's internal records indicated that it expected to achieve a PIT result of 11.0 ppg, but after conducting the first seven of these tests, it did not obtain any result higher than 10.25 ppg (unless stated to the contrary, all figures below will be surface, rather than downhole mudweight, equivalents). (Exhibit 4533). When these first seven PITs were conducted, the well had not been drilled past 8,011'. BP's Daily PPFG Report dated October 22, 2009 suggests that BP had questions about the validity of at least some of these tests, stating: "[t]he earlier tests appeared ambiguous due to the minimal build up pressure available." (BP-HZN-MBI 00073351—53)

After conducting those first seven PITs on October 21 and 22, 2009, BP drilled down to 8050' and performed what is known as a cement squeeze job, which ensured that the portion of the well in which BP conducted the first seven tests was placed behind cement. On October 25, 2009, BP drilled 10 new feet of formation from 8050' to 8060' and performed an eighth PIT. This is discussed in Halliburton's 22" Casing Post Job Report, dated October 29, 2009 (BP-HZN-MBI00172162—88) as well as in BP's Daily Operations Logs (BPC001-052454—669).

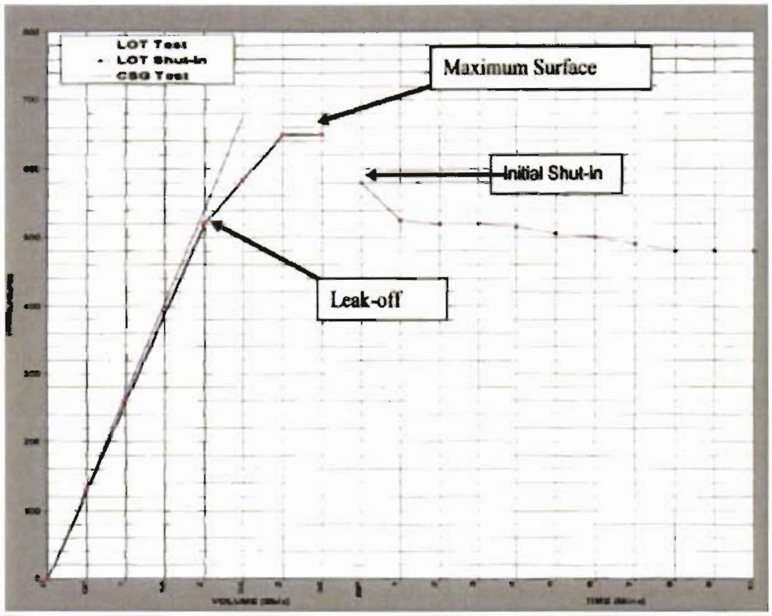
There is no question that at the end of completing those eight PITs, the appropriate PIT result to report was the result of the eighth test. Mark Alberty, who at the time of the Macondo well was BP's chief authority on pore pressure fracture gradient matters, testified at his deposition that it is appropriate to report the results of the final test conducted because that test best reflects the condition of the wellbore at the time the relevant interval was drilled. (Alberty Depo., p. 279). Kate Paine, a pore pressure analyst retained by BP for the Macondo well, testified similarly that the final LOT was "the right one" and that "the right one would be the reported one." (Paine Depo., p. 283). Since the area where the first seven tests were conducted was behind cement at the time the relevant interval was drilled, only the area where the eighth test was conducted is truly part of the interval that BP was about to drill. BP recorded the result of this eighth test as 10.09 ppg (with a downhole mud weight equivalent of 10.38 ppg). (Exhibit 4533).

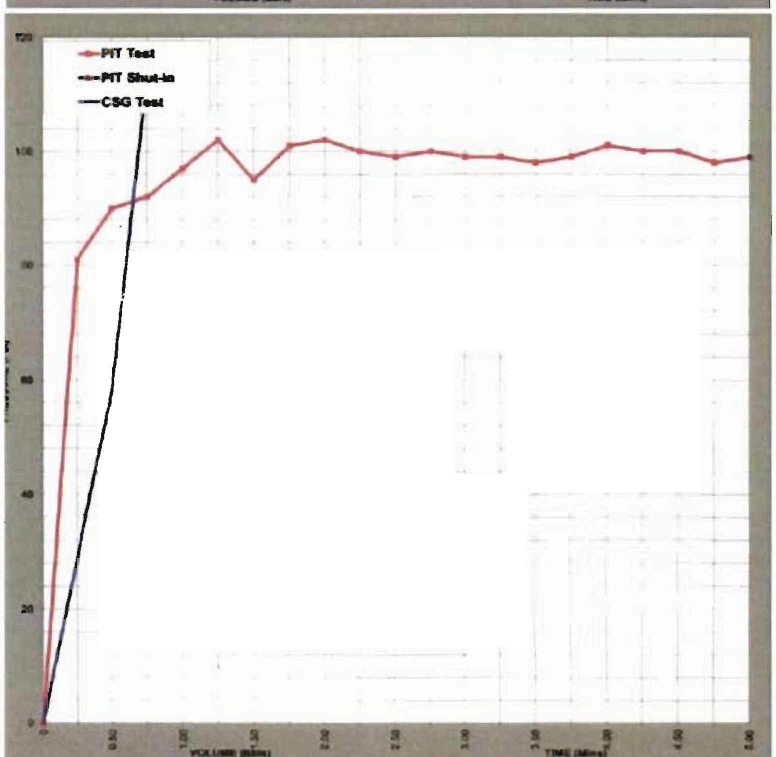
On October 25, 2009, BP's Scherie Douglas e-mailed Lynard Carter, Workover Engineer for MMS, requesting a waiver of the drilling margin for the 20" open hole interval. Douglas wrote

"LOT at 22" shoe: 10.38 ppg" and requested approval to drill the hole section with "up to a 10.0 ppg MW." (BP-HZN-2179MDL02859913). Carter approved the request later that day. (Ibid.) Then, near the end of the day, Scherie Douglas wrote Carter again, saying that "I got some clarification on surface and downhole numbers. The numbers I gave you were downhole instead of surface. Surface numbers below. Max LOT (Surface MW Equivalent) – 10.25 ppg. ... Max surface MW we will drill with – 9.95. Let me know if you have any questions." (Exhibit 3727). I have seen no indication that MMS responded to that request, which appears to be the last margin-related statement that BP made to MMS before drilling the interval.

Thus, BP's waiver requests never reported that the correct and valid result of its pressure integrity testing was 10.09 ppg. Rather, in its first October 25 waiver report, it reported the *downhole* mud weight equivalent of the eighth PIT (10.38 ppg) that yielded a surface mud weight equivalent of 10.09 ppg. Then, when it wrote back to correct its initial e-mail and point out that it had mistakenly provided a downhole number, it said that its surface number was 10.25 ppg rather than 10.09 ppg.

The 10.25 ppg figure that was reported to MMS was actually the highest result it obtained in one of its first seven tests. As discussed above, these tests were no longer relevant with respect to the open hole that was about to be drilled. But what is worse, this particular test generated a curve that in no way resembles what a valid PIT curve should look like. Figure 7 compares the curve that generated the 10.25 ppg with the curve that BP created as a model PIT curve.

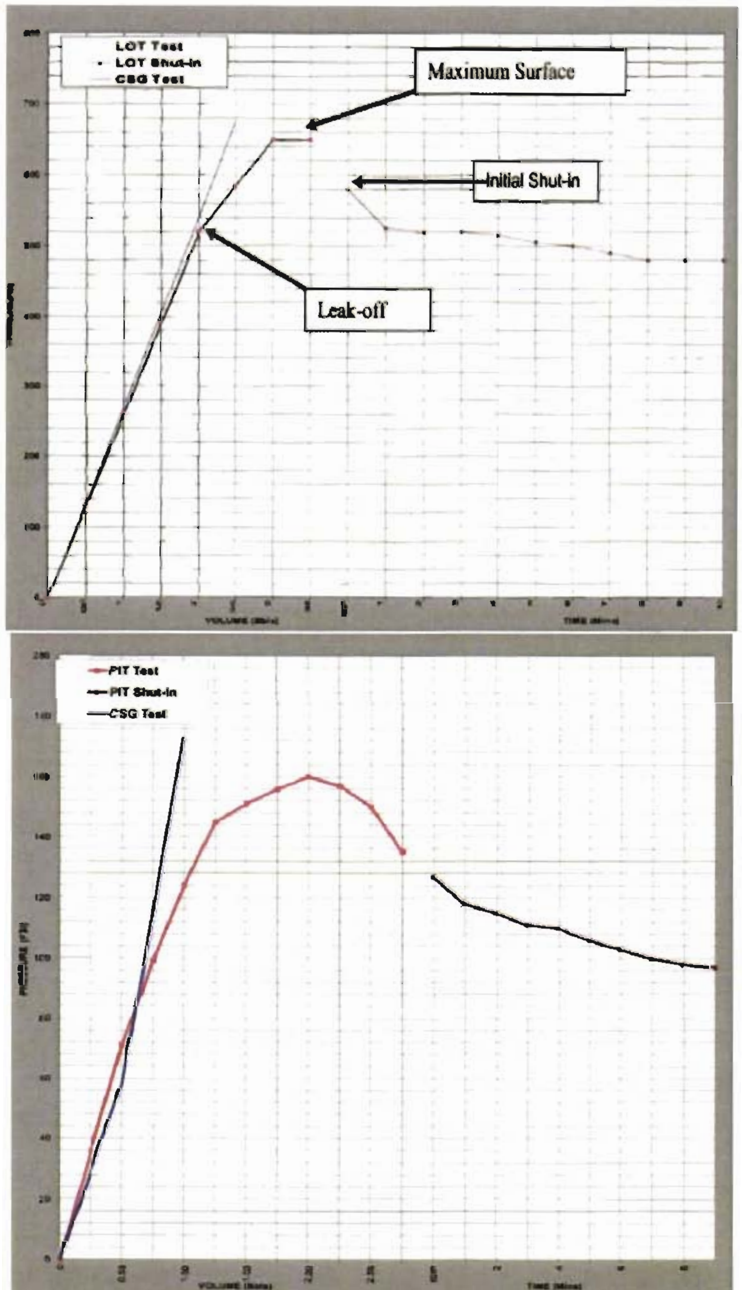




PRE-TEST CALCULATIONS/RECORDINGS	(Surface)	(Downhole)
PROJECTED FIT/LOT:	11. ppg	
Expected pressure for "Projected FIT/LOT", (psi):	413	
POST-TEST RESULTS		
MAXIMUM OBSERVED PRESS (psi):	102	
INITIAL SHUT-IN (ISIP) OR LOT PRESS (psi):	81	
MUD PUMPED (bbl):	5.00	
MUD FLOW BACK (bbl):	1.00	
MMS Value →MEASURED PIT (EMW) =	10.25 ppg	10.53 ppg
MEASURED LOT (EMW) =	10.2 ppg	10.48 ppg

Fig 7 : Comparing BP's Model PIT curve (above), to PIT performed below 22" Casing Shoe on October 21, 2009, yielding 10.25ppg FG result (below). Both curves are attachments to Exhibit 4533, BP-HZN-2179MDL00895458.

Figure 8 compares the curve the curve that generated the 10.09 ppg result, and the curve that BP created as a model PIT curve.



PRE-TEST CALCULATIONS/RECORDINGS	(Surface)	(Downhole)
PROJECTED PIT/LOT:	11. ppg	
Expected pressure for "Projected PIT/LOT", (psi):	537	
POST-TEST RESULTS		
MAXIMUM OBSERVED PRESS (psi):	160	
INITIAL SHUT-IN (ISIP) OR LOT PRESS (psi):	145	
MUD PUMPED (bbl):	2.75	
MUD FLOW BACK (bbl):	2.00	
MMS Value -->MEASURED PIT (EMW) =	10.09 ppg	10.34 ppg
MEASURED LOT (EMW) =	10.05 ppg	10.34 ppg

Fig 8: Comparing BP's Model PIT curve (top), to PIT performed below 22" Casing Shoe on October 25, 2009, yielding 10.09 ppg FG result (bottom). Both curves are attachments to Exhibit 4533, BP-HZN-2179MDL00895458.

The curve for the final test looks much more like what you would expect from a PIT than the curve that generated the 10.25 ppg. What is especially notable about the curve that generated the 10.25 ppg result is there is no evidence that the test achieved a maximum pressure above a valid LOP and then declined in pressure – rather, the pressure simply oscillated for minute after minute after it (first) reached its maximum pressure. The results of this test suggest that the fluids were leaking into a permeable formation at the casing shoe or through a cement channel. Moreover, it is particularly clear that this test should not have been reported because the interval it tested was already behind cement when BP drilled the relevant interval, and yet this is the test that BP reported to MMS as its LOT.

Finally, as discussed below, even assuming that it was appropriate for BP to rely on the PIT test that generated a figure of 10.25 ppg, it still did not provide BP with an adequate margin to drill.

Drilling Ahead Without a "Safe Drilling Margin"

Late in the evening of October 25, 2009, BP proceeded to drill this interval, which effectively began at the depth of 8050'. It continued to drill until it took a kick at roughly 8,970', which occurred on October 26, 2009. The kick resulted from a package of sand that it encountered drilling down the hole and that had a relatively high pore pressure.

The situation BP faced after taking the kick is described in a PowerPoint presentation entitled "18 1/8" x 22" hole-section review (18" CSG Section)." (Exhibit 1337). The PowerPoint states that, at that point, BP had to decide whether to set casing above the depth where it took the kick or continue to drill ahead. On the one hand, BP reasoned that if it stopped drilling and set casing at a depth above 8,970', it would have to potentially use an additional casing string – meaning that it would "potentially sacrifice hole-diameter in the reservoir interval." On the other hand, if it kept drilling, it risked drilling through another over-pressured sand package below the first one, which "would initiate a potentially uncontrollable well control event." The decision, then, was one of safety versus economics. BP chose economics – on October 27, 2009, it drilled ahead to the depth of roughly 9090'.

As is clear from BP's Daily PPFG Report for October 28, 2009 (Exhibit 1335) and its Daily Operations Log, BP drilled the vast majority of the roughly 120 additional feet after the kick at a surface mud weight of 10.1 ppg. The problem is that drilling with a mud weight of 10.1 ppg provided no margin at all. BP's relevant fracture gradient was 10.09 ppg at the time – meaning that it literally had a zero kick margin. And even if BP's fracture gradient had been validly measured at 10.25 ppg, the highest of the eight PIT results it obtained, that still would have provided a kick margin of only 0.15 ppg – far below any waiver allowance approved by MMS.

I know of no safety reason why BP could not have set casing before drilling ahead at 8970', or at least contact MMS and attempt to obtain MMS approval prior to drilling ahead, without a proper margin.

On October 29, 2009, BP filed with MMS an Application for Revised New Well. (Exhibit 1336). This application focused specifically on the interval that we are discussing. However, even though only a couple of days earlier, BP drilled this interval without any drilling margin, this new application provided no indication that BP had drilled ahead without a safe margin and exaggerated the window at the shoe above the interval. In particular, the Application misrepresented the relevant fracture gradient in four different places.

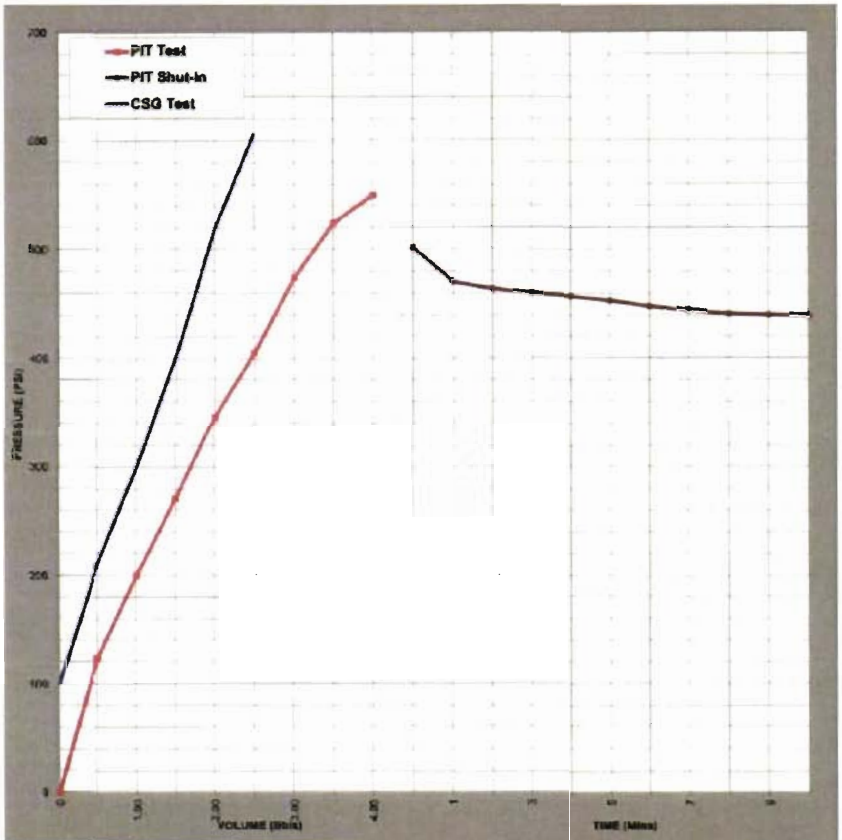
The Well Design Information worksheet in the October 29th drilling permit application clearly appears to be an updated document compared to the May 2009 APD. For example, for the interval that was drilled in late October 2009 (the interval with a casing size of 18"), the Well Design Information worksheet for the October 29th application indicates that the depth of the 18" casing shoe was changed from 9900' (the depth in the APD) to 9090'. It also indicated that the highest mud weight to be used in the interval was changed from the APD value of 10.6 ppg to 10.2 ppg. But in contrast to that mud weight, the worksheet represented that the formation test figure for the shoe right above that interval – the shoe for the 22" casing interval – was 11.1 ppg. It also represented that the fracture gradient for that same shoe was 11.1 ppg.

The October 29th drilling permit application also included a pore pressure fracture gradient plot and a schematic that listed these same inflated figures. In both cases, the fracture gradient for the 22" casing shoe was identified as 11.1 ppg. Although these latter documents were still dated May 2009, that is not the case for the Well Design Information worksheet. In all, the October 29th application indicates falsely in four separate places that the relevant fracture gradient/PIT figure for the interval drilled in late October 2009 was 11.1 ppg. As I discussed earlier, the actual fracture gradient BP should have been reporting is 10.09 ppg, and none of BP's PIT tests yielded a result higher than 10.25 ppg.

I noted that in a drilling permit application dated January 12, 2010, BP provided inconsistent information about the pressure integrity test result for the 22" casing shoe. (Exhibit 4008). In one part of the application, it indicated that the relevant number was 11.1 ppg, in a second part, the relevant number was 10.5 ppg, and in a third part, the relevant number was 10.3-downhole. The last of these three figures was essentially accurate, but the other two were not.

Open Hole Interval from the 18" Shoe to the 16" Shoe

This is the interval BP drilled in February 2010 after it completed the previous interval discussed above. Although I do not contend that BP violated the required drilling margin for this interval, I note that the documents I have reviewed indicate that BP attempted to conduct six different pressure integrity tests at the 18" shoe and obtained five pressure integrity test results. (BP-HZN-2179MDL00239511). In each case, the results were less than the predicted value, according to BP's documents. The final test did produce a curve that has all the indications of a valid test. That curve is reproduced below as Figure 9.



PRE-TEST CALCULATIONS/RECORDINGS	(Surface)	(Downhole)
PROJECTED FIT/LOT:	12 ppg	
Expected pressure for "Projected FIT/LOT". (psi):	852	
POST-TEST RESULTS		
MAXIMUM OBSERVED PRESS (psi):	550	
INITIAL SHUT-IN (ISIP) OR LOT PRESS (psi):	510	
MUD PUMPED (bbl):	4.25	
MUD FLOW BACK (bbl):	3.50	
MMS Value →MEASURED PIT (EMW) =	11.7[illegible] ppg	11.8[illegible] ppg
MEASURED LOT (EMW) =	11.69 ppg	11.79 ppg

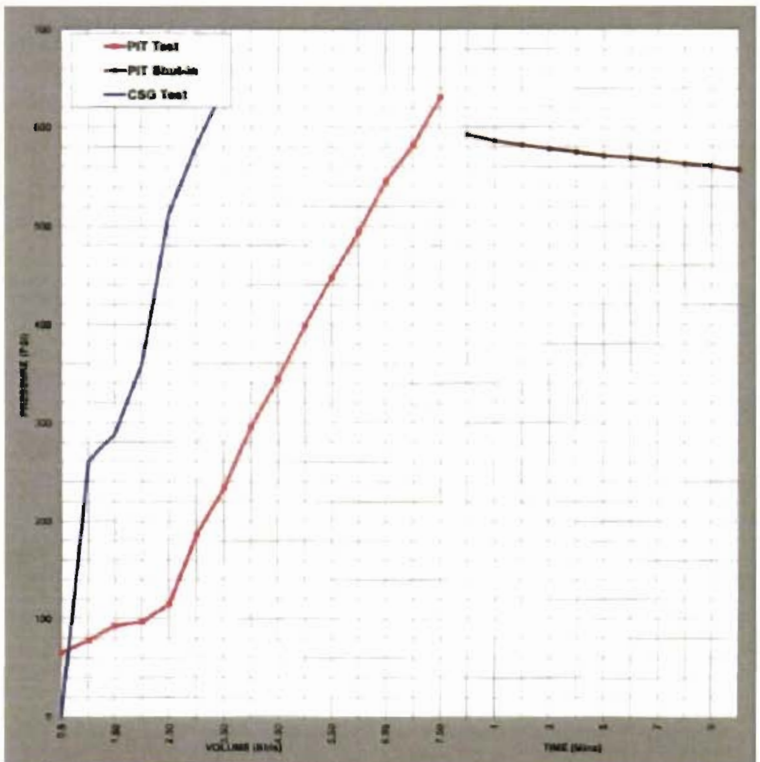
Fig. 9: PIT performed below 18" Casing Shoe on or around February 15, 2010, yielding 11.78 ppg FG result. This curve is an attachment to Exhibit 4533, BP-HZN-2179MDL00895458.

Open Hole Interval from the 16" Shoe to the 13 5/8" Shoe

Reporting an Excessive Fracture Gradient in an MMS Drilling Permit Application

This was the first of three intervals that BP drilled in March 2010. It immediately followed the previously referenced interval. BP was drilling this interval when it got its pipe stuck and needed to do a bypass in order to continue to drill the well. It stuck its pipe on March 8, 2010, filed its Application for Bypass on March 15, 2010, and then began drilling ahead again on March 18, 2010.

From the records I reviewed, the one PIT that BP conducted for this interval was a test that BP declares to be a FIT – meaning that it did not take the test all the way to the leak-off point - where the shut-in curve shows some evidence of pressure decline, unlike the test at the 9 7/8" casing shoe, which is discussed below. In BP's own internal worksheet for the test, it identified the "MMS reporting value" as 12.55 ppg, which was less than what it purported to be the projected FIT/LOT value of 12.8 ppg. See Figure 10 below.



PRE-TEST CALCULATIONS/RECORDINGS	(Surface)	(Downhole)
PROJECTED FIT/LOT:	12.8 ppg	
Expected pressure for "Projected FIT/LOT", (psi):	782	
POST-TEST RESULTS		
MAXIMUM OBSERVED PRESS (psi):	631	
INITIAL SHUT-IN (ISIP) OR LOT PRESS (psi):	592	
MUD PUMPED (bbl):	7.50	
MUD FLOW BACK (bbl):	7.50	
MMS Value -->MEASURED FIT (EMW) =	12.55 ppg	12.76 ppg
MEASURED LOT (EMW) =	12.48 ppg	12.69 ppg

Fig 10: PIT performed below 16" Casing Shoe on or around March 7, 2010, yielding 12.55 ppg FIT result. This curve is an attachment to Exhibit 4533, BP-HZN-2179MDL00895458.

At this point, BP was required to report a value no higher than 12.55 ppg – because it stopped its test when it reached that point. However, in the March 15th Application for Bypass, it identified its PIT result/fracture gradient for the relevant casing shoe/interval as 13.0 ppg. This number was listed twice in the Well Design Information worksheet (as the fracture gradient and as the formation test result), once in the plot, and again in the schematic (although the schematic also lists the number 12.6 ppg, as well). In the Well Activity Reports for the weeks ending March 20, 2010 (BP-HZN-2179MDL01906851—3) and March 27, 2010 (BP-HZN-2179MDL01906847—50), BP again listed 13.0 ppg as the shoe test result for the 16" casing shoe.

I see no substantiation for the 13.0 ppg PIT figure. It did not appear in any of the earlier drilling permit applications that I have examined. There is no mention in the Daily Operations Log of a PIT that was taken on March 14th or March 15th generating a 13.0 ppg result, and it appears that no such test was ever done. Because BP's FIT yielded a result of 12.55 ppg, BP should have reported a figure of 12.55 ppg.

I note that my independent review of the applicable data is consistent with an e-mail from Brett Cocales to Brian Morel and Mark Hafle on March 14, 2010. The e-mails says, in part, "[O]ur FIT is 12.55 and our TD MW will be 12.1 ppg, which falls just short of the 0.5 ppg margin. Maybe it is close enough for them, but we would have to ask them for this waiver as they require us to maintain 0.5 ppg unless a waiver is granted and that would technically be a 12.6 ppg shoe test. In most cases, we can get a 0.3 waiver, however, I wonder about this with a well control event in the interval." (Exhibit 3732).

Reporting an Excessive Fracture Gradient in an MMS Waiver Request

It appears that on March 18, 2010, the day that BP began drilling after the bypass application was approved, BP's Scherie Douglas had a conversation with Frank Patton regarding a waiver of the 0.5 ppg drilling margin for this interval down to 0.3 ppg. Some of the contents of this conversation were memorialized in a facsimile note that I have reviewed. Specifically, it said "12, 250 ... 12.1 MW, mud up to 12.3 ... last shoe test 12.6 ... no HC in hole section." (Exhibit 4039). It is my understanding from the record that this request was orally granted; however, the waiver was granted based on BP's erroneous reporting of data from the well.

Given that the actual PIT result for this interval was 12.55 ppg, the 12.6 ppg figure is another example of misreporting on BP's part. As the Cocales e-mail referenced above implies, if an operator's PIT result is 12.55 ppg, it cannot simply report it to MMS as a 12.6 ppg. BP records its PITs internally to the hundredth of a ppg, and when it reported its LOT results in October 2009, it reported the higher figure, which created the appearance that BP would be drilling with a margin of 0.3 ppg when, in fact, it's true margin would only be 0.25 ppg.

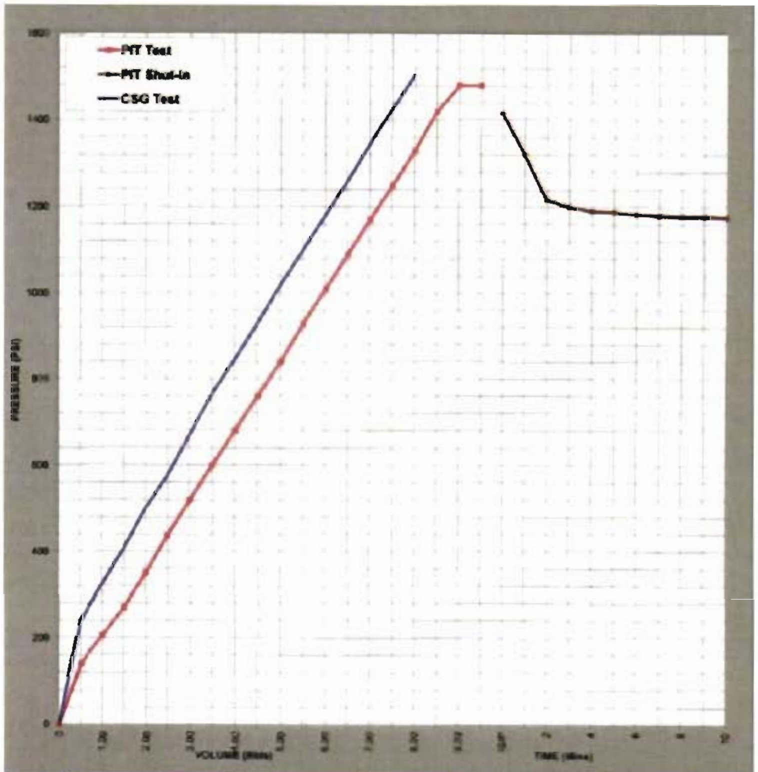
Improperly Drilling Ahead Without the Required Margin

BP's March 19, 2010 Daily Geological Report indicates that BP drilled from 12,793' to 13,150' with a mud weight of 12.3 ppg. (Exhibit 1332). (This is only 0.25 ppg less than its PIT result.) Since MMS only gave BP a waiver to drill with a 0.3 ppg margin, BP drilled ahead in violation of the margin approved by MMS.

Open Hole Interval from the 13 5/8" Shoe to the 11 7/8" Shoe

This was the second of three intervals that BP drilled in March 2010, and was the interval that immediately followed the previously-referenced interval.

According to BP's worksheet for the PIT that was conducted for the 13 5/8" casing shoe, BP conducted that test on March 21, 2010 and obtained an "MMS value" for the test of 14.67 ppg. See Figure 11 below. BP began drilling the interval the following day.



PRE-TEST CALCULATIONS/RECORDINGS	(Surface)	(Downhole)
PROJECTED FIT/LOT:	13.8 ppg	
Expected pressure for "Projected FIT/LOT", (psi):	88?	
POST-TEST RESULTS		
MAXIMUM OBSERVED PRESS (psi):	1480	
INITIAL SHUT-IN (ISIP) OR LOT PRESS (psi):	1416	
MUD PUMPED (bbl):	9.50	
MUD FLOW BACK (bbl):	9.25	
MMS Value -->MEASURED PIT (EMW) =	14.67 ppg	14.89 ppg
MEASURED LOT (EMW) =	14.58 ppg	14.8 ppg

Fig. 11: PIT performed below 13 5/8" Casing Shoe on or around March 21, 2010, yielding 14.67 ppg FG result. This curve is an attachment to Exhibit 4533, BP-HZN-2179MDL00895458.

From the above curve, it appears that BP conducted a bad test that involved testing cement, rather than formation. The problems with this test include:

- A LOT pressurization curve that is suspiciously similar in slope to the slope of the casing integrity test
- An extremely small difference between the apparent leak-off pressure and the fracture propagation pressure (roll over point)
- An initial shut-in pressure that is lower than one would expect relative to the apparent leak-off pressure

- And anomalously steep decline in pressure during the shut-in period.

The character of the test, the fact that it exceeded the overburden gradient, and the fact that it exceeded the pre-drill fracture gradient estimates by nearly a full ppg make the test very suspect. (The *overburden pressure* at any depth is the pressure that results from the combined weight of the rock matrix and the fluids in the pore space overlying the formation. It would be highly unusual for the fracture gradient to exceed the overburden pressure in a well at this location except under physical circumstances that do not appear to apply to the Macondo location.) This test needed to be re-done after drilling out an additional 10 feet, or so, of formation below the shoe.

BP internal documents bolster my conclusion that this test was most likely invalid and a re-test should have been performed. First, on March 23, 2010, Martin Albertin, BP's "Single Point of Accountability" for pore pressure fracture gradient issues involving the Macondo well, wrote an e-mail to two colleagues, Mark Alberty and Randall Sant. (Exhibit 3733). The e-mail began by saying that the PIT for this interval was "well above overburden."

Albertin's e-mail then went on to give four explanations for why the PIT result exceeded the overburden pressure. The first explanation was "not a valid LOT, somehow performed another casing test?" The next explanation was the "OB/PP models wrong (tough to get OB and PP high enough to explain the test)." The third explanation was "tectonic effects (we are between salt bodies, but they are far away (4-6 miles) and only normal faulting is observed)." And the final explanation was "tensile strength (seems farfetched given a likely high poisson's ratio shale)." Albertin then went on to say "[w]e have been discussing an open hole LOT (with much opposition) … ." Thus, Albertin himself lacked confidence in the validity of the test.

Similarly, BP's Daily PPFG Report for March 23, 2010 says "Performed LOT that gave no meaningful formation data. Drilled." It then goes on to say "LOT broke over at 1480 psi which was above overburden of 14.5 ppg causing uncertainty about its usefulness as a formation evaluation tool. Maximum ECD of 13.7 based on the possible sand frac at the 13250 sand seen on the original hole." (BP-HZN-MBI 00114042—5)

An e-mail from BP Drilling Engineer Brian Morel to another BP Drilling Engineer, Mark Hafle, dated March 23, 2010, reports that the "current PPFG team onboard [was] using 13.7 as a max LOT." He later states that the PPFG team "do[es]n't believe the 14.7 LOT." Morel does offer a possible explanation for the PIT that was conducted, though he sounds less than convinced in its reliability: "Maybe we set our casing into a higher pressure regime which exists at that shale and below ??? Stranger things have occurred." (Exhibit 1311)

All of the above information leads me to one conclusion: the validity of this particular PIT was highly suspect and, under those circumstances, BP needed to conduct a re-test after drilling additional formation to be sure about what it was testing.

In its March 26, 2010 Application for Revised Bypass, BP reported in its Well Design Information worksheet a formation test figure and a fracture gradient of 14.7 ppg. It reported that same figure in its schematic, and a 14.6 ppg figure in its plot. BP had no justification for reporting these figures to MMS without more confidence in their validity.

Improperly Drilling Ahead Without the Required Margin

Despite lacking any justification for its reported 14.6 ppg fracture gradient, and despite its internal "max LOT" estimate of 13.7 ppg, BP nevertheless drilled ahead. It did so without an adequate margin, because any drilling in an interval when the operator does not have confidence in its PIT's validity and has not disclosed this fact to MMS is, under my interpretation of the drilling margin regulations, improper.

In an e-mail dated March 18, 2010 from Brian Morel to a number of his colleagues, Morel states that there would be tight margins in this interval that "will require 0.3 deviation from MMS (will get once we have a LOT)." (Exhibit 1132). It appears BP never sought such a waiver.

According to the Daily Operations Log, at the depth of 14581', BP increased its mud weight to 13.3 ppg and continued to drill ahead, despite its concerns about the validity of the PIT and despite its "max LOT" estimate of 13.7 ppg (less than 0.5 ppg above its mud weight). (Exhibit 1311). It did not complete the interval until it drilled to the depth of 15113'.

Clearly, then, BP drilled a portion of the interval with less than a 0.5 ppg margin between its mud weight and its PPFG team's estimation of the "max LOT" value for the shoe at the top of the interval. But even if this were not the case, it should not have drilled ahead without confidence in its pressure integrity test figure.

Open Hole Interval from the 9 7/8" Shoe to 18360' (TD):

BP began drilling the final interval of the Macondo well on April 2, 2010. It started drilling at the depth of 17173' and ended the interval when it reached the Macondo's total depth of 18,360'.

Improperly Drilling Ahead Without a Valid PIT/Fracture Gradient

BP drilled this entire interval improperly, in my view. This is because when it began drilling the interval, it had no confidence in the validity of the PIT that was conducted at the shoe at the top of the interval (the 9 7/8" shoe). In fact, from all the evidence, no reasonable operator could have had confidence in this PIT.

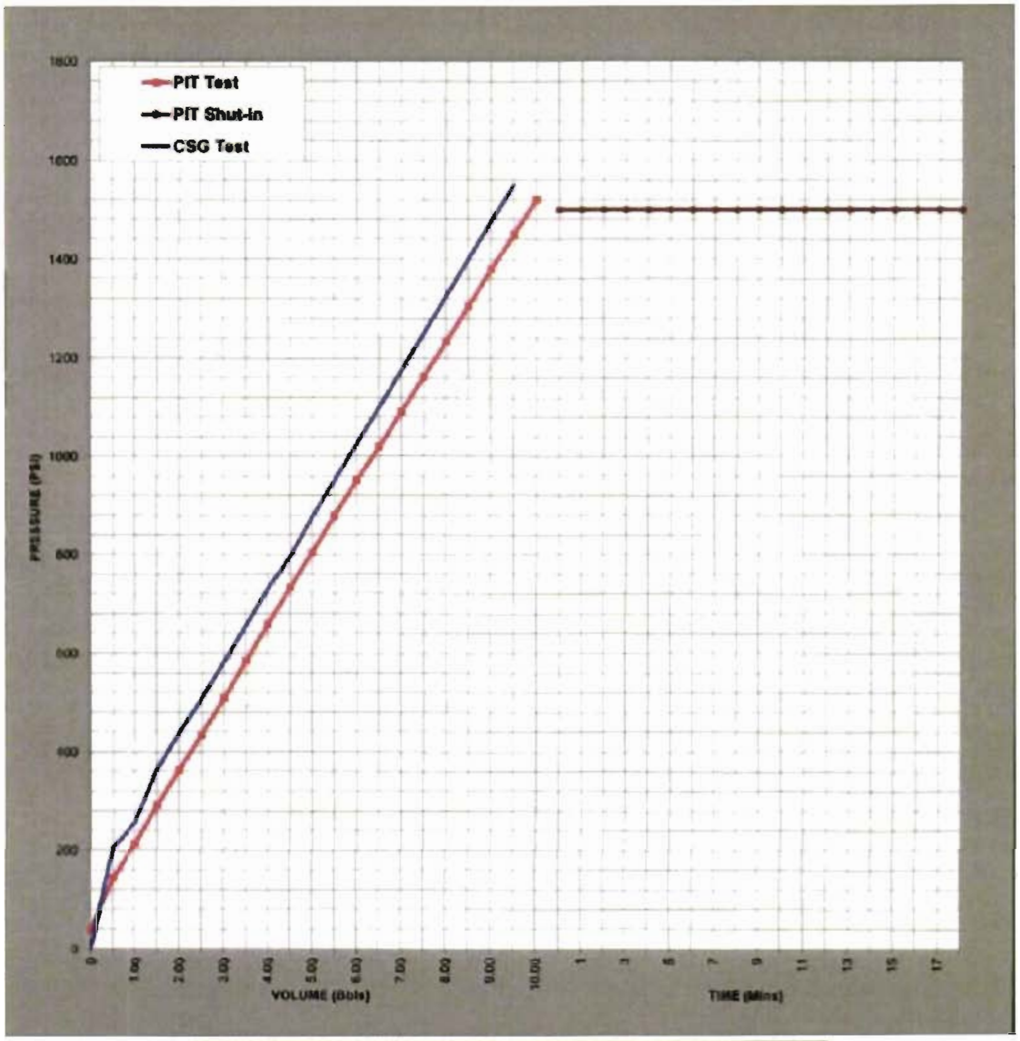
The dubious PIT was conducted on April 2, 2010. E-mails written by members of BP's Macondo team appear to point out the doubts they had with respect to the test's validity. In an e-mail from Martin Albertin to various colleagues dated April 2, 2010, he points out that the overburden gradient was "about 15.5 ppg at the shoe." (Exhibit 1343). By contrast, the result of the PIT was 16.23 ppg downhole and 16.01 ppg surface. He also says that "I think it is safe to say that this test is not indicative of the true fracture strength of the average shale that we are about to drill – which I expect is much lower than this FIT suggests." Albertin goes on to offer a few explanations, one of which is that this was an "erroneous test." Later in the e-mail, he says that "the most likely explanation is that we have tested a shale that has very high tensile strength, or we have tested cement/casing."

The next day, Brian Morel wrote an e-mail to two of his colleagues saying that BP did commence a second attempt at a PIT, "as we were not expecting to get anywhere close to 16.0 ppg with the lot." (Exhibit 3734). However, when the pressure reached the point where they had stopped testing the casing, Morel said, BP "opted to shut down without going to leak off because we wouldn't know if it was casing or formation."

Recall that in October 2009, BP did drill out additional formation when it was unsure about the validity of its PITs, and had expected a higher number. In April, when its PIT result was much higher than expected, BP cannot reasonably defend its decision to refrain from drilling out additional formation and thereby ensure that it had not been testing "cement/casing," to use Albertin's words.

The results of April PIT exceeded the overburden gradient by at least half a pound per gallon, which is highly abnormal. Moreover, BP's worksheet for this FIT test indicates that the projected FIT/LOT was 15.2 ppg, but at 16.0 ppg, the pressure was still increasing at the same rate. In other words, despite already exceeding pre-test expectations by nearly a full pound per gallon, the test never showed signs of leaking off, meaning that there is no way to determine how much higher the test pressure would have gone had BP not shut off the pumps. That difference between the pre-test expectations and overburden gradient, on the one hand, and the fracture gradient, on the other, is very strong evidence that the test was invalid.

Another red flag is the appearance of the test curve. Figure 10 shows the FIT conducted at the 16" casing shoe. The earlier of the two tests shows that the slope of the formation test is noticeably less steep than the slope of the casing test, which is what you would expect for a formation test. By contrast, the test at the 9 7/8" casing shoe is nearly identical in slope to the casing test. See Figure 11. Also, when the pumps were turned off in the earlier of the two tests, the pressure did bleed off significantly, whereas in the test conducted at the 9 7/8" casing shoe, the pressure did not bleed off at all – not even a single psi. This is highly irregular for a formation test that the operators are claiming to be valid.



PRE-TEST CALCULATIONS/RECORDINGS	(Surface)	(Downhole)
PROJECTED FIT/LOT:	15.2 ppg	
Expected pressure for "Projected FIT/LOT", (psi):	802	
POST-TEST RESULTS		
MAXIMUM OBSERVED PRESS (psi):	1520	
INITIAL SHUT-IN (ISIP) OR LOT PRESS (psi):		
MUD PUMPED (bbl):	10.00	
MUD FLOW BACK (bbl):	10.00	
MMS Value -->MEASURED PIT (EMW) =	16.01 ppg	16.23 ppg
MEASURED LOT (EMW) =		

Fig. 12: PIT performed below 9 7/8" Casing Shoe on or around April 2, 2010, yielding 16.01 ppg FG result. This curve is an attachment to Exhibit 4533, BP-HZN-2179MDL00895458.

Figure 12 shows the formation test conducted at the 9 7/8" casing shoe and Figure 1 shows that analogous casing test. It is striking how much the casing test resembles the formation test – and how little the formation test resembles the classic formation test curves that are attached in Figure 2 and the first of the curves in Figure 7 and 8 (the latter is BP's own model). I cannot understand how BP could have looked at its formation test curve and gained confidence that it was testing formation and not casing or cement.

I also examined a lithology report for this interval and found nothing in this report that would lead me to change my conclusions. (Exhibit 4536). (That report suggests that the drilling of new formation past the cemented interval may not have been accomplished since cement was still being cut by the drill. However, the only valid way to confirm that enough new formation has been drilled is by the detection of a drilling break at the bottom of cement followed by circulating bottoms up to remove the cement cuttings from the mud and then drilling out additional feet of new formation by confirming that cement cuttings are still not the dominant cutting type present in the mud. I have not seen that evidence for this interval, or for the interval beneath the 13 5/8" shoe). Mark Alberty in his deposition acknowledged that the lithology report was inconclusive. (Alberty Depo, pp. 303-4).

For all of these reasons, I do not believe it was acceptable for BP to treat the results of its April 2, 2010 test as a valid PIT test and to commence drilling deeper into the Macondo well on the basis of that test.

Improperly Drilling Ahead Despite A Number of Loss Return Incidents

Once BP began drilling this interval, the open hole observations confirmed that the drilling window was dangerously small. Separate and apart from its failure to conduct a valid PIT, BP was obliged based on these open-hole observations to cease drilling, report its loss of drilling margin to MMS, and specifically seek approval from MMS before it could continue drilling further into the interval. Yet BP never reported any loss of drilling margin before it completed the interval, and it misrepresented its fracture gradient to MMS when it reached the bottom of the interval.

I have reviewed, among other documents pertaining to this interval, a PowerPoint presentation by BP's Randall Sant entitled "Macondo 8 ½" x 9 7/8" Hole Section." (Exhibit 4533). This presentation discusses how BP encountered three separate loss-returns incidents in drilling the interval. The first one was encountered at the depth of 17,761', when BP was drilling with a surface mud weight of 14.5 ppg. After the incident, BP pumped loss circulation material (LCM), reduced the surface mud weight to 14.3 ppg, and continued to drill ahead. This incident would have confirmed that the weakest fracture gradient in the interval was nowhere near the 16.0 ppg surface figure indicated by the PIT at the top of the interval.

By the time BP had drilled to the depth of 18220', its internal documents indicate that it successfully conducted GeoTap tests at two different depths in this interval. The GeoTaps are highly reliable pore pressure tests that operators can conduct in sand. According to its Daily PPFG Report for April 4, 2010 (BP-HZN-MBI 00118072—4) and its Daily Geological Report for April 5, 2010 (DHCIT-ASX-5973599-601) : it conducted three GeoTaps at the depth of 17712'-17713' and obtained results ranging from 14.14-14.16 ppg (these are downhole mud weight equivalents, not surface equivalents); when it had drilled to the depth of 18220', it also conducted a GeoTap at the depth of 18090' and obtained a result of 12.58 ppg (again, a downhole mud weight equivalent). (These tests indicate that there were at least two separate sand packages in that part of the interval and the deeper of the two actually had a much *lower* pressure than the more shallow package. It also means, for the reasons I am about to explain, that BP had found themselves experiencing an extremely tight squeeze when it comes to its drilling window.

The GeoTap at roughly 17713' provided solid evidence that the highest pore pressure in the interval was *at least* 14.14 ppg to 14.16 ppg (in downhole mud weight equivalents). BP appears to be determining the mud weights needed to overbalance the well's pore pressures by calculating the surface mud weights that would, when converted to downhole mud weights, exceed the downhole pore pressure. Also, BP appears to be calculating its surface mud weights to the *tenth* of a ppg, rather than to the hundredth of a ppg. Here, BP was faced with the situation where the downhole pressures at the bottom of this interval were roughly 0.24 ppg above the surface pressures (see the Daily Geological Reports' comparisons between the surface mud weights and ESDs for the lower portion of the final interval). (DHCIT-ASX-5973599-601). Thus, to overbalance a downhole pore pressure of 14.16 ppg, BP could not use mud with a surface weight of 13.9 ppg, since that would translate to a downhole weight of 14.14 ppg, which is less than the 14.16 ppg pore pressure measurement. It needed to use a surface mud weight of at least 14.0 ppg to equal or exceed that 14.16 ppg figure.

Given that the downhole numbers at the bottom of the interval were roughly 0.24 ppg above the surface numbers (see the Daily Geological Reports' comparisons between the surface mud weights and ESDs for the lower portion of the final interval), this means that BP would need to use a surface mud weight of at least 14.0 ppg in drilling this interval if it wished to remain overbalanced – and assuming that it is calculating its surface mud weights to the tenth and not the hundredth of a ppg, which appears to be the case.

Those facts need to be considered in comparison to the result obtained at 18090', when the pore pressure was measured at only 12.58 ppg (downhole MW equiv.). Operators can estimate fracture gradients based on these pore pressure results, and while they may not be 100 percent reliable, they are indications that prudent operators do not simply ignore. In this case, the Daily PPFG Report for April 5, 2010 said that the 12.58 ppg pore pressure figure translated to an estimated 14.4 ppg fracture gradient (downhole MW equiv.), but in the depositions of Mark Alberty and Martin Albertin, it was revealed that the more precise estimate was 14.34 or 14.35 ppg. (Albertin Depo, pp. 382-3; Alberty Depo, pp. 332-4).

In other words, when BP had drilled to the depth of 18220' and had already conducted the two sets of GeoTaps discussed in the previous paragraphs, its best estimate was that the window between the highest pore pressure in the interval and the lowest fracture gradient in the interval was less than 0.2 ppg. And given that BP would need to drill with at least a surface mud weight of 14.0 ppg (as discussed above), which would exceed the GeoTap pore pressure figure by nearly 0.1 ppg, it could not have assumed that its margin exceeded 0.1 ppg. Based on my experience in the industry and my interpretation of the MMS regulations, this is *not* a drilling margin sufficient for drilling ahead without MMS approval. As an industry practitioner, I would also have serious doubts that MMS would grant a waiver under these circumstances (i.e., a 0.1 ppg margin in an interval with a hydrocarbon zone).

But BP drilled ahead nevertheless, and as Sant's PowerPoint presentation indicates, at the depth of 18,260', it lost returns for the second time in the interval. Other BP internal documents (including the Bodek April 13, 2010 e-mail discussed below) indicate that BP lost total returns at that point. It did so when it was pulling its pipe out of the hole with a surface mud weight of 14.4 ppg.

That loss of total returns took place on the evening of April 4th, according to the Daily Operations Log. BP's records indicated that BP lost thousands of barrels of drilling mud over the next couple of days as it attempted to get the situation under control with the help of form-a-set/form-a-squeeze pills and decreasing the surface mud weight to 14.0 ppg (the lowest amount it could handle without risking a kick). It appeared to have lost no more mud on the dates of April 7th or 8th, but on the morning of April 9th, as it was circulating mud with a surface mud weight of 14.0 ppg, it suffered what Sant's PowerPoint refers to as the interval's third lost circulation incident. This time, the well's losses were modest, but the event indicates that with a downhole mud weight equivalent of roughly 14.45 ppg (Sant's PowerPoint estimates the ECD at "14.5-14.4 ppg"), it was losing mud. When BP shut off the pumps, its initial static losses of 6 barrels per hour dropped to 1.2 barrels per hour. At that point, BP pumped LCM and the loss returns stopped.

All of the events from the evening of April 4th through the early-morning of April 9th took place when BP had drilled to the depth of 18260'. After these two final loss-return incidents, BP had every reason to estimate its fracture gradient at no more than roughly 14.45 ppg (downhole MW equiv.). This is the rate at which it was losing returns after it had previously lost total returns at the same depth and then closed up the fracture. BP's internal documents – including an e-mail from BP's Operations Geologist Bobby Bodek, dated April 13, 2010 (Exhibit 1241), a "Drilling and Completions MOC" dated April 15, 2010 (Exhibit 1562), and a document dated in July 20, 2010 entitled "Macondo MC 252 #1 Permanent Abandonment Statement of Requirements" (Exhibit 3739) – all suggest that BP identified its fracture gradient at the depth of 18,260' at no higher than 14.5 ppg (downhole MW equiv.). But as discussed above, to keep overbalanced, BP could not drill with less than a surface mud weight of 14.0 ppg and a downhole mud weight of roughly 14.24 ppg.

Thus, at 18260', BP understood its margin to be no more than roughly 0.26 ppg – and I would estimate that margin to be closer to 0.20 ppg. Nevertheless, late in the morning of April 9th, BP drilled another 100' down to the Macondo's total depth of 18360'. (BPC001-052454—669). While it was improper for BP to drill any portion of this interval without having confidence in its PIT, the impropriety was especially pronounced after the GeoTaps reliably indicated the loss of margin, and even more pronounced when BP lost returns twice at the depth of 18,260', thereby underscoring that it was drilling ahead with a margin nowhere near 0.5 ppg.

In stating that at the depth of 18,260' BP had "minimal, if any, drilling margin," and explaining why that is the case, Bodek's April 13, 2010 e-mail, as I interpret it, indicates that had BP decreased its mud weight by a single tenth of a pound per gallon, it would have been underbalanced, but if it increased its mud weight by a single tenth of a pound per gallon, it would have exceeded its estimated fracture gradient. This further illustrates the extent to which BP's "safe drilling margin" was eliminated.

Misrepresenting to MMS the Macondo Well's Fracture Gradient in its Final Interval

On April 15, 2010, BP filed its (corrected) Application for Revised Bypass. (Exhibit 3067). This Application, which sought to alter the way that the final interval was cased, purported to provide both fracture gradient and formation test figures for the shoe at the top of the final interval and for the well at the total depth of 18360'. In each case, BP presented the situation as if the well had an ample window between its pore pressure and its fracture gradient – which was clearly not true for the bottom of the well.

The Well Design Information worksheet in BP's April 15th (corrected) Application stated that at the shoe above the final interval, the appropriate fracture gradient and formation test figures were both 15.0 ppg. The pore pressure identified for that depth was 13.7 ppg. The worksheet went on to say that at the depth of 18,360', the well had a formation test figure of 15.2 ppg and a fracture gradient of 16.0 ppg. The pore pressure identified for that depth was 13.9 ppg.

In fact, at the bottom of the well, the surface equivalent of the pore pressure might reasonably be estimated in the neighborhood of 13.9 ppg. But the fracture gradient was roughly 14.2 ppg (these are surface, not downhole mud weight equivalents). And when the 14.0 ppg mud weight is factored into the equation, the lack of a margin and window become very clear. None of that was apparent from BP's submission to MMS – which falsely depicted a window of more than 2.0 ppg, or many times the actual window.

VII. SPECIFIC CONCLUSIONS

1. **BP represented that it would always maintain a 0.5 ppg "safe drilling margin" absent advance permission from MMS to drill with a lesser margin, but it repeatedly failed to honor this commitment and improperly drilled ahead without maintaining a safe margin.**

In BP's Well Design Information worksheet of its May 2009 Application for Permit to Drill, BP provided estimates of the relevant fracture gradients and maximum mud weights for each interval. The fracture gradients exceeded the maximum mud weights by 0.5 ppg. BP obtained waivers to drill with a lower margin for the interval beneath the 22" shoe, the 18" shoe and the 16" shoe; however, in none of these situations did these waivers permit BP to drill with less than a 0.3 ppg margin.

In BP's March 15, 2010 Application for Bypass and March 26, 2010 Application for Revised Bypass, BP included plots indicating that it would consistently maintain its mud weight to be at least 0.5 ppg below the well's fracture gradient.

Repeatedly, however, BP drilled ahead despite its inability to maintain a 0.5 ppg margin (or a 0.3 ppg margin where permitted by the MMS) and despite neither seeking nor obtaining MMS approval of its decision to drill ahead without such a margin. This practice took different forms. In some situations, BP did not have any basis for knowing that it had a safe drilling margin (because it did not conduct a pressure integrity test in which it had confidence). In other situations, BP affirmatively established that it lacked a safe drilling margin but drilled ahead anyway.

Specific examples of such improper drilling conduct include:

- In the interval beneath the 22" shoe, by drilling with a surface mud weight of 10.1 ppg at the depth of 8970' and continuing for most of the remaining 120' of the interval, when the most recent and relevant pressure integrity test result was 10.09 ppg, no PIT result was obtained for the interval that exceeded 10.25 ppg, and MMS did not permit drilling ahead with a margin of less than 0.3-0.38 ppg.

- In the interval beneath the 16" shoe, by drilling ahead with a surface mud weight of 12.3 ppg at the depth of 12793' and continuing until 13150', when the pressure integrity test result for the interval was 12.55 ppg, and MMS did not permit drilling ahead with a margin of less than 0.3 ppg.

- In the interval beneath the 13 5/8" shoe, by: (a) drilling the entire interval without having conducted a pressure integrity test in which BP had confidence in its results; and (b) drilling from 14581' to 15113' with a surface mud weight of 13.3 ppg, despite the fact that BP's pore pressure fracture gradient team estimated the maximum leak off test figure at 13.7 ppg, and despite the fact that MMS did not permit drilling ahead with a margin of less than 0.5 ppg.

- In the final interval of the well, by: (a) drilling the entire interval without having conducted a pressure integrity test in which BP had confidence; (b) drilling from 18200' to 18260' despite having estimated the difference between the highest pore pressure in the interval and the lowest fracture gradient in the interval to be less than 0.2 ppg; and (c) drilling from 18260' to 18360' despite having lost returns on two separate occasions at that depth, including a situation where the pressure at which the returns were lost was only about 0.2 ppg above the mud weight, and despite the fact that MMS did not permit drilling ahead with a margin of less than 0.5 ppg.

As I interpret the MMS regulations, based on my reading of the regulations and experience in the industry, the above conduct violated the following regulations: 30 C.F.R. § 401, which requires operators to use the best and safest available technology to minimize the opportunity for a well to flow or kick; 30 C.F.R. § 250.427(b), which requires operators to maintain the safe drilling margin identified in their approved APD, and to suspend drilling operations and remedy the situation when they cannot maintain that safe margin; 30 C.F.R. § 250.428(a), which requires an operator, when it encounters conditions that warrant revising its casing design, to submit a revised casing program to MMS for approval; and 30 C.F.R. § 250.427(a), which requires using the pressure integrity test and related hole-behavior observations, including pore pressure test results, to adjust the well's mud weight and casing design.

2. BP repeatedly misrepresented the Macondo well's pressure integrity test results and/or fracture gradients to MMS

Repeatedly, BP misrepresented its pressure integrity tests and/or fracture gradients in its submissions to MMS. These misrepresentations include:

- In the interval beneath the 22" shoe, by: seeking a waiver based on the written representation that the relevant pressure integrity test result was 10.25 ppg when, in fact, it was only 10.09 ppg; and repeatedly and consistently stating in the October 29, 2009 Application for Revised New Well that the pressure integrity test result and fracture gradient was 11.1 ppg.

- In the interval beneath the 16" shoe, by: repeatedly stating in the March 15, 2010 Application for Bypass that the pressure integrity test result and fracture gradient was 13.0 ppg when, in fact, the only pressure integrity test conducted for this interval yielded a result of 12.55 ppg; submitting Well Activity Reports that misrepresent that the relevant pressure integrity test result for this interval was 13.0 ppg; and seeking a waiver of the 0.5 ppg drilling margin requirement based on the misrepresentation that the pressure integrity test result was 12.60 ppg.

- In the interval beneath the 13 5/8" shoe, by representing in the March 26, 2010 Application for Revised Bypass that the relevant pressure integrity test result and fracture gradient was 14.6-14.7 ppg, when, in fact, BP did not have confidence in the validity of the pressure integrity test that resulted in those numbers and had no reason to have confidence in the validity of that test.

- In the well's final interval, by representing in the April 15, 2010 (corrected) Application for Revised Bypass that: the relevant pressure integrity test result and fracture gradient for the shoe above this interval was 15.0 ppg, when, in fact, BP did not have confidence in the validity of the pressure integrity test that resulted in those numbers and had no reason to have confidence in the validity of that test; and the relevant pressure integrity test result and the fracture gradient at the bottom of the well were 15.2 and 16.0 ppg, respectively, when in fact, BP knew that the fracture gradient at the bottom of the well was no higher than roughly 14.2 ppg (surface mud weight equivalent).

As I interpret the MMS regulations, and based on my experience in the industry:

- To the extent these misstatements were made in drilling permit applications, they violate 30 C.F.R. § 250.413, which requires operators to report their fracture gradients in drilling permit applications, and 30 C.F.R. § 250.428(a), which requires an operator, when it encounters conditions that warrant revising its casing design, to submit a revised casing program to MMS for approval. Implicit in that requirement is the condition that the information set forth in the casing design is accurate; and

- To the extent these misstatements were made in requests for waivers of the drilling margin requirement, they violate 30 C.F.R. § 250.409, which permits operators to seek departures from drilling requirements. Implicit in that requirement is the condition that the information set forth in the waiver request is accurate.

3. BP repeatedly failed to disclose information to MMS that it was required to disclose before drilling further down into the Macondo well

As stated in the analysis of conclusion #1 above, BP represented to MMS that it would maintain a safe drilling margin of 0.5 ppg, unless it receives a waiver from MMS to drill with a margin of no less than 0.3 ppg. Repeatedly, as discussed above, BP drilled ahead without the margin it promised to maintain and without providing notice of this fact to MMS.

Such a practice violates industry standards and, according to my interpretation of the MMS regulations and in light of my experience in the industry, it also violates § 30 C.F.R. 250.401, 250.427(b) and 250.428(a), for the reasons explained in item #1 above.

4. In repeatedly failing to honor its commitments to drill with a safe drilling margin, BP departed from the standards that would be met by any prudent operator

The drilling margin regulations are important in maintaining well control and ensuring the safety of oil drilling in the Outer Continental Shelf. To the extent BP violated these regulations, it departed from prudent drilling conduct.

Attached below: Appendices A, B and C

APPENDIX A – STATEMENT OF COMPENSATION

I have been compensated at a rate of $375 per hour for my services to the United States Department of Justice in this matter.

APPENDIX B – DATA AND DOCUMENTS REVIEWED AND REFERENCES

DOCUMENTS REVIEWED

In preparation for this report, I have reviewed numerous documents including the following:

BP EPT Pore Pressure Prediction Manual (GP-10-15)	BP-HZN-MBI00208552—70
BP EPT Pore Pressure Detection While Drilling Manual (GP-10-16)	BP-HZN-2179MDL00408027—43
BP internal Tubular Design Manual BPA-D-003 (12/30/2008)	BP-HZN-OIG00036949—7389
BP internal leak off test manuals and materials	
• Standardization of Leak-off Testing Procedures (2/15/2010)	BP-HZN-2179MDL03137901—23
• Standardization of Leak-off Testing Procedures (4/29/2010)	BP-HZN-2179MDL03141720—46
9/3/2009 Pre-Drill Data Package	BP-HZN-CEC011483—521
June 2009 Macondo Well Information	BP-HZN-OIG00074493—505
September 2009 Macondo Well Information	BP-HZN-OIG00053432—45
September 2009 Macondo Subsurface Information	BP-HZN-MBI00019700—08
January 2010 Macondo Well Information	BP-HZN-OIG00072321—333
January 2010 Macondo Subsurface Information	BP-HZN-MBI00010928—36
Halliburton 22" Casing Post Job Report (10/29/2009)	BP-HZN-MBI00172162—88
Halliburton 18" Liner Post Job Report (12/2/2009)	BP-HZN-MBI00172218—24
Halliburton 18" Liner Post Job Report (3/22/2010	BP-HZN-MBI00172042—61
Halliburton 16" Liner Post Job Report (3/27/2010)	BP-HZN-MBI00172114—29
Halliburton 13 5/8" Liner Post Job Report (4/25/2010)	BP-HZN-CEC011456—63
Halliburton 11 7/8" Liner Post Job Report (4/25/2010)	BP-HZN-CEC011426—33
Halliburton 9 7/8" Liner Post Job Report (4/25/2010)	BP-HZN-CEC011434—43

Halliburton 9 7/8" X 7" Production Casing (4/18/2010)	BP-HZN-CEC008381—92
All Applications for Permit to Drill (APDs) submitted to the MMS	
All Weekly Activity Reports (WARs) submitted to the MMS	
E-mail from: Douglas, Scherie Sent: October 25, 2009- Subject: RE: MC 252 #001, - MW change request	BP-HZN-2179MDL02859913
Macondo Daily Drilling Reports:	
• 10/16-25/2009	TRN-USCG_MMS-00011654—90
• 10/26-27/2009	BP-HZN-MBI00171927—35
• 10/28/2009	BP-HZN-MBI00171941—45
• 1/31/2010—2/28/2010	HCG009-015853—971
• 3/1/2010—3/17/2010	HCG009-015972—6047
• 3/18/2010—3/30/2010	HCG009-015787—843
• 4/1/2010—4/20/2010	HCG009-015700—786
All Macondo Daily PPFG Reports	BP-HZN-MBI 0073351 – 3 BP-HZN-MBI 0073292 – 3 BP-HZN-MBI 0073351 – 3 BP-HZN-MBI 0073403 – 22 BP-HZN-MBI 0074995 – 7 BP-HZN-MBI 00103114 – 6 BP-HZN-MBI 00103883 – 5 BP-HZN-MBI 00104053 – 5 BP-HZN-MBI 00109120 – 3 BP-HZN-MBI 00109565 – 7 BP-HZN-MBI 00112491 – 2 BP-HZN-MBI 00113144 – 6 BP-HZN-MBI 00114035 – 45 BP-HZN-MBI 00114391 – 7 BP-HZN-MBI 00116130 – 1 BP-HZN-MBI 00116294 – 8 BP-HZN-MBI 00118072 – 4 BP-HZN-MBI 00118114 – 5
All Macondo Daily Geological Reports	DHCIT-ASX-5973361--3684
All Sperry-Sun Daily Reports	DHCIT_TP-5974247
Macondo daily recorded operations data sheet	BPC001-052454—669

Macondo leak off test data sheets on BP official LOT work sheet format:	
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (10/19/2010)	BP-HZN-2179MDL00895460
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (2/11/2010)	BP-HZN-2179MDL00032164
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (2/15/2010)	BP-HZN-2179MDL00239511
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (3/7/2010)	BP-HZN-2179MDL00096600
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (3/21/2010)	BP-HZN-2179MDL00003937
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (3/26/2010)	BP-HZN-2179MDL00006200
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (4/1/2010)	BP-HZN-2179MDL00005669
• BP Formation Pressure Integrity Test (PIT) Reporting Spreadsheet (4/2/2010)	BP-HZN-2179MDL00032164
BP reports on mud loss events and other well related issues:	
• Macondo 22" Open Hole Mud Loss Event Summary	BP-HZN-2179MDL00762246—53
• Macondo 20" Open Hole Mud Loss Event Summary	BP-HZN-2179MDL00765359—63
• Macondo 8.5x9.875" Open Hole Mud Loss Event Summary	BP-HZN-2179MDL00752353—57
BP internal Memoranda of Change (MOCs):	
• 6/22/2009	BP-HZN-MBI00143033—35
• 4/7/2010	BP-HZN-MBI00143255—57
• 4/14/2010	BP-HZN-CEC021665—67
• 4/15/2010	BP-HZN-2179MDL01577009—11

BP internal PowerPoint files relating to the Macondo well	
• 18 1/8" x 22" hole-section review (18"CSG section)	BP-HZN-MBI 00099622—32
• 10/29/2009 Macondo LL PowerPoint Presentation	BP-HZN-2179MDL00373877—86
• 16.5" x 20" hole section review (16" CSG section)	BP-HZN-MBI00142285—99
• 2/17/2010 Macondo LL PowerPoint Presentation	BP-HZN-OIG00029806—15
• Macondo MC_252-1-A Losses Analysis	BP-HZN-MBI 00107192—96
• 3/4/2010 Macondo LL PowerPoint Presentation	BP-HZN-MBI 00111804—06
• 4/1/2010 Macondo LL PowerPoint Presentation	BP-HZN-OIG00023289—95
• April 2010 Macondo PPFG PowerPoint	BP-HZN-BLY00047267—76
• BP Well Control Incidents—Based on Bi-Weekly Lessons Learned Mtg Presentations February '09 to April '10	BP-HZN-2179MDL00658011—50
Post Well Report (5/25/2010)	BP-HZN-BLY00105597—5634
Post Well Report (7/26/2010)	BP-HZN-BLY00082874—2914
Deposition transcripts for the following witnesses:	
• Martin Albertin	
• Mark Alberty	
• Jonathan Bellow	
• Robert Bodek	
• Kate Paine	
• Graham Vinson	
• Frank Patton	
• Michael Saucier	

I have also reviewed the following deposition exhibits

Exhibit No.	Description	Bates Number
0106	Critical Questions	BP-HZN-BLY00061243 - BP-HZN-BLY00061250
0336	Macondo M252 Cement Analysis: BP Investigation Team 24-June-2010	BP-HZN-BLY00173428- BP-HZN-BLY00173451
1045	E-Mail - From: Bodek, Robert Sent: Tue Apr 06 15:26:40 2010 - Subject: RE: Good morning!	BP-HZN-2179MDL00895056 - BP-HZN-2179MDL00895060
1046	GoM Exploration and Appraisal Communication Plan (September 2009, Rev. 2)	BP-HZN-MBI00071986 - BP-HZN-MBI00072008
1047	E-Mail - From: Bodek, Robert Sent: Wed Oct 14 20:17:39 2009 - Subject: FW: Alex Voltaire	BP-HZN-2179MDL00884526 - BP-HZN-2179MDL00884527
1048	E-Mail - From: Bodek, Robert Sent: Wed Oct 21 20:48:02 2009 - Subject: RE: Macondo well flow event	BP-HZN-2179MDL00891525 - BP-HZN-2179MDL00891526
1049	E-Mail - From: LeBleu, John Sent: Tue May 04 18:28:39 2010 - Subject: Macondo Information	BP-HZN-2179MDL00762245 - BP-HZN-2179MDL00762253
1050	E-Mail - From: Bodek, Robert Sent: Mon Oct 26 18:23:04 2009 - Subject: FW: BP Request For MC 252 / MC 292 Drilling Information	BP-HZN-2179MDL00884634 - BP-HZN-2179MDL00884636
1051	E-Mail - From: Bodek, Robert Sent: Thu Oct 29 15:20:26 2009 - Subject: RE: Macondo	BP-HZN-2179MDL00884296
1052	E-Mail - From: Bodek, Robert Sent: Tue Jan 26 15:53:02 2010 - Subject: Macondo: 18" CSG section review	BP-HZN-MBI00099621
1053	bp - MC 252 #1 (Macondo): 18 1/8" x 22" hole-section review (18" CSG section)	BP-HZN-MBI00099622 - BP-HZN-MBI00099632
1054	E-Mail - From: Bodek, Robert Sent: Wed Nov 18 14:13:37 2009 - Subject: RE: Macondo	BP-HZN-2179MDL00876761

1055	E-Mail - From: Bodek, Robert Sent: Wed Dec 02 16:17:16 2009 - Subject: RE: Hey	BP-HZN-2179MDL00894881 - BP-HZN-2179MDL00894882
1056	E-Mail - From: Bodek, Robert Sent: Fri Feb 12 20:28:43 2010 - Subject: RE: Macondo Update 2pm	BP-HZN-2179MDL00888541
1057	E-Mail - From: Bodek, Robert Sent: Sat Feb 13 17:53:47 2010 - Subject: RE: Macondo LOT #4	BP-HZN-2179MDL00270472
1058	E-Mail - From: Albertin, Martin L. Sent: Tue Mar 09 21:39:19 2010 - Subject: FW: The event that started it all?	BP-HZN-2179MDL00284169 - BP-HZN-2179MDL00284170
1059	E-Mail - From: Bodek, Robert Sent: Wed Feb 24 16:53:54 2010 - Subject: RE: Macondo	BP-HZN-2179MDL00002974 - BP-HZN-2179MDL00002975
1060	E-Mail - From: Bodek, Robert Sent: Thu Feb 25 01:16:31 2010 - Subject: RE: LWD memory data	BP-HZN-2179MDL00003391 - BP-HZN-2179MDL00003392
1061	E-Mail - From: LeBleu, John Sent: Thu Feb 25 23:59:25 2010 - Subject: FW: LWD memory data from Macondo trip out / loss zone	BP-HZN-2179MDL00006206 - BP-HZN-2179MDL00006216
1062	E-Mail - From: Bondurant, Charles H. Sent: Thu Feb 25 01:41:34 2010 - Subject: Re: LWD memory data	BP-HZN-2179MDL00006483 - BP-HZN-2179MDL00006484
1063	E-Mail - From: Cocales, Brett W [Brett.Cocales@bp.com] Sent: Sunday, February 28, 2010 4:25 PM - Subject: RE: DWH - Updated 5 day Planner	TRN-MDL-00481787
1064	E-Mail - From: Bodek, Robert Sent: Sat Mar 06 23:05:21 2010 - Subject: RE: 14 3/4" x 16" hole-section preview	BP-HZN-2179MDL00001935 - BP-HZN-2179MDL00001937
1065	E-Mail - From: Bodek, Robert Sent: Sun Mar 07 23:11:39 2010 - Subject: RE: Macondo daily update	BP-HZN-2179MDL00001898 - BP-HZN-2179MDL00001904
1066	E-Mail - From: Bodek, Robert Sent: Mon Mar 08 13:28:47 2010 - Subject: RE: Out of the office this week	BP-HZN-2179MDL00893376

1067	E-Mail - From: Albertin, Martin L. Sent: Tue Mar 09 07:11:31 2010 - Subject: RE: Macondo kick	BP-HZN-2179MDL00005606 - BP-HZN-2179MDL00005607
1068	E-Mail - From: Greg Naverette Sent: Wed May 05 21:41:32 2010 - Subject: RE: MWD time data run 1000	BP-HZN-2179MDL00876825 - BP-HZN-2179MDL00876826
1069	E-Mail - From: Albertin, Martin L. Sent: Wed Mar 10 16:10:32 2010 - Subject: RE: Remainder of Macondo	BP-HZN-2179MDL00039111 - BP-HZN-2179MDL00039112
1070	E-Mail - From: Bellow, Jonathan M Sent: Mon Mar 15 14:29:57 2010 - Subject: FW: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00044180 - BP-HZN-2179MDL00044182
1071	E-Mail - From: Johnson, Paul (Houston) Sent: Fri Mar 12 16:11:51 2010 - Subject: FW: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00004927 - BP-HZN-2179MDL00004928
1072	E-Mail - From: Bellow, Jonathan M Sent: Mon Mar 15 14:30:20 2010 - Subject: FW: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00032990- BP-HZN-2179MDL00032991
1073	Daily Operations Report - Partners (Drilling) {3/13/2010}	BP-HZN-2179MDL00063576 - BP-HZN-2179MDL00063580
1074	E-Mail - From: Bodek, Robert Sent: Tue Mar 16 19:13:30 2010 - Subject: For your review…	BP-HZN-2179MDL00006076 - BP-HZN-2179MDL00006078
1075	E-Mail - From: Bodek, Robert Sent: Tue Mar 16 13:36:34 2010 - Subject: RE: INC000001455454: Add to Interact for BP Macondo	BP-HZN-2179MDL00007208 - BP-HZN-2179MDL00007210
1076	E-Mail - From: Bodek, Robert Sent: Thu Mar 18 16:13:49 2010 - Subject: FW: Lessons learned - plan forward: Macondo	BP-HZN-2179MDL00015694 - BP-HZN-2179MDL00015695
1077	E-Mail - From: Gray, Kelly S (Sperry-Sun Drilling Services) Sent: Mon Mar 15 05:48:22 2010 - Subject: Future proposal and Best Crew Scenario	***Multiple***

1078	E-Mail - From: Bodek, Robert Sent: Thu Mar 18 18:49:07 2010 - Subject: RE: Lessons learned - plan forward: Macondo	BP-HZN-2179MDL00021267 - BP-HZN-2179MDL00021268
1079	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Fri Mar 19 01:44:47 2010 - Subject: RE: Lesson Learned - Plan Forward: Macondo	BP-HZN-2179MDL00025882 - BP-HZN-2179MDL00025884
1080	E-Mail - From: Bodek, Robert Sent: Fri Mar 19 03:08:07 2010 - Subject: RE: Macondo Update 8pm	BP-HZN-2179MDL00022579 - BP-HZN-2179MDL00022580
1081	E-Mail - From: Johnson, Paul (Houston) Sent: Fri Mar 19 04:01;12 2010 - Subject: RE: Macondo Update 8pm	BP-HZN-2179MDL00031794 - BP-HZN-2179MDL00031795
1082	Transocean - Personnel On-Board: As of 22 Mar 2010 13:10:16	TRN-USCG-MMS-00030217 - TRN-USCG-MMS-00030222 TRN-MDL-00030217 - TRN-MDL-00030222
1083	E-Mail - From: Bodek, Robert Sent: Wed Mar 24 19:47:26 2010 - Subject: RE: Macondo Casing Plan & Pore Pressure Update	BP-HZN-2179MDL00002160 - BP-HZN-2179MDL00002161
1084	E-Mail - From: Bodek, Robert Sent: Wed Mar 24 23:12:11 2010 - Subject: Macondo LCM	BP-HZN-2179MDL00890037
1085	E-Mail - From: Bodek, Robert Sent: Thu Mar 25 00:41:48 2010 - Subject: RE: 9 7/8" TD	BP-HZN-MBI00114962
1086	E-Mail - From: Bodek, Robert Sent: Thu Mar 25 00:19:00 2010 - Subject: Macondo core	BP-HZN-2179MDL00016499
1087	E-Mail - From: Bodek, Robert Sent: Sat Mar 27 02:30:19 2010 - Subject: RE: Kira Tushman - Macondo ops visit	BP-HZN-2179MDL00011147 - BP-HZN-2179MDL00011149
1088	E-Mail - From: Bodek, Robert Sent: Mon Mar 29 13:39:45 2010 - Subject: RE:	BP-HZN-2179MDL00884559 - BP-HZN-2179MDL00884560

1089	E-Mail - From: Bodek, Robert Sent: Mon Mar 29 11:54:15 2010 - Subject: RE:	BP-HZN-2179MDL00881160
1090	E-Mail - From: Bodek, Robert Sent: Mon Mar 29 16:18:01 2010 - Subject: RE: Macondo bp1 Mar 29 model	BP-HZN-MBI00116545 - BP-HZN-MBI00116546
1091	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Sat Apr 03 21:50:06 2010 - Subject: PP update Macondo BP01 17835MD	BP-HZN-2179MDL00247819 - BP-HZN-2179MDL00247820
1092	E-Mail - From: Morel, Brian P Sent: Mon Mar 29 16:24:49 2010 - Subject: RE: Macondo bp1 Mar 29 model	BP-HZN-2179MDL00246940 - BP-HZN-2179MDL00246941
1093	E-Mail - From: Albertin, Martin L. Sent: Fri Apr 02 16:34:40 2010 - Subject: RE: Macondo 9-78 LOT FIT Worksheet .xls	BP-HZN-2179MDL00006046
1094	E-Mail - From: Skripnikova, Galina Sent: Sat Apr 03 03:18:35 2010 - Subject: Macondo Update	BP-HZN-2179MDL00247798 - BP-HZN-2179MDL00247799
1095	E-Mail - From: Albertin, Martin L. Sent: Mon Apr 05 20:10:44 2010 - Subject: RE: Macondo Sand pressures	BP-HZN-2179MDL00004909
1096	E-Mail - From: Bodek, Robert Sent: Mon Apr 05 14:00:07 2010 - Subject: RE: Macondo Reservoir Section	BP-HZN-2179MDL00002081 - BP-HZN-2179MDL00002083
1097	E-Mail - From: Morel, Brian P Sent: Mon Apr 05 14:00:07 2010 - Subject: RE: Macondo Sand pressures	BP-HZN-2179MDL00034106 - BP-HZN-2179MDL000341069
1098	E-Mail - From: Beirne, Michael Sent: Wed Apr 14 19:38:24 2010 - Subject: FW: Macondo	BP-HZN-2179MDL00015683- BP-HZN-2179MDL00015685
1099	E-Mail - From: Bodek, Robert Sent: Fri Apr 09 12:15:59 2010 - Subject: Macondo	BP-HZN-2179MDL00028569
1132	E-Mail - From: Morel, Brian P Sent: Thu Mar 18 14:32:36 2010 - Subject: Macondo - Updated PP/FG	BP-HZN-MBI00112983

	and Mud Schedule	
1200	E-Mail - From: McAughan, Kelly Sent: Fri Apr 09 16:51:56 2010 - Subject: Macondo	BP-HZN-2179MDL00004320
1201	E-Mail - From: Bodek, Robert Sent: Sat Apr 10 02:22:55 2010 - Subject: RE: Core plugs and fluid sampling program	BP-HZN-2179MDL00884795
1202	E-Mail - From: Bondurant, Charles H Sent: Tue Apr 13 00:12:23 2010 - Subject: RE: Pressure points	BP-HZN-2179MDL00033054 - BP-HZN-2179MDL00033056
1203	E-Mail - From: Bodek, Robert Sent: Fri May 07 13:17:11 2010 - Subject: FW: DSI Log Evaluation	BP-HZN-2179MDL00876806 - BP-HZN-2179MDL00876807
1204	Technical Memo - MC252 #1 Synthetic CBL from a Dipole Sonic Tool 9 7/8", 11 7/8", 13 5/8" Liner Cement Evaluation	BP-HZN-2179MDL00876808 - BP-HZN-2179MDL00876813
1205	E-Mail - From: Morel, Brian P Sent: Fri Apr 16 18:49:44 2010 - Subject: RE: Pip Tags	BP-HZN-BLY00069235 - BP-HZN-BLY00069238
1206	E-Mail - From: Morel, Brian P Sent: Wed Apr 21 16:36:36 2010 - Subject: Re:	BP-HZN-2179MDL00413908
1207	E-Mail - From: Bellow, Jonathan M Sent: Thu Apr 27 14:12:04 2010 - Subject: Tiger team support - two relief well operations	BP-HZN-2179MDL00427183
1208	E-Mail - From: Bondurant, Charles H Sent: Wed May 05 10:38:15 2010 - Subject: OW project for Relief Wells	BP-HZN-2179MDL00877707 - BP-HZN-2179MDL00877708
1209	E-Mail - From: Bodek, Robert Sent: Wed May 05 21:10:51 2010	BP-HZN-2179MDL00877653 - BP-HZN-2179MDL00877656
1210	E-Mail - From: Bodek, Robert Sent: Fri May 07 00:32:18 2010 - Subject: Re: 14" MoC Document	BP-HZN-2179MDL00876814 - BP-HZN-2179MDL00876816

1211	E-Mail - From: Bodek, Robert Sent: Fri Jun 14 18:20:11 2010 - Subject: FW: Macondo Relief Welgeochem Sampling_05-12-10.ppt	BP-HZN-2179MDL00890023 - BP-HZN-2179MDL00890024
1212	E-Mail - From: Bodek, Robert Sent: Thu Apr 15 16:56:10 2010 - Subject: Re: Diary & temp files?	BP-HZN-2179MDL00891838
1213	E-Mail - From: Bodek, Robert Sent: Tue Jan 26 16:04:48 2010 - Subject: MC 252 #1 (Macondo) WellSpace	BP-HZN-MBI00175753 BPD108_007827
1214	E-Mail - From: Beirne, Michael Sent: Tue Oct 27 18:21:06 2009 - Subject: FW: Macondo Latest AFE and Well Plan	BP-HZN-MBI00074934 - BP-HZN-MBI00074935
1215	E-Mail - From: Bodek, Robert [robert.bodek@bp.com] Sent: Tuesday, February 02, 2010 12:31 PM - Subject: Add to INSITEanywhere access list for Macondo	
1216	E-Mail - From: Naoki Ishii [naoki_ishii@moexus.com] Sent: Friday, February 12, 2010 1:55 PM - Subject: RE: Macondo Update	DWHMX0070342 - DWHMX0070344 DHCIT_AS-3530789 - DHCIT_AS-3530791
1217	E-Mail - From: Bodek, Robert [robert.bodek@bp.com] Sent: Monday, April 05, 2010 4:27 PM - Subject: FW: Real time access	
1218	E-Mail - From: Chandler, Paul Sent: Wed 3/24/2010 10:04:57 PM - Subject: FW: Macondo Casing Plan & Pore Pressure Update	ANA_MDL-000007262 - ANA_MDL-000007264 ADR017-0007262 - ADR017-0007264
1219	E-Mail - From: Quitzau, Robert Sent: Monday, April 05, 2010 3:55 PM - Subject: FW: Macondo Update	
1220	E-Mail - From: Beirne, Michael Sent: Tue Apr 13 14:11:43 2010 - Subject: FW: Macondo TD	BP-HZN-2179MDL00044347 - BP-HZN-2179MDL00044348 BPD109-044347 - BPD109-044348

1221	E-Mail - From: Beirne, Michael Sent: Tue Apr 20 13:13:19 2010 - Subject: RE: Macondo Forward Plan	BP-HZN-MBI00129063 - BP-HZN-MBI00129064
1222	Chief Counsel's Report - Chapter 4.2: Well Design	
1223	E-Mail - From: Bodek, Robert Sent: Wed Oct 07 17:19:30 2009 - Subject: RE: Issues with INSITE	BP-HZN-2179MDL00891532
1224	E-Mail - From: Bodek, Robert Sent: Wed Oct 14 12:27:22 2009 - Subject: Mudloggers	BP-HZN-2179MDL00876525
1225	Analysis 5A. Well Integrity Was Not Established or Failed: 2 Annulus Cement Barrier	BP-HZN-2179MDL00876525
1226	E-Mail - From: Skripnikova, Galina Sent: Wed Apr 14 21:08:39 2010 - Subject: RE: Rotary Sidewall	BP-HZN-2179MDL00884286 - BP-HZN-2179MDL00884288
1227	E-Mail - From: Wydrinski, Ray Sent: Wed Apr 21 15:16:01 2010 - Subject: RE: Rotary Sidewall	BP-HZN-2179MDL00413817 - BP-HZN-2179MDL00413818
1228	E-Mail - From: Lacy, Stuart C (QO Inc.) Sent: Sat Apr 10 22:44:55 2010 - Subject: FW: BP Macondo MDT	BP-HZN-2179MDL00884444
1229	E-Mail - From: Johnson, Paul (Houston) Sent: Sat Apr 03 01:19:21 2010 - Subject: Re: PP Update Macondo BP01 17321 MD	BP-HZN-2179MDL00003761 - BP-HZN-2179MDL00003762
1230	E-Mail - From: Bodek, Robert Sent: Thu Apr 15 20:32:53 2010 - Subject: Re: Brad Simpson	BP-HZN-2179MDL00884320 - BP-HZN-2179MDL00884321
1231	E-Mail - From: Lacy, Stuart C (QO Inc.) Sent: Wed Mar 17 20:04:12 2010 - Subject: Macondo Update	BP-HZN-2179MDL00889526
1232	E-Mail - From: Bodek, Robert Sent: Tue Feb 09 19:34:53 2010 - Subject: Macondo real-time data transmission	BP-HZN-MBI00196427
1233	E-Mail - From: Bodek, Robert Sent: Mon Feb 01 03:50:11 2010 - Subject: Re: Horizon POB	BP-HZN-2179MDL00378603 - BP-HZN-2179MDL00378607

1234	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Fri Mar 19 05:06:10 2010 - Subject: FW: Lesson learned - Plan forward: Macondo	BP-HZN-2179MDL00011120 - BP-HZN-2179MDL00011122
1235	E-Mail - From: Bodek, Robert Sent: Fri Feb 12 20:28:43 2010 - Subject: RE: Macondo Update 2pm	BP-HZN-2179MDL00888541
1236	E-Mail - From: Hafle, Mark E Sent: Tue Feb 23 04:31:04 2010 - Subject: Macondo Lost Circulation / Fracture modelling	BP-HZN-MBI00104421 - BP-HZN-MBI00104423
1237	20" Open Hole Mud Loss Event Summary (Near 18" casing shoe) {Date: May 20, 2010}	BP-HZN-2179MDL00765359 - BP-HZN-2179MDL00765363
1238	E-Mail - From: Bodek, Robert Sent: Wed Mar 10 14:15:15 2010 - Subject: Remainder of Macondo	BP-HZN-2179MDL00002933
1239	E-Mail - From: Johnson, Paul (Houston) Sent: Fri Mar 19 03:55:05 2010 - Subject: RE: Macondo Update 8pm	BP-HZN-2179MDL00004529 - BP-HZN-2179MDL00004530
1240	E-Mail - From: Maxie, Doyle Sent: Mon Apr 05 21:13:42 2010 - Subject: RE: Macondo Sand pressures	BP-HZN-MBI00118350 - BP-HZN-MBI00118354
1241	E-Mail - From: Bodek, Robert Sent: Tue Apr 13 13:43:50 2010 - Subject: RE: Macondo TD	BP-HZN-MBI00126338 - BP-HZN-MBI00126339
1242	Daily Drilling Report (dated 06-Oct-2009)	TRN-HCJ-00076343 - TRN-HCJ-00076347
1243	RATIFICATION AND JOINDER OF OPERATING AGREEMENT MACONDO PROSPECT	ANA_MDL-000030610 - ANA_MDL-000030612 APC-HEC1-000001601 - APC-HEC1-000001840
1244	LEASE EXCHANGE AGREEMENT	DWHMX0000247 - DWHMX0000260
1245	E-Mail - From: Beirne, Michael [Michael.Beirne@bp.com] Sent: Friday, February 19, 2010 3:36 PM - Subject: Re: Will K Drilling Plan	DWHMX00070243 - DWHMX00070244

1246	bp -DRILLING OPERATIONS PROGRAM	DWHMX00068855 - DWHMX00068856
1247	E-Mail - From: Beirne, Michael [Michael.Beirne@bp.com] Sent: Friday, January 15, 2010 11:23 AM - Subject: RE: Will K Drilling Plan	DWHMX00070889 - DWHMX00070890
1248	E-Mail - From: Beirne, Michael [Michael.Beirne@bp.com] Sent: Thursday, March 04, 2010 5:57 PM - Subject: RE: Golf and Macondo	DWHMX00070166 - DWHMX00070167
1249	E-Mail - From: Beirne, Michael [Michael.Beirne@bp.com] Sent: Wednesday, March 10, 2010 7:06 AM - Subject: RE: Golf and Macondo	DWHMX00069946 - DWHMX00069947
1250	E-Mail - From: Beirne, Michael [Michael.Beirne@bp.com] Sent: Thursday, April 01, 2010 08:43 AM - Subject: RE: Macondo - Information Request	DWHMX00068887
1251	E-Mail - From: Naoki Ishii [naoki_ishii@moexus.com] Sent: Thursday, April 01, 2010 9:13 AM - Subject: RE: Macondo - Information Request	DWHMX00068852 - DWHMX00068854
1252	Daily Operations Report - Partners (Drilling) {4/17/2010}	BP-HZN-IIT-0004778 - BP-HZN-IIT-0004782 BP-HZN-MBI00137832 - BP-HZN-MBI00137836 BP-HZN-2179MDL00609768 - BP-HZN-2179MDL00609719
1253	E-Mail - From: Halliburton Central Data Hub Sent: Wednesday, January 06, 2010 1:12 PM - Subject: RE: Access to MC 252 #1 (Macondo WellSpace)	HAL_0000456 - HAL_0000457
1254	INSITE Anywhere Access Log	HAL_0050546 - HAL_0050563
1255	E-Mail - From: Quitzau, Robert Sent: Fri 4/9/2010 6:39:00 PM - Subject: Macondo TD Reached	ANA_MDL-000002456

1256	E-Mail - From: Huch, Nick Sent: Wed Apr 14 18:54:22 2010 - Subject: RE: Macondo TD & Draft Sub. Op. AFE	BP-HZN-MBI00178357 - BP-HZN-MBI00178358
1257	E-Mail - From: Bodek, Robert Sent: Tue Apr 13 13:43:50 2010 - Subject: RE: Macondo TD	BP-HZN-MBI00126338 - BP-HZN-MBI00126339
1258	E-Mail - From: Chandler, Paul <Paul.Chandler@Anadarko.com> Sent: Monday, April 19, 2010 1:05 PM - Subject: RE: Macondo CMR DLIS files	APC-SHS2A-000007936
1259	GoM Exploration Wells: MC 252 #1ST00BP01 - Macondo Prospect, 7" x 9-7/8" Interval	BP-HZN-CEC021281 - BP-HZN-CEC021301
1260	BP Incident Investigation Team - Notes of Interview with Greg Walz - July 29, 2010 10:00 a.m CDT (Telephonic Interview from Washington D.C.)	BP-HZN-BLY00061325 - BP-HZN-BLY00061334
1261	Gulf of Mexico SPU - Guidance for Sharing of Drilling, Completion and Interventions Information with Co-Owners	BP-HZN-2179MDL00315197 - BP-HZN-2179MDL00315206
1262	E-Mail from Jay C. Thorseth	BP-HZN-MBI00096551
1263	E-Mail - From: Lirette, Nicholas J Sent: Thu Sep 17 12:20:13 2009 - Subject: RE: It will all get sorted	BP-HZN-2179MDL00209289 - BP-HZN-2179MDL00209292
1264	E-Mail - From: Bodek, Robert Sent: Thu Apr 22 11:15:54 2010 - Subject: RE: PPFG for Macondo	BP-HZN-2179MDL00427055 - BP-HZN-2179MDL00427056
1265	E-Mail - From: Bellow, Jonathan M Sent: Thu Apr 22 21:06:15 2010 - Subject: FW: Macondo PPFG forecast	BP-HZN-2179MDL00427519
1266	E-Mail - From: Bodek, Robert Sent: Tue Apr 27 18:25:02 2010 - Subject: PPFG plot: Macondo final "while drilling" plot	BP-HZN-2179MDL00449002
1267	Macondo_MC 525-1-A Pressure Forecast: REV 8, 4/21/10	

1268	Forecast Development Historical Information	
1308	E-Mail - From: Bodek, Robert Sent: Mon Jan 25 19:33:36 2010 - Subject: RE: Monday status	BP-HZN-2179MDL00893578
1309	E-Mail - From: Bodek, Robert Sent: Thu Nov 19 18:51:28 2009 - Subject: RE: Would you recommend Kate Paine or Jorge Viera	BP-HZN-2179MDL00891598 - BP-HZN-2179MDL00891599
1310	E-Mail - From: Hafle, Mark E Sent: Thu Mar 11 22:58:22 2010 - Subject: RE: Out of control	BP-HZN-MBI 00110148
1311	E-Mail - From: Morel, Brian P Sent: Tue Mar 23 12:04:27 2010 - Subject: RE: Open hole lot?	BP-HZN-MBI 00114048
1312	BP - Pre-Drill Data Package: OCS-G32306 No. 1, 60-817-411690000, Mississippi Canyon Block 252	BP-HZN-2179MDL00351800 - BP-HZN-2179MDL00351838
1313	National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling - Pore Pressure and Fracture Gradients	
1314	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Tue Sep 08 16:53:33 2009 - Subject: PP monitoring on the Marianas	BP-HZN-2179MDL00891636
1315	Chief Counsel's Report - Chapter 4.2: Well Design, Page 59	
1317	E-Mail - From: Albertin, Martin L. Sent: Wed Oct 21 20:43:35 2009 - Subject: RE: Macondo well flow event	BP-HZN-2179MDL00884793 - BP-HZN-2179MDL00884794
1318	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Thu Oct 22 13:21:01 2009 - Subject: RE: Macondo LOT	BP-HZN-2179MDL00888535 - BP-HZN-2179MDL00888536 BP-HZN-2179MDL00889304
1319	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Thu Oct 22 22:06:35 2009 - Subject: RE: Alberty email	BP-HZN-2179MDL00895195 - BP-HZN-2179MDL00895196

1320	BP - DAILY GEOLOGICAL REPORT	BP-HZN-MBI00140816 - BP-HZN-MBI00140820
1321	E-Mail - From: Bodek, Robert Sent: Tue Mar 09 05:10:27 2010 - Subject: FW: Macondo kick	BP-HZN-2179MDL00028746 - BP-HZN-2179MDL00028747
1322	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Tue Mar 09 10:15:44 2010 - Subject: PP Report Macondo 13305 MD	BP-HZN-MBI 00109564 - BP-HZN-MBI 00109567
1323	E-Mail - From: Bodek, Robert Sent: Thu Mar 18 16:11:47 2010 - Subject: Lesson learned - Plan forward: Macondo	BP-HZN-2179MDL00040392 - BP-HZN-2179MDL00040396
1324	E-Mail - From: Morel, Brian P Sent: Thu Mar 18 23:26:15 2010 - Subject: MW Increase	BP-HZN-MBI 00113109
1325	E-Mail - From: Lacy, Stuart C (QO Inc.) Sent: Fri Mar 12 19:20:11 2010 - Subject: RE: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00010256 - BP-HZN-2179MDL00010257
1326	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Fri Mar 19 04:44:47 2010 - Subject: RE: Lesson learned - Plan forward: Macondo	BP-HZN-2179MDL00025882 - BP-HZN-2179MDL00025884
1327	BP's RESPONSE TO REQUEST FOR SAFETY EXAMPLES	BP-HZN-2179MDL00972796 - BP-HZN-2179MDL00972800 BP-HZN-2179MDL00973520 - BP-HZN-2179MDL00973521
1328	Gulf of Mexico SPU - Recommended Practice for Cement Design and Operations in DW GoM	BP-HZN-2179MDL00347509 - BP-HZN-2179MDL00347550 BPD008-007864 - BPD008-007905
1329	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Fri Mar 19 20:47:01 2010 - Subject: RE: 11-7/8" Procedure	BP-HZN-2179MDL00290043 - BP-HZN-2179MDL00290045
1330	Gulf of Mexico SPU - Technical Memorandum	BP-HZN-BLY00164099 - BP-HZN-BLY00164136

1331	BP - DAILY PPFG REPORT	BP-HZN-MBI00104053 - BP-HZN-MBI00104055 BPD107_192454 - BPD107_206456
1332	BP - DAILY GEOLOGICAL REPORT	
1333	BP - DAILY PPFG REPORT	BP-HZN-MBI00073292 - BP-HZN-MBI00073292
1334	BP - DAILY PPFG REPORT	BP-HZN-MBI00073421 - BP-HZN-MBI00073422
1335	BP - DAILY PPFG REPORT	BP-HZN-MBI00074995 - BP-HZN-MBI00074997
1336	Application for Revised New Well	
1337	bp - MC 252 #1 (Macondo): 18 1/8" x 22" hole-section review (18" CSG section)	BP-HZN-MBI00099622 - BP-HZN-MBI00099632
1340	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Thu Mar 18 02:58:27 2010 - Subject: RE: Time drilling	BP-HZN-2179MDL00890265 BPD148_013954
1341	E-Mail - From: Hafle, Mark E Sent: Thu Mar 18 23:12:40 2010 - Subject: Re: PP at TD	BP-HZN-MBI000113108 BPD107_201509
1342	E-Mail - From: Bodek, Robert Sent: Mon Mar 29 16:18:01 2010 - Subject: RE: Macondo bp1 Mar 29 model	BP-HZN-MBI000116545 - BP-HZN-MBI000116546 BPD107_204956 - BPD107_204957
1343	E-Mail - From: Albertin, Martin L. Sent: Fri Apr 02 16:34:40 2010 - Subject: RE: Macondo 9-78 LOT FIT Worksheet .xls	BP-HZN-2179MDL00006046 BPD109_006046
1344	bp - DAILY PPFG REPORT	BP-HZN-MBI00117997 - BP-HZN-MBI00117998
1345	E-Mail - From: Vinson, Graham (Pinky) Sent: Fri Apr 02 23:47:49 2010 - Subject: Re: PP Update Macondo BP01 17321 MD	BP-HZN-2179MDL00015170 - BP-HZN-2179MDL00015171 BPD109-015170 - BPD109-015171

1346	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Fri Mar 19 05:06:26 2010 - Subject: FW: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL0000563 - BP-HZN-2179MDL0000563
1347	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Mon Mar 08 10:49:10 2010 - Subject: Macondo PP model Mar 8	BP-HZN-2179MDL0002107
1348	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Tue Feb 16 11:00:48 2010 - Subject: PP Report Macondo 11010MD	BP-HZN-MBI00103113
1349	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Wed Feb 17 10:45:22 2010 - Subject: PP Report Macondo 11887MD	BP-HZN-MBI00103882
1350	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Tue Mar 09 08:11:57 2010 - Subject: RE: Macondo kick	BP-HZN-2179MDL00044464 - BP-HZN-2179MDL00044466
1532	GP 10-15 - Pore Pressure Prediction: Group Practice - BP Group Engineering Technical Practices	BP-HZN-2179MDL00408124 - BP-HZN-2179MDL00408142
1533	GP 10-16 - Pore Pressure Detection During Well Operations: Group Practice - BP Group Engineering Technical Practices	BP-HZN-2179MDL00408027 - BP-HZN-2179MDL00408043
1534	E-Mail - From: Zena Miller Sent: Mon May 24 12:49:10 2010 - Subject: RE: MC252 #1 Data Release Request	BP-HZN-2179MDL00338236 - BP-HZN-2179MDL00338319
1535	E-Mail - From: Albertin, Martin L. Sent: Wed May 13 21:01:47 2009 - Subject: Emailing: HIA_119_1_PPG_WhileDrilling1.doc	BP-HZN-2179MDL00893517 - BP-HZN-2179MDL00893561
1536	E-Mail - From: Pere, Allen L Sent: Thu Jun 25 20:12:12 2009 - Subject: Macondo Peer Review Feedback	BP-HZN-MBI00066999 - BP-HZN-MBI00067007

1537	E-Mail - From: Mitchell, Paul Sent: Sun Jul 19 23:20:12 2009 - Subject: RE: Tiber Update 3pm	BP-HZN-MBI00068731 - BP-HZN-MBI000687314
1538	E-Mail - From: Guide, John Sent: Thu Oct 22 11:03:28 2009 - Subject: RE: Kodiak Update 5.00 am	BP-HZN-2179MDL00918390 - BP-HZN-2179MDL00918391
1539	E-Mail - From: Lirette, Nicholas J Sent: Thu Oct 22 11:03:28 2009 - Subject: RE: Kodiak Update 5.00 am	BP-HZN-2179MDL00371084 - BP-HZN-2179MDL00371086
1540	E-Mail - From: Bellow, Jonathan M Sent: Sun Dec 06 16:01:51 2009 - Subject: RE: Q - Tip	BP-HZN-MBI00077768 - BP-HZN-MBI00077769
1541	E-Mail - From: Bodek, Robert Sent: Thu Feb 04 15:24:27 2010 - Subject: Macondo: sample requirements and data distribution	BP-HZN-MBI00100832 - BP-HZN-MBI00100853
1542	E-Mail - From: Morel, Brian P Sent: Sat Feb 13 14:19:33 2010 - Subject: RE: LOT Test	BP-HZN-2179MDL00270470 - BP-HZN-2179MDL00270471
1543	E-Mail - From: Morel, Brian P Sent: Sat Feb 13 13:03:19 2010 - Subject: FW: Macondo LOT Worksheet	BP-HZN-2179MDL00239378
1544	E-Mail - From: Morel, Brian P Sent: Mon Feb 15 19:53:02 2010 - Subject: FW: Macondo 18" LOT #5	BP-HZN-CEC00063449
1545	E-Mail - From: Skripnikova, Galina Sent: Tue Feb 16 15:44:06 2010 - Subject: Macondo logs	BP-HZN-2179MDL00889014
1546	E-Mail - From: Bodek, Robert Sent: Mon Mar 08 14:38:44 2010 - Subject: FW: FIT/LOT result?	BP-HZN-2179MDL00011323
1547	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Mon Mar 08 10:40:32 2010 - Subject: PP Report Macondo 12350 MD	BP-HZN-MBI00109119 - BP-HZN-MBI00109123
1548	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Tue Mar 09 10:15:44 2010 - Subject: PP Report Macondo 13305 MD	BP-HZN-2179MDL00243313 - BP-HZN-2179MDL00243316

1549	E-Mail - From: Albertin, Martin L. Sent: Tue Mar 09 21:39:19 2010 - Subject: FW: The event that started it all?	BP-HZN-2179MDL00335072
1550	E-Mail - From: Bodek, Robert Sent: Tue Mar 09 05:09:34 2010 - Subject: FW: Macondo kick	BP-HZN-2179MDL00003040
1551	E-Mail - From: Bodek, Robert Sent: Tue Mar 09 01:28:22 2010 - Subject: Re: PP Report Macondo 12850MD on seismic	BP-HZN-MBI00109434 - BP-HZN-MBI00109435
1552	E-Mail - From: Bodek, Robert Sent: Thu Mar 18 16:11:47 2010 - Subject: Lesson learned - Plan forward: Macondo	BP-HZN-2179MDL00039787 - BP-HZN-2179MDL00039791
1553	E-Mail - From: Johnson, Paul (Houston) Sent: Fri Mar 12 16:11:51 2010 - Subject: FW: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00004927 - BP-HZN-2179MDL00004928
1554	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Fri Mar 12 13:54:19 2010 - Subject: RE: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL01199769 - BP-HZN-2179MDL01199770
1555	E-Mail - From: Lacy, Stuart C (QO Inc.) Sent: Fri Mar 12 19:20:11 2010 - Subject: RE: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00010256 - BP-HZN-2179MDL00010257
1556	E-Mail - From: Gord Bennett Sent: Fri Mar 12 16:22:58 2010 - Subject: RE: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00032165 - BP-HZN-2179MDL00032167
1557	E-Mail - From: Bennett, Gord (Q0, Inc.) Sent: Thu Mar 18 17:08:59 2010 - Subject: RE: Lesson learned - Plan forward: Macondo	BP-HZN-2179MDL00010949 - BP-HZN-2179MDL00010951
1558	Westlaw - Effective: August 14, 2006 - Code of Federal Regulations Currentness	
1559	Form MMS 123A/123S - Electronic Version Application for Bypass	DHCIT_TP-0745897 - DHCIT_TP-0745911 BP-HZN-2179MDL00011120

1560	bp - DAILY PPFG REPORT	BP-HZN-MBI00073421 BP-HZN-MBI00073404
1561	Event Description: Well Location: Macondo Prospect, Mississippi Canyon Block 252, Gulf of Mexico USA: Rig: TransOcean Marianas	BP-HZN-2179MDL00895007 - BP-HZN-2179MDL00895009 BPD148_018696 - BPD148_018698
1563	E-Mail - From: Bodek, Robert Sent: Tue Mar 16 19:13:30 2010 - Subject: For your review…	BP-HZN-2179MDL00006076 - BP-HZN-2179MDL00006078
1564	E-Mail - From: Bodek, Robert Sent: Thu Mar 18 13:52:45 2010 - Subject:	BP-HZN-2179MDL00033024 - BP-HZN-2179MDL00033027
1565	E-Mail - From: Gray, George E Sent: Wed Aug 26 13:35:51 2009 - Subject: RE: Well Site Subsurface Report for Macondo	BP-HZN-2179MDL00888528 - BP-HZN-2179MDL00888529
1566	E-Mail - From: Paine, Kate (QuaDril Energy LT) Sent: Tue Sep 08 16:53:33 2009 - Subject: PP monitoring on the Marianas	BP-HZN-2179MDL00891636
1567	E-Mail - From: Hafle, Mark E Sent: Thu Feb 25 01:30:21 2010 - Subject: RE: LWD memory data	BP-HZN-MBI00107449 - BP-HZN-MBI00107450
1568	E-Mail - From: Gord Bennett Sent: Fri Mar 12 16:22:58 2010 - Subject: RE: Some Thoughts and Help Requested, PP detection, Macando	BP-HZN-2179MDL00032165 - BP-HZN-2179MDL00032167
1569	E-Mail - From: Morel, Brian P Sent: Mon Apr 05 16:38:33 2010 - Subject: RE: Macondo Scan pressures	BP-HZN-2179MDL00832745 - BP-HZN-2179MDL00832746
1570	E-Mail - From: Johnson, Paul (Houston) Sent: Sun Apr 04 01:14:12 2010 - Subject: Re: PP update Macondo BP01 17835MD	BP-HZN-2179MDL01215773 - BP-HZN-2179MDL01215774
1571	E-Mail - From: Morel, Brian P Sent: Fri Apr 02 16:05:22 2010 - Subject: RE: Macondo 9-78 LOT FIT Worksheet .xls	BP-HZN-2179MDL00247769

1573	E-Mail - From: Morel, Brian P Sent: Mon Apr 05 18:50:50 2010 - Subject: RE: Macondo Sand pressures	BP-HZN-2179MDL00048350 - BP-HZN-2179MDL00048352
1574	Our commitment to integrity - BP code of conduct	BP-HZN-2179MDL00405586 - BP-HZN-2179MDL00405668
1575	GP 10-75 - Simultaneous Operations: Group Practice - BP Group Engineering Technical Practices	BP-HZN-2179MDL00408286 - BP-HZN-2179MDL00408296
1576	E-Mail - From: Hafle, Mark E Sent: Sat Apr 24 11:35:53 2010 - Subject: Hive session	BP-HZN-2179MDL00441962
1577	E-Mail - From: Bellow, Jonathan M Sent: Sun Apr 25 22:35:38 2010 - Subject: Re: Mudlogs	BP-HZN-2179MDL00443783 - BP-HZN-2179MDL004437834
1578	E-Mail - From: Vinson, Graham (Pinky) Sent: Mon Oct 26 19:17:13 2009 - Subject: 2009_performance mid.doc	BP-HZN-2179MDL01215767 - BP-HZN-2179MDL01215772
1963	E-Mail - From: Guide, John Sent: Thu Apr 15 02:48:20 2010 - Subject: Re: Meeting	BP-HZN-MBI00311590 BPD115_037741
1967	BP - DAILY PPFG REPORT	BP-HZN-2179MDL00247855 - BP-HZN-2179MDL00247856
2654	DAILY PPFG REPORT - Date and Time: Mar 23, 2009	BP-HZN-MBI0114042 - BP-HZN-MBI0114045 BPD107-202443 - BPD107-202446
3065	BP Drilling and Completions MOC for Macondo Exploration Well dated 4/7/2010	BP-HZN-MBI00143259, three pages
3066	Drilling Completions MOC 4/14/10	BP-HZN-MBI 00143259
3067	Department of the Interior, Minerals Management Service, Form MMS 123A/123S - Electronic Version, Application for Revised Bypass	BP-HZN-2179 MDL 0096724 through BP-HZN-2179 MDL 0096731
3068	BP Trainwreck Early Warning Indicators Analysis	BP-HZN-2179MDL02311982
3069	String of e-mails among Corser, Emilsen, et al.,	AE-HZN-2179MDL00154780-AE-HZ-2179 MDL00154785

3070	String of e-mails among Bodek, Vinson, et al.,	BP-HZN-2179MDL00894548
3071	String of e-mails among Marty Albertin, Graham Vinson, et al.	BP-HZN-2179MDL00031696
3072	3/2/10 document from Stuart Lacy	BP-HZN-2179MDL00031429
3073	3/5/10 document from Stuart Lacy	BP-HZN-2179MDL00011696
3532	Gulf of Mexico SPU; Technical Memorandum, dated 26th July 2010	BP-HZN-OSC00005378 through 418
3701	GP 10-15, Pore Pressure Prediction, dated, 9 July 2008	BP-HZN-2179MDL00408124 through 42
3702	GP 10-15, Pore Pressure Detection During Well Operations, dated 9 July 2008	BP-HZN-2179MDL00408027 through 43
3703	GoM Exploration and Appraisal Communication Plan; Rev 2, dated September 2009	BP-HZN-279MDL00210002 through 28
3704	E-mail from Ms. Paine to Mr. Bennett, et al., dated February 18 10:45:02 2010	BP-HZN-2179MDL00242060
3705	Macondo MC 252-1-A Losses Analysis	BP-HZN-2179MDL00009439 through 44
3706	E-mail chain, top e-mail from Mr. Bodek to Mr. Bellow, et al., dated February 25 01:16:31 2010	BP-HZN-2179MDL00003391 through 92
3707	E-mail from Mr. Lacy to Mr. Albertin, dated March 03 11:27:55 2010	BP-HZN-2179MDL00242862
3708	E-mail from Mr. Lacy to Mr Albertin, et al., dated March 05 00:40:12 2010	BP-HZN-2179MDL00242961
3709	E-mail from Ms. Paine to Mr. Albertin, et. al, dated, March 08 10:49:10 2010	BP-HZN-2179MDL00021074
3710	E-mail chain, top e-mail from Mr. Bodek to Mr. Bellow, et al., dated March 08 14:38:44 2010	BP-HZN-2179MDL00029080
3711	E-mail from Mr. Albertin to Mr. Viceer, dated March 09 21:54:18 2010	BP-HZN-2179MDL01765742

3712	E-mail chain, top e-mail from Mr. Hafle to Mr. Albertin, dated March 10 00:04:21 2010	BP-HZN-2179MDL00004771 through 78
3713	E-mail from Mr. Albertin to Mr. Bodek, dated March 09 21:39:19 2010	BP-HZN-2179MDL00284171 through 72
3714	E-mail from Mr. Bellow to Mr. Lacy, et. al, dated March 12 13:13:482 2010	BP-HZN-MBI00110242 through 43
3715	E-mail chain, top e-mail from Mr. Albertin to Mr. Hafle, dated March 23 21:21:02 2010	BP-HZN-2179MDL00292583
3716	E-mail chain, top e-mail from Mr. Bennett to Mr. Bodek, dated April 08 18:35:07 2010	BP-HZN-2179MDL00048474 through 75
3717	E-mail chain, top e-mail from Mr. Bodek to Mr. Albertin, et al., dated April 24 16:18:01 2010	BP-HZN-2179MDL00246936 through 37
3718	E-mail with chart from Mr. Bennett to Mr. Albertin, et al., dated April 03 10:31:09 2010	BP-HZMN-2179MDL00247801 through 806
3719	E-mail from Mr. Bellow to Mr Albertin, et al., dated April 03 15:01:04 2010	BP-HZN-2179MDL00892767
3720	E-mail from Mr. Bennett to Mr. Albertin, et al., dated April; 05 10:18:37 2010	BP-HZN-2179MDL00009604
3721	E-mail chain top e-mail from Mr. Morel to Mr. Sant, et al., dated April 0516:43:34010	BP-HZN-2179MDL00824922 through 23
3722	E-mail from Mr. Sant to Mr. Albertin, dated April 05 19:41:46 2010	BP-HZN-2179MDL00025983
3723	E-mail from Mr. Lacy to Mr. Albertin, et al., dated April 09 19:09:39 2010	BP-HZN-2179MDL00248421
3724	E-mail chain, top e-mail from Mr. McAughan to Mr. Bodek, et al., dated, April 13 01:41:13 2010	BP-HZN-2179MDL00005587 through 91
3725	Macondo LL with charts, dated October 29, BP-HZN-2179MDL00373877 through 866, 21	

	pages	
3726	E-mail with chart from Mr. Hafle to Mr Albertin, dated October 22 11:58:43 2009	BP-HZN-2179MDL00365710
3727	E-mail chain, top e-mail from Ms. Douglas to Mr. Carter, dated October 25 23:11:35 2009	BP-HZN-2179MDL02747482 and 83
3728	E-mail chain, top e-mail from Mr. Albertin to Mr. Vinson, dated October 30 15:27:34 2009	BP-HZN-2179MDL02393264 through 65
3729	E-mail from Mr. Albertin to Mr. Hafle, dated April 27 13:41:31 2010	BP-HZN-2179MDL00466398
3730	E-mail from Mr. Morel to Mr. Albertin, dated, Jan 07 20:32:05 2010	BP-HZN-2179MDL00269732
3731	E-mail chain, top e-mail from Mr. Hafle to Mr. Albertin, dated March 06 22:20:29 2010	BP-HZN-2179MDL00002077 through 79
3732	E-mail from Mr. Cocales to Mr. Morel, dated, March 14 13:50:01 2010	BP-HZN-2179MDL00286863
3733	E-mail chain, top e-mail from Mr. Alberty to Mr. Albertin, dated March 25 14:345:42 2010	BP-HZN-2179MDL00034060 through 62
3734	E-mail from Mr. Morel to Mr. Burns, et al., dated April 03 14:56:42 2010	BP-HZN-2179MDL00247809
3735	E-mail with charts from Mr. Albertin to Mr. Bodek, et al., dated April 24 22:36:25 2010, 12 pages	BP-HZN-2179MDL00442953
3736	E-mail chain, top e-mail from Mr. Albertin to Mr. Alberty, dated, May 10 17:09:28 2010	BP-HZN-2179MDL02912973
3737	E-mail from Mr. Albertin to Mr. Sant et al., dated April 05 20:10:44 2010,	BP-HZMN-2179MDL00247801 and 806
3738	Daily Geological Report, dated April 09, 2010	DEP019-0000698 through 99

3739	Gulf of Mexico SPU, GoM Drilling and Completions, dated 7/20/2010	BP-HZN-2179MDL00412932 through 73
3740	ICS-214 Responder Logbook, dated 4/21/2010	BP-HZN-2179MDL02914458 through 71
3741	E-mail chain, top e-mail from Mr. Albertin to Mr. Johnston, et al., dated April 22 02:54:30 2010,	BP-HZN-2179MDL00426906
3742	Chart, MC 252 #1 (Macondo), dated April 24, 2009	BP-HZN-2179MDL02606163 through 65
3743	Annual Individual Performance Assessment, dated 2/10/2010	BP-HZN-2179MDL02311878 through 85
4000	E-mail from Scherie Douglas to Mark Hafle and others, dated May 26, 2009	BP-HZN-2179MDL00237054 - BP-HZN-2179MDL00237082
4001	Application for Revised New Well	BP-HZN-BLY00235604 - BP-HZN-BLY00235614
4002	Application for Revised New Well	BP-HZN-BLY00237943 - BP-HZN-BLY00237949
4003	E-mail from Brian Morel to Ronald Sepulvado and others, dated January 19, 2010	BP-HZN-BLY00237039 - BP-HZN-BLY00237051
4004	E-mail from Brett Cocales to Don Vidrine and others, dated February 25, 2010	BP-HZN-2179MDL00005471 - BP-HZN-2179MDL00005479
4005	E-mail from Brett Cocales to Brian Morel, dated March 13, 2010	BP·HZN-MBI00110584; BP-HZN-BLY00063570 - BP-HZN-BLY00063570
4006	Application for Revised Bypass	BP-HZN-BLY00235651 - BP-HZN-BLY00235660
4007	E-mail from Scherie Douglas to Brian Morel and others, dated February 8, 2010	BP-HZN-SNR00000625 - BP-HZN-SNR00000631
4008	Application for Revised New Well	BP-HZN-SNR00000770 - BP-HZN-SNR00000782
4009	E-mail from Scherie Douglas to Brian Morel and others, dated February 8, 2010	BP-HZN-BLY00241259
4010	Form MMS - 133, Electronic Version	BP-HZN-SNR00000491 - BP-HZN-SNR00000492

4011	E-mail from James Grant to James Grant and others, dated April 5, 2010	BP-HZN-2179MDL00302808 - BP-HZN-2179MDL00302810
4012	MMS District SAFE Award Recipients	
4013	MMS SAFE Award Program	BP-HZN-2179MDL00302811 - BP-HZN-2179MDL00302812
4014	E-mail from Lars Herbst to James Grant and others, dated March 19, 2010	BP-HZN-2179MDL00290025 - BP-HZN-2179MDL00290026
4015	30 CFR 250.140	
4016	E-mail from Frank Patton to Graham Crane, dated August 7, 2006	IMS026-000799 - IMS026-000800
4017	E-mail from David Trocquet to Graham Crane and others, dated August 22, 2006	IMS026-013830
4018	E-mail from Frank Patton to Tom Meyer and others, dated August 6, 2009	IMS023-045399 - IMS023-045400
4019	BOEMRE - National Office Potential Incident of Noncompliance (PINC) List	
4020	End of Operations Report	BP-HZN-SNR00000406 - BP-HZN-SNR00000408
4021	Application for Permit to Drill a New Well	BP-HZN-SNR00000122 - BP-HZN-SNR00000150
4022	30 CFR 250.427	
4023	Daily Operations Report - Partners (Drilling)	BP-HZN-MBI00013764 - BP-HZN-MBI00013769
4024	Daily Operations Report - Partners (Drilling)	BP-HZN-MBI00014025 - BP-HZN-MBI00014030
4025	Instructions for Use of the Formation Pressure Integrity (PIT) Workbook	
4026	30 CFR 250.400	
4027	Not attached	
4028	E-mail from David Trocquet to Glenn Woltman and others, dated April 21, 2006	IMS026-010823 - IMS026-010826
4029	E-mail from Scherie Douglas to Trent Fleece and others, dated October 20, 2009	BP-HZN-2179MDL00211240 - BP-HZN-2179MDL00211241

4030	Application for Revised Bypass	BP-HZN-SNR00000441 - BP-HZN-SNR00000450
4031	Standard Operating Procedures Drilling Operations, Field Operations, GoM, dated June 15, 2008	IMS020-011185 - IMS020-011237
4032	Form MMS 124 - Electronic Version	BP-HZN-SNR00000944 - BP-HZN-SNR00000947
4033	30 CFR 250.1712	
4034	30 CFR 250.1721	
4035	E-mail from Joseph Levine to William Rhome and others, dated July 11, 2008	IMS023-014842 - IMS023-014843
4036	E-mail from Scherie Douglas to Heather Powell, dated February 16, 2010	BP-HZN-2179MDL00161084 - BP-HZN-2179MDL00161085
4037	Daily Drilling Report	BP-HZN-BLY00242520 - BP-HZN-BLY00242523
4038	E-mail from Scherie Douglas to Brian Morel, dated March 18, 2010	BP-HZN-2179MDL02859918
4039	MMS New Orleans District - Record of Conversation	
4040	Daily Drilling Report	BP-HZN-2179MDL00060898; BP-HZN-2179MDL00060900
4041	E-mail from Scherie Douglas to lcarter46@cox.net, dated October 25, 2009	BP-HZN-2179MDL02747482 - BP-HZN-2179MDL02747483
4042	E-mail from John Lebleu to Jianguo Zhang, dated April 2, 2010	BP-HZN-2179MDL00026120 - BP-HZN-2179MDL00026121
4043	Daily PPFG report	BP-HZN-2179MDL00247855 - BP-HZN-2179MDL00247856
4044	Application for Revised Bypass	BP-HZN-OGR000748 - BP-HZN-OGR000756
4045	Application for Revised Bypass	BP-HZN-OGR000735 - BP-HZN-OGR000747
4046	Daily Operation Report - Partners (Drilling)	BP-HZN-MBI00013935 - BP-HZN-MBI00013937
4047	Application for Revised Bypass	BP-HZN-OGR000709 - BP-HZN-OGR000724
4048	Daily Geological Report	

4049	Notice of Lessees and Operators of Federal Oil, Gas, and Sulphur Leases, Outer Continental Shelf, Gulf of Mexico OCS Region	BP-HZN-2179MDL01987517 - BP-HZN-2179MDL01987519
4050	E-mail from Rita Lewis to David Trocquet and others, dated May 24, 2010	IMS021-023359 - IMS021-023360
4051	Chart	IMS025-013583 - IMS025-013585
4052	MC252 OCS-G 32306 Well Number 1 - History Macondo Prospect	IMS021-008823 - IMS021-008825
4053	E-mail from Ronald Sepulvado to DWH OIM and others, dated January 15, 2010	TRN-INV-00598056 - TRN-INV-00598057
4054	E-mail from Frank Patton to Scherie Douglas, dated February 24, 2010	BP-HZN-2179MDL00005009 - BP-HZN-2179MDL00005010
4055	Form MMS 124 - Electronic Version	BP-HZN-OGR000686 - BP-HZN-OGR000689
4056	E-mail from David Trocquet to Scherie Douglas, dated March 10, 2010	BP-HZN-2179MDL00004812 - BP-HZN-2179MDL00004814
4057	Form MMS 133 - Electronic Version	BP-HZN-FIN00000261 - BP-HZN-FIN00000263
4058	E-mail from Heather Powell to Frank Patton, dated April 15, 2010	BP-HZN-2179MDL00031929
4059	E-mail from Heather Powell to Frank Patton, dated April 16, 2010	BP-HZN-2179MDL00042191
4060	E-mail from Gregory Walz to Wes Black and others, dated April 19, 2010	BP-HZN-MBI00128990 - BP-HZN-MBI00128996
4061	E-mail from Sam Sankar to David Trocquet, dated October 20, 2010	IMS018-001016 - IMS018-001024
4062	Daily Operations Report - Partners (Drilling)	BP-HZN-MBI00013764 - BP-HZN-MBI00013769
4063	Personal Background	IMS017-004747 - IMS017-004764
4519	Long Circulation Recommended Practices	BP-HZN-2179MDL03131794 through 805
4520	E-mail chain, top e-mail from Mr. Alberty to Mr. Morel, dated July 13,	BP-HZN-2179MDL00068163 and 64

	2009	
4521	E-mail from Mr. Alberty to Mr. LeBleu, dated November 09, 2009	BP-HZN-179MDL00759848
4522	E-mail chain, top e-mail from Mr. Sant to Mr. Alberty, dated February 24, 2010	BP-HZN-2179MDL00002710 and 11
4523	E-mail chain, top e-mail from Mr. Alberty to Mr. Wagner, dated February 25, 2010	BP-HZN-2179MDL01943007 and 08
4524	E-mail from Mr. Pere to Mr. Alberty, dated March 05, 2010	BP-HZN-2179MDL00006082 through 95
4525	E-mail from Mr. Alberty to Mr. Last, dated March 11, 2010	BP-HZN-2179MDL00043384
4526	E-mail chain, top e-mail from Mr. LeBleu to Mr. Alberty, dated March 14, 2010	BP-HZN-2179MDL00002917 through 19
4527	E-mail chain top e-mail from Mr. Alberty to Mr. Johnston, dated March 17 2010	BP-HZN-2179MDL00004881 and 00004969
4528	E-mail from Mr. LeBleu to Ms. Zhang dated April 4, 2010	BP-HZN-2179MDL00001938 and 39
4529	E-mail chain, top e-mail from Mr. Alberty to Mr. Sant, dated April 05, 2010	BP-HZN-2179MDL00042395 through 97, 00009564 through 66
4530	E-mail from Mr. Bodek to Mr. Beirne, dated April 13, 2010	BP-HZN-MBI00126338
4531	E-mail from Mr. Alberty to Mr. Walz, et al., dated April 29, 2010	BP-HZN-2179MDL00451456 and 57
4532	Drilling Doghouse GoM Standard Operating Practice Formation Pressure Integrity Tests, dated Sept. 10, 2007	BP-HZN-2179MDL01920075 through 91
4533	E-mail chain, top e-mail from Mr. Alberty to Mr. Albertin, et al., dated September 23, 2010	BP-HZN-2179MDL00895458 through 60
4534	E-mail chain, top e-mail from Mr. Alberty to Mr. Hafle, dated February 24, 2010	BP-HZN-MBI00107335 and 36
4535	E-mail from Mr. Morel to Mr. Wesley, et al., dated April 28, 2010	BP-HZN-2179MDL00449900 through 05

4536	E-mail from Mr. Bennett to Mr. Alberty et al., dated April 02, 2010	BP-HZN-2179MDL00004060
4537	Application for Revised Bypass, dated April 15, 2010	BP-HZN-2179MDL02772865 through 76
4538	Drilling & Completions MOC Initiate dated 4/15/2010	BP-HZN-2179MDL03072952 through 54
4539	E-mail from Mr. Douglas to Mr. Jordan dated February 08, 2008	BP-HZN-2179MDL01920074
4540	E-mail from Mr. Hafle to Mr. Alberty, et al., dated May 13,2010	BP-HZN-2179MDL00765364 through 7
4541	Drilling & completions MOC Initials, dated 6/22/2009	BP-HZN-2179MDL00252249 through 51
4542	Format: Standard Porosity Curves, dated July 25, 2011, one page	
4543	Format: Standard Porosity Curves, dated July 25, 2011, one page	
4544	E-mail chain from Mr. Albertin to Mr. Johnston, et al., dated April 22, 2010, 3 pages	BP-HZN-217MDL00428906, 908
4545	2 Anulus Cement Barrier, one page	
4546	Draft for Legal Review, dated 21-Sept-2010	BP-HZN-2179MDL00196067 through 71
4547	ERA Summit, dated March 15, 2010	BP-HZN-2179MDL03139082 through 105
4548	E-mail chain top e-mail from Mr. LeBleu to Ms. Zhang, dated April 02, 2010	BP-HZN-2179ML00002683, 2839, 222717, 3417, 5364
4549	E-mail chain, top e-mail from Mr. Sant to Mr. Morel, et al., dated April 05, 2010	BP-HZN-2179MDL01329329 through 31
4550	E-mail from Mr Jordan to Mr. Little, et al., dated February 07, 2008	BP-HZN-2179MDL03199425
4722	MMS District Program, Overview of Components, Inspector Workload and Engineering Workload by District, April**, 2010, Michael Saucier Regional Supervisor, Field Operations	IMS172-030385 - 30394

4723	United States Department of the Interior Minerals Management Service NTL No. 2010-N06 Effective Date: June 1, 2010	IMS172-038169 - 38174
4724	Discussion of challenges for 24/7 inspection coverage for GOMR and possible alternative methods for achieving increased MMS inspection presence	IMS172-012079 - 12083
4725	Question and Answer excerpt	IMS172-005394 - 05395
4726	Department of the Interior Tasking Profile	IMS172-015132 - 15135
4727	Deepwater Horizon Response Unified Area Command Daily Report	IMS172-015915 - 15936
4728	"Destroyed IKE Platforms"	IMS182-000001 - 00090
4729	Graph	BP-HZN-2179MDL03138015
4730	Spreadsheet	BP-HZN-2179MDL03138943
4731	E-mail dated April 21, 2006 Trocquet to Woltman and others	IMS026-010823 - 10825
4732	Calendar	IMS059-000399 - 00401
4733	E-mail dated February 12, 2008 Saucier to Douglas and others	IMS056-000104
4734	E-mail dated February 7, 2008 Jordan to Little and others	BP-HZN-2179MDL03199425
4735	E-mail dated February 7, 2008 Douglas to G NA EXPL HSE REG NET	BP-HZN-2179MDL03199423 - 99424
4736	E-mail dated February 11, 2008 Wilson to Hafle and others	BP-HZN-2179MDL00091810 - 91827
4737	Westlaw 30 CFR 250.427 Effective August 14, 2006	
4738	E-mail dated August 22, 2010 Saucier to Rodi and others	IMS172-051743 - 51745
4739	2009 District SAFE Awards Gulf of Mexico Region	IMS063-004475 - 04486
4740	E-mail dated April 5, 2010 Grant to Todd and others	BP-HZN-2179MDL00302808 - 02810
4741	E-mail dated March 19, 2010 Herbst to Grant and others	BP-HZN-2179MDL00290025 - 90026
4742	Westlaw 30 CFR 250.400	

4743	Appendix O. Industry Comparison Data on Long String Casing and Casing Liners in the Macondo Well Area	BP-HZN-BLY00000371 - 00372
4744	E-mail dated June 6, 2008 Levine to Fontenot and others	IMS023-041850 - 41851
4745	U.S. Department of the Interior, Mineral Management Service FOR MMS USE ONLY-Test A-Key Drilling	IIG013-001437 - 01443
4746	Safety Drill Report - Complete	TRN-INV-00018273 - 18314
4747	Macondo, Containment and Disposal Project for MC252-1	BP-HZN-2179MDL01522652 - 22686
4748	Westlaw 30 CFR 250.440	
4749	Handwritten Notes	
4750	Westlaw 30 CFR 250.427	
4751	Application for Permit to Drill a New Well	BP-HZN-CEC008683 - 08711
4752	Application for Revised Bypass	BP-HZN-2179MDL00001748 - 01763
4753	Application for Revised Bypass	BP-HZN-2179MDL00096724 - 96731
4754	Application for Revised Bypass	BP-HZN-2179MDL00155415 - 55424
4755	E-mail dated May 17, 2010 Dessauer to Patton and others	IMS019-021282 - 21286
4756	E-mail dated May 18, 2010 Trocquet to Saucier	IMS172-005700 - 05704
4757	E-mail dated October 27, 2009 Fleece to Shaughnessy	BP-HZN-2179MDL03065183 - 65185
4758	E-mail dated April 16, 2010 Morel to Kaluza and others	BP-HZN-MBI 00127906
4759	E-mail dated December 9, 2009 Trocquet to Carter and others	IMS019-012226
4760	E-mail dated September 29, 2010 McLean to Saucier	IMS176-077756 - 77757
4761	MMS Requirements Overview Wellsite Leaders, Scherie Douglas, August, 2009	BP-HZN-2179MDL01339703 - 38750
4762	Regulatory Meeting/Trip Report	BP-HZN-2179MDL01278944

4763	List of Questions	IMS173-000459 - 00461
4764	BOEMRE Discussion Topics Thursday, October 14, 2010	IMS173-001930 - 01932
4765	MMS Requirements Overview Wellsite Leaders, Scherie Douglas, August, 2009	BP-HZN-2179MDL01928130 - 28177
4766	FormMMS-133 Electronic Version	BP-HZN-BLY00046221 - 46223
4767	E-mail dated May 7, 2010 Rodi to Saucier and others	IMS050-020606 - 20607
4768	E-mail dated July 15, 2010 Herbst to LaBelle and others	IMS172-052222
4769	E-mail dated June 21, 2010 Miller to Saucier and others	IMS172-012501
4770	E-mail dated May 16, 2010 Trosclair to Saucier	IMS047-000001 - 00012
4771	E-mail dated July 22, 2010 Flynn to G Safety & Operations HSSE LT and others	BP-HZN-BLY00158150 - 58159
4772	Website Article - "MMS Scrubs Safety Nod for BP from Website"	

APPENDIX C – CURRICULUM VITAE OF DOCTOR ALAN R. HUFFMAN

CURRICULUM VITAE **JULY 2011**

ALAN R. HUFFMAN
18 Carriage Pines Court
The Woodlands, Texas 77381
Cell: (281)-744-4338
Residence: (281)-681-1481
email: huffman@fusiongeo.com

CAREER SUMMARY

A seasoned energy executive and proven oil finder with over 25 years of experience in international and domestic exploration and production. Recognized internationally as a technology leader and lecturer in several areas including pore pressure and fracture pressure prediction and detection while drilling, rock physics, seismic detection of hydrocarbons, and shock wave and stress effects in natural materials.

Experience includes general management, E&P project management, exploration portfolio risking and assessment, business development, and technology development and application. Personal traits include excellent leadership, communication, and interpersonal skills. Previous experience includes computer software design and implementation, hardware/software integration, and technology commercialization in the petroleum industry. Experienced in corporate strategy and planning, corporate recruiting, personnel development and integration of technology into a global business enterprise. Experience also includes management and administration in the medical industry.

EDUCATION

- **1990;** Ph.D, Geophysics, Texas A&M University, College Station, Texas
- **1983;** B.A., Geology, Franklin and Marshall College, Lancaster, Pennsylvania

EMPLOYMENT HISTORY

Sigma[3] Integrated Reservoir Solutions LLC **January 2011 to Present**

Chief Technology Officer. Duties include P&L responsibility for Fusion subsidiaries of Sigma[3] and management and implementation of technology and R&D across the value chain of the business. FusionGeo Inc. was merged into Sigma[3] in January of 2011 in a private equity investment transaction.

Fusion Petroleum Technologies Inc. **January 2007 to Present**

Chairman & CEO. Duties include P&L responsibility for the enterprise including all subsidiaries and global growth of the company. Also President and CEO of all subsidiaries and FusionGeo Inc. holding company and Sole Manager of Fusion Geophysical LLC parent entity. Duties include direct supervision and management of all technical projects involving pore pressure and fracture pressure prediction and shallow marine drilling hazards worldwide. Worked on projects in over 40 countries including land, marine and deepwater settings. Also taught Fusion geopressure technology school for multiple clients worldwide.

Fusion Petroleum Technologies Inc. **May 2005 to January 2007**

President. Duties include P&L responsibility for the enterprise with primary focus on corporate growth and expansion of the business globally with a target of 50% revenue growth in 2005. Job responsibilities include design and implementation of critical business processes, negotiation and management of domestic and international service contracts, design of marketing and business development plans, and design and implementation of a corporate growth strategy for a rapidly growing technology company in the energy services sector. Duties included direct supervision and management of all technical projects involving pore pressure and fracture pressure prediction and shallow marine drilling hazards worldwide. Also taught Fusion geopressure technology school for multiple clients worldwide.

Fusion Petroleum Technologies Inc. **January 2003 to May 2005**

President and Chief Operating Officer. Duties include P&L responsibility for the entire business, including daily operations, design and implementation of critical business processes, negotiation and management of domestic and international service contracts, design of marketing and business development plans, and design and implementation of a corporate growth strategy for a rapidly growing technology company in the energy services sector. Duties included direct supervision and management of all technical projects involving pore pressure and fracture pressure prediction and shallow marine drilling hazards worldwide. Also taught Fusion geopressure technology school for multiple clients worldwide.

The University of Oklahoma **August 2003 to December 2004**

Lissa and Cy Wagner Professor of Geology and Geophysics, School of Geology and Geophysics. Quarter-time, 2-year term appointment at Full Professor level with responsibility of teaching upper-level undergraduate and graduate level courses and supervising graduate student research. Teaching included the theory and application of seismic methods, rock physics and rock mechanics to the practice of pore pressure and fracture pressure prediction.

Fusion Geophysical LLC **October 2002 to December 2003**

Vice President of Operations. Duties included P&L responsibility for daily business operations, design and implementation of critical business processes, management of domestic and international service contracts, design of marketing and business development plans, and design and implementation of corporate growth strategy for a rapidly growing technology company in the energy services sector. Duties included direct supervision and management of all technical projects involving pore pressure and fracture pressure prediction and shallow marine drilling hazards worldwide. Also taught Fusion geopressure technology school for multiple clients worldwide.

Conoco Inc. **1997 to October 2002**

Manager, Seismic Imaging Technology Center. Duties included management of the geophysical technology division of Conoco, with responsibility for worldwide technology development, technical service and marketing/commercialization of geophysical technology including seismic acquisition, seismic data processing, seismic analysis, gravity and magnetics, seismic data management, geological hazard surveys, ocean acoustic surveys and geodetics. Organization included 80 staff in these disciplines located in Ponca City, Oklahoma and Houston, Texas. Personally led an integrated team of geoscientists and engineers for 4 years to develop a unique 3D platform for the prediction and analysis of pore pressure, fracture pressure and other rock properties that resulted in the award of 4 patents. Led and supervised the application of this technology in Conoco's global exploration and production business. Also taught Conoco geopressure technology school for business units worldwide.

Responsible for coordination of Conoco's global exploration technology strategy and the coordination and integration of the strategy with Conoco's global exploration programs. Managed the development of advanced geophysical software and integration of software and hardware specialty solutions for the energy business. Responsible for the development, implementation and integration of Conoco's leading-edge seismic data processing system and the design and implementation of Conoco's 2.2 Teraflop Intel/LINUX "Fast Cat" supercomputer and its associated systems and infrastructure.

Involved in the coordination of Geoscience recruiting for the corporation, coordination of development for emerging leaders, coordination and management of global Geoscience and reservoir engineering skills, management of intellectual property, marketing and commercialization of proprietary technology, and integration of geophysical technology into the business process for finding and developing oil and gas reserves. Responsible for maintaining strong networks and coordinating research efforts with academia and federal laboratories. Coordinated with Conoco governmental affairs and public affairs in representing Conoco viewpoints on science and technology to the public, and government agencies. Responsible for a $21 MM annual operating budget and annual external geophysical contracts of $100-150 MM, with direct impact on Conoco's $500MM global exploration program and worldwide production programs. Reported to the Vice President of Exploration Production Technology.

From January to September 2002, assigned to the merger integration team for the ConocoPhillips merger. Worked closely with other senior leaders from Conoco and Phillips to design a new technology organization, business plan, business processes and strategy for the new company. Managed the negotiation with vendors for data license transfer fees, developed strategies for integrated sourcing of geophysical services, and planned the integration of legacy hardware, software and technical processes for the geophysical technology center.

Exxon Corporation
1990 to 1997

Exploration Geophysicist, Exxon Exploration Company, Houston, TX (1996-1997)
Assigned to Africa/Middle East Business Unit for Ventures in Deepwater Offshore West Africa. Also provided expertise for ventures in Far East, Russia and U.S.A. Provided coordination, application and integration of technology with 3D seismic data to optimize exploration and appraisal results and provide support for wildcat and appraisal well planning. Technical areas of responsibility included pore pressure and fracture pressure prediction (global designated expert in this specialty), rock physics and physical properties analysis, specialized seismic data processing (2D and 3D,

controlled amplitude and phase), direct detection of hydrocarbons using DHI and AVO technology, geophysical modeling and inversion, velocity analysis and time-depth conversion. Also continued to provide technical leadership and project management for global technology development programs in abnormal pressure prediction, 3D AVO technology, seismic modeling, and completion and management of the Exxon Global Physical Properties Database. Taught pore pressure and fracture pressure prediction schools for the company geosciences and drilling department training programs as needed.

Senior Petroleum Geophysicist, Exxon Exploration Company, Houston, TX. (1992-1996)
Provided primary geophysical coordination and support for exploration operations in China and Vietnam (1992-1995), and technical coordination and support for exploration programs in Offshore West Africa (1996). Also provided expertise for ventures in Russia and the U.S Gulf of Mexico. Initiated several new geophysical technology development programs in 3D pore pressure and fracture pressure prediction, AVO technology, seismic modeling and construction of the Exxon Global Physical Properties Database, and provided design, technical leadership and project management for the projects. Taught pore pressure and fracture pressure prediction schools for the company training program as needed.
Senior Geophysicist, Exxon Company U.S.A., Offshore/Alaska Division, Houston TX (1990-1991)
Provided primary geophysical support for Gulf of Mexico Shelf and Deepwater exploration efforts, including pore pressure and fracture pressure prediction, physical properties analysis and database management, specialized seismic data processing, AVO analysis and direct hydrocarbon detection, velocity survey trade negotiation, and chance of success estimation for drilling.

Drilling, Observation and Sampling of Earth's Continental Crust **1989 to 1990**

Science and Database Manager, DOSECC Continental Scientific Drilling Office, Texas A&M University. Duties included the organization and science management of the drilling program office after it was transferred from Washington D.C. to College Station, TX.

Texas A&M University
1983 to 1990

Doctoral Research Fellow, Department of Geophysics, Texas A&M University. Pursued a wide range of research topics and taught undergraduate and graduate courses and labs. Provided the earthquake and seismic stability analysis for the site proposal for the Superconducting Supercollider for Waxahachie, TX. The main focus of the graduate research was on rock physics and rock mechanics and earthquake seismology. Research topics are listed under academic research work.

The Medical College of Pennsylvania
1978 to 1983

Unit Manager/Supervisor, Medical College of Pennsylvania Hospital (1981-1983) Philadelphia, PA. Supervised clerical and non-nursing staff in the Department of Nursing, including represented employees of the 1199C Teamsters Hospital Workers Union.
Unit Secretary, Medical College of Pennsylvania Hospital (1978-1980) Philadelphia, PA. Duties included management of nursing stations, patient records, and supervision of non-nursing functions on the unit.

PROFESSIONAL AFFILIATIONS

- American Association of Petroleum Geologists
- Society of Exploration Geophysicists

- American Geophysical Union
- Geological Society of America
- Association of Engineering Geologists

CONTINUING EDUCATION

- **2001;** Critical Thinking: Real-World, Real-Time Decisions, Executive Education Program, Wharton School of Business, University of Pennsylvania
- **2001;** CMC Trailblazer Program For Executive Development, Session 5, Conoco University in cooperation with London Business School and JMW Associates.
- **2001;** Communication That Matters: Engaging Others In Shaping The Future, Conoco University and Rick Ross Training Program
- **2000;** Power Through Influence, Harvard Business School Executive Education Program
- **2000;** Managing People: Power Through Influence, Executive Education Program, Wharton School of Business, University of Pennsylvania
- **1996;** IVP School, Western Geophysical
- **1996;** 3D Seismic Interpretation, Exxon 5 day school
- **1996;** GEOQUEST IESX Training
- **1996;** Hampson-Russell AVO Workshop
- **1995;** GXII Training School, GX Technologies
- **1995;** INTERWELL Inversion Training School
- **1994;** Velocity Interpretation & Analysis Workshop
- **1992;** Basic Well Logging, Exxon 10 day school
- **1991;** Seismic Data Gathering, Exxon 5 day school
- **1991;** Applied Seismic Interpretation, Exxon 15 day school
- **1991;** Exploration Economics, Exxon 2 day school
- **1991;** Introduction to SAS for Geologists, Exxon 5 day school
- **1991;** Direct Hydrocarbon Indicator Symposium, Exxon 5 day seminar
- **1990;** Seismic Identification of Hydrocarbons, Exxon 5 day school

PROFESSIONAL ACTIVITIES

- **2011;** Meeting Chairman, Geopressure 2011 International Conference on Pressure Prediction, Galveston, Texas, October 2-5, 2011.
- **2010;** Charter Member, Technical Computing Executive Advisory Council, Microsoft Corporation, two year term for 2010-2011.
- **2009;** Member, Advisory Board, Institute of Earth Science and Engineering, The University of Auckland, New Zealand
- **2007;** Invited Speaker, Geophysical Pressure Prediction For Ultradeep wells; When the Reservoir Becomes The Enemy; Robert Sheriff Symposium, University of Houston
- **2007;** Milton Dobrin Lecturer, Pressure Prediction in the Presence of Multiple Mechanisms with Application to Deep wells; University of Houston
- **2007;** Organizing Committee Member and Session Chairman, SPE Conference on Stress and Pressure Prediction, Galveston, Texas, February 11-14, 2007
- **2006;** Executive Panel Member, SPE Digital IT Forum Executive Discussion Panel on Business Performance Issues, Houston, Texas, February 22, 2006
- **2005-2006;** Program Committee Member (SEG), Offshore Technology Conference, May, 2006
- **2004;** Organizing Committee and Session Co-Chair, SEG Workshop on Geophysical Pressure Prediction, SEG Annual Meeting, Denver, CO, October 14, 2004
- **2003-present;** District 3 Council Representative, Society of Exploration Geophysicists
- **2003-2005;** Member, Industry Liaison Panel (ILP), International Ocean Drilling Program
- **2002-2003;** Member, Interim Industry Liaison Panel (iILP), International Ocean Drilling Program

- **2002-2003;** Planning Committee, GeoSCAN Panel for Geophysical Site Surveying, International Ocean Drilling Program
- **2002;** Steering Committee and Session Manager, SPE Forum Series in North America, Enhanced Recovery from Deepwater Reservoirs, July, 2002, Park City, Utah.
- **2001-2002;** IOGCC Blue Ribbon Task Force on Petroleum Professionals Education and Recruiting, Interstate Oil and Gas Compact Commission.
- **2001-2004;** Board of Visitors, School of Geology and Geophysics, The University of Oklahoma
- **2001;** Expert Witness, Hearings on Industry Input to DOE Fossil Energy Programs, Office of Fossil Energy, United States Department of Energy, August 14, 2001
- **2001;** Expert Witness, Hearings on National Oil and Gas Research Policy, Subcommittee on Energy, House Science Committee, United States Congress, June 12, 2001
- **2001-2002;** Organizing Committee Member and Technical Committee Chairman, SEG Summer Research Workshop on Pressure Prediction, Galveston, TX, May, 2002
- **2001-2002;** Program Committee Member (SEG), Offshore Technology Conference, May, 2002
- **2000-2001;** Invited Speaker and Panel Member, SEG Summer Research Workshop on Advances in Medical, Geophysical and Space Imaging, Newport Beach, CA, July, 2001
- **2000-2002;** Executive Committee, Midcontinent Oil and Gas Association
- **2000-2001;** Session Chairman, Pore Pressure Prediction Using Geophysical Methods, Offshore Technology Conference, May, 2001
- **2000;** Co-Chairman and Sponsor, ODP Drilling Workshop on Geopressure In Sedimentary Basins
- **2000;** Session Chairman, Shallow Water Flow Hazards, Offshore Technology Conference, May 2000
- **2000;** Organizing Committee, SPE Forum On Deepwater Appraisal and Development, Breckenridge, CO, July 2000
- **1999;** Chairman, Pennwell Forum on Shallow Water Flows, October, 1999.
- **1999-2002;** Editor, AAPG Special Volume on Pressure Regimes in Sedimentary Basin and Their Prediction, to be published in 2002
- **1999-2002;** Board of Directors, Mid Continent Oil and Gas Association
- **1999-2002;** Board of Directors, United States Oil and Gas Association
- **1999;** Session Chairman, SEG D&P Forum, Kananaskis, Alberta, Canada, July, 1999
- **1998-2000;** Member, Scientific Measurements Panel, Ocean Drilling Program, 3 year term
- **1998;** Member, External Review Panel, School of Geology and Geophysics, University of Oklahoma
- **1998;** General Chairman, American Association of Drilling Engineers Industry Forum on Pressure Regimes in Sedimentary Basins and Their Prediction, held September, 1998.
- **1998;** Expert Panel Member, SEG Workshop on Deepwater Challenges in Exploration and Production, New Orleans, LA, September 18 1998.
- **1998;** Organizing Committee member and Expert Panel Member, DEA/AADE Workshop on Shallow Flows, held at The Woodlands Conference Center, July, 1998.
- **1997;** Invited Speaker, SEG Workshop on Pressure Prediction, Dallas, Texas, November 1997.
- **1997-present;** Member, American Association of Drilling Engineers Disciplinary Standing Committee on Abnormal Pressure Drilling Technology
- **1994-2000;** Astrogeology Committee, American Association of Petroleum Geologists.
- **1987-88;** Secretary to Steering Committee, Texas A&M University Petroleum Recovery Research Program.
- **1987;** Secretary to the Steering Committee, Workshop on Not Visible or Recoverable Hydrocarbons, Office of Basic Energy Sciences, U.S. Department of Energy.
- **1987;** Technical Secretary, Workshop on Not Yet Visible or Recoverable Hydrocarbons, Office of Basic Energy Sciences, U.S. Department of Energy
- **1986-87;** President, Lone Star Chapter, Association of Engineering Geologists.
- **1986;** Executive Secretary to Geoscience Research Council, Office of Basic Energy Sciences, U.S. Department of Energy.
- **1985;** Texas Section, Association of Engineering Geologists, Annual Meeting Chairman.

PATENTS ISSUED AND PATENTS PENDING

- **2005;** Alan R. Huffman, David Bell, Ernest Onyia, Rick Lahann and Robert Lankston, United States Patent 6,977,866 B2, Method and Process For The Prediction of Subsurface Fluid and Rock Pressures in the Earth, issued December 20, 2005
- **2004;** Alan R. Huffman, David Bell, Ernest Onyia, Rick Lahann and Robert Lankston, United States Patent 6,751,558 B2, Method and Process For The Prediction of Subsurface Fluid and Rock Pressures in the Earth, issued June 15, 2004
- **2001;** Alan R. Huffman, United States Patent 6,694,261, A Method for Identification for Shallow Water Flow Hazards Using Marine Seismic Data, patent issued February 17, 2004
- **2002;** Sally Thomas, Trey W. Gilbert and Alan R. Huffman; United States Patent 6,427,774; Process and Apparatus for Coupled Electromagnetic and Acoustic Stimulation of Crude Oil Reservoirs Using Pulsed Power Electro-Hydraulic and Electromagnetic Discharge, issued August 6, 2002.
- **2002;** Gregory J. Jorgensen, Jerry L. Kisabeth and Alan R. Huffman, United States Patent 6,430,507, A method for Gravity and Magnetic Data Inversion with Geopressure Prediction for Oil, Gas and Mineral Exploration and Production, issued on August 6, 2002.
- **2002;** Gregory J. Jorgensen, Jerry L. Kisabeth, Alan R. Huffman, and John B. Sinton, and David W. Bell, United States Patent 6,424,918, A method for Integrating Gravity and Magnetic Inversion Data With Model Based Seismic Data for Oil, Gas and Mineral Exploration and Production, issued July 23, 2002.
- **2002;** Gregory J. Jorgensen, Jerry L. Kisabeth, Alan R. Huffman, and John B. Sinton and David W. Bell, United States Patent 6,502,037, A method for Gravity and Magnetic Data Inversion using Vector and Tensor Data with Seismic Imaging and Geopressure Prediction for Oil, Gas and Mineral Exploration and Production
- **2002;** Alan R. Huffman, David Bell, Ernest Onyia, and Rick Lahann, United States Patent 6,473,696, Method and Process For The Prediction of Subsurface Fluid and Rock Pressures in the Earth, issued October 29, 2002
- **2001;** Alan R. Huffman and Richard H. Wesley, United States Patent 6,227,293; Process and Apparatus for Coupled Electromagnetic and Acoustic Stimulation of Crude Oil Reservoirs Using Pulsed Power Electro-Hydraulic and Electromagnetic Discharge, issued February 9, 2001

ACADEMIC AND PROFESSIONAL HONORS

- **2004;** American Association of Petroleum Geologists, Robert H. Dott Sr. Memorial Award, recognizing the contribution of AAPG Memoir 76, Pressure Regimes in Sedimentary Basin and Their Prediction, co-edited by Dr. Alan R. Huffman and Dr. Glenn Bowers.
- **2002;** Society of Exploration Geophysicists, Best Paper Award, The Leading Edge Magazine for "The Petrophysical Basis for Shallow-Water Flow Prediction Using Multicomponent Seismic Data, co-authored with J. P. Castagna of The University of Oklahoma
- **1989;** Association of Former Students Award for Excellence in Doctoral Research, Texas A&M University
- **1989;** Williford Dean's Scholarship, TAMU
- **1989;** John and Francis Handin Fellowship, TAMU
- **1988-89;** AMOCO Doctoral Fellowship, TAMU
- **1988;** ARCO Doctoral Fellowship, TAMU
- **1987-88;** CONOCO Geophysics Fellowship, TAMU
- **1987-88;** Williford Dean's Scholarship, TAMU
- **1986-87;** Geophysics Dept. Fellowship, TAMU
- **1986-87;** Teaching Assistant, Department of Geophysics, TAMU.
- **1985-86;** Faculty Doctoral Fellowship, TAMU
- **1984-85;** ARCO Doctoral Fellowship, TAMU
- **1983-84;** University Fellowship, TAMU
- **1982-83;** Moss Scholarship, F & M College

PROFESSIONAL EXPERIENCE

- General Management with P&L Responsibility
- Merger Integration Planning and Design
- Business Development and Planning
- Technology Management, Strategy, Development and Planning
- Intellectual Property Management (Patents and Trademarks)
- Marketing and Commercialization of Technology
- Contract Management and Negotiation
- Petroleum Exploration & Production Geophysics
- Detection of abnormal pressure using geophysical methods
- Direct detection of hydrocarbons using DHI, AVO and attribute technologies
- Seismic and geophysical data processing
- Geophysical database management
- Geophysical software design and implementation
- 2D and 3D seismic interpretation
- Geophysical modeling and inversion
- Velocity analysis and time-depth conversion
- Geophysical log and VSP planning and log analysis
- Rock Physics, Mechanics, and Deformation
- Earthquake Seismology and Hazard Reduction
- Engineering & Environmental Geophysics
- Design, placement and operations of micro-seismic arrays, land refraction surveys, marine and land reflection seismic surveys, and gravity surveys
- Design and operation of high-pressure and high-temperature experimental apparatus
- Geochemical analysis, including XRD, XRF, EDS, WDS, and INAA
- Scanning and transmission electron microscopy
- Design and implementation of shock recovery experiments
- Development of pulsed power applications in geophysics, mining, and petroleum

RESEARCH EXPERIENCE

- Development and implementation of geophysical methods for the detection of abnormal fluid pressures
- Physical properties of sediments and their relationship to seismic stratigraphy and seismic attributes.
- Development and implementation of DHI and AVO technology using controlled amplitude 3D seismic processing,
- High-pressure/temperature rheology of mafic and ultramafic rocks, including the effects of fluid phases.
- Mathematical and numerical modeling of geophysical phenomena of the lower crust and upper mantle.
- Microseismic and pattern recognition studies for earthquake hazard reduction along the Meers Fault, S.W. Oklahoma.
- Causes and effects of shock-wave propagation from natural phenomena including meteor impacts and volcanism.
- Development of shock-induced microstructures in silicate minerals as a function of variables other than peak shock stress.
- Pressure-solution effects as a function of fluid chemistry and its relation to oil-field consolidation problems and EOR.
- Gravity effects of large mantle plumes and their relationship to other geophysical phenomena.
- Application of pulsed power to engineering, environmental, and oil production problems.

THESIS WORKS

Huffman, A.R., (1981), The Geology, Petrology, and Geochemistry of the N.W. Hambone and S.W. Medicine Lake Quadrangles, N. California, Bachelor's Thesis, Franklin and Marshall College, 72 pages

Huffman, A.R., (1983), The Petrology of the Late Stage Lavas of The Medicine Lake Highlands, Bachelor's Thesis, Franklin and Marshall College, 156 pages.

Huffman, A.R., (1990), Shock Deformation and Volcanism Across The Cretaceous/Tertiary Transition, Ph.D. Dissertation, Texas A&M University, 347 pages.

ABSTRACTS

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Buitrago, J., Dessay, J., Diaz, C., Gruenwald, R., Huffman, A.R., Moreno, C., Gonzalez Muñoz, J.M., (2010), Pore Pressure Prediction Based on High Resolution Velocity Inversion in Carbonate Rocks, Offshore Sirte Basin – Libya, AAPG Annual Meeting, New Orleans, LA, April, 2010.

Buitrago, J., Dessay, J., Diaz, C., Gruenwald, R., Huffman, A.R., Moreno, C., Gonzalez Muñoz, J.M., (2010), Pore Pressure Prediction Based on High Resolution Velocity Inversion in Carbonate Rocks, Offshore Sirte Basin – Libya, EAGE Annual Meeting, Barcelona, Spain, June 14-17, 2010.

Gartner, S., Huffman, A.R., and Crocket, J.H., (1990), The Cretaceous-Tertiary Boundary At Brazos River, East Texas, GSA Abstracts with Programs, in press.

Huffman, A. R., (2008), Geopressure Prediction For Ultradeep Wells: When the Reservoir Becomes The Enemy: Overpressure 2008 Conference, April 6-9, 2008, Durham University, United Kingdom

Huffman, A. R., (2008), Geopressure Prediction For Ultradeep Wells: When the Reservoir Becomes The Enemy: Geo2008, March 2-5, 2008, Bahrain

Huffman, A. R., (2008), Geophysical Pressure Prediction In the Presence of Multiple Pressure Mechanisms With Applications To UltraDeep Wells: Geo2008, March 2-5, 2008, Bahrain

Huffman, A. R., (2007), Geopressure Prediction In the Presence of Multiple Pressure Mechanisms With Applications To Deep Wells, in Basin Modeling Perspectives: Innovative Developments and Novel Applications: Hedburg Conference, May 6-9, 2007, The Hague, Netherlands.

Huffman, A. R., (2006), Recent Developments and Future Challenges In Geopressure Prediction, Special Technology Session Invited Abstract, CSPG/CSEGCWLS Joint National Convention, May 17, 2006

Huffman, A. R., (2006), Digital Technology Challenges And Issues In The Global E&P Business, SPE Digital Energy Conference, Houston, Texas, February 22, 2006

Huffman, A. R., (2003), Integration of Real-Time Geophysical Data For Geopressure Prediction During Drilling, SEG Workshop on Real-Time Drilling Decisions, SEG Annual Meeting, Dallas, Texas.

Huffman, A.R., (2002), Recent Advances and Future Challenges in Geopressure Prediction, SEG Annual Meeting, Abstracts with Programs, Salt Lake City, Utah.

Huffman, A. R., (1998), The Future of Pressure Prediction Using Geophysical Methods, AADE Industry Forum on Pressure Regimes in Sedimentary Basins and Their Prediction, September 2-4, 1998.

Huffman, A. R., (1995), Experimental Constraints on Shock-Induced Microstructures in the Impact Deposits of the Ames Crater, Industry Workshop on the Ames Impact Crater, Oklahoma, Mar 28-29, 1995, in press.

Huffman, A.R., (1990), Grain-Boundary Dynamics During Annealing of Dunite, Texas Society for Electron Microscopy Annual Meeting, April 5-7, 1990.

Huffman, A.R., (1988), Seismicity and Faulting Studies for Siting the Superconducting Supercollider in Texas, invited paper abstract, Association of Engineering Geologists, Texas Section Meeting, April 16, 1988.

Huffman, A.R., (1987), Grain-Boundary Dynamics During Annealing of Dunite, EOS, Trans. American Geophysical Union, vol. 68, no. 16: 404.

Huffman, A.R., (1984), Response of the Uppermost Mantle to Indo-Eurasian Collisional Tectonics, Texas A&M 6th Geodynamics Symposium, Abstracts, April, 1984.

Huffman, A.R., Carter, N.L., Brown, J.M., and Shaner, J., (1989), Temperature-dependence of Shock-induced Microstructures in Tectosilicates, Abstract, EOS Transactions, AGU, in press.

Huffman, A.R., Carter, N.L., and Brown, J.M., (1989), Temperature-dependence of Shock-induced Microstructures in Tectosilicates, Abstract, APS Topical Conference on Shock Compression of Condensed Matter, Albuquerque, NM, August 14-17, 1989.

Huffman, A.R., Carter, N.L., and Kronenberg, A.K., (1989), Can terrestrial processes produce shock microstructures, Abstract, GSA Abstracts with Programs, v. 21, no. 6.

Huffman, A.R., Carter, N.L., and Kronenberg, A.K., (1990), TEM-Scale Shock-Wave Damage in Silicates and The Cretaceous-Tertiary Boundary Event, Texas Society for Electron Microscopy Annual Meeting, April 5-7, 1990.

Huffman, A.R., Carter, N.L., and C.B. Officer, (1989), Are Shocked Minerals Unique to Impact?, Abstract, 20th Lunar and Planetary Science Conference, Houston, TX, March 13-17, 1989, p. 426-427.

Huffman, A.R., and Castagna, J.P., (1999), Rock Physics and Mechanics Considerations for Shallow Water Flow Characterization, Pennwell Shallow Water Flow Forum, October 6-8, 1999.

Huffman, A. R., Castagna, J. P., Mendez, E., Santana, J. A., and J. Mancilla, (2003), Geopressure Prediction Advances In The Veracruz Basin, Mexico, SEG Annual Meeting, Abstracts with Programs, Dallas, Texas, 2003

Huffman, A.R., Castagna, J.P., Sahai, S.K., Cox, V.D., and K. Smith, (2000), Shallow Water Flow Prediction Using Analysis of Multicomponent Seismic Data, SEG Research Workshop, Boise ID, October 61-6, 2000.

Huffman, A.R., Crocket, J.H., and N.L. Carter, (1988), Iridium, Shocked Quartz, and Trace Elements Across the Cretaceous/Tertiary Boundary at Maud Rise, Wedell Sea, and Walvis Ridge, South Atlantic, Abstract, Conference on Catastrophes in Earth History, Snowbird, Utah, Oct. 20-23, 1988.

Huffman, A.R., Crocket, J.H., and S. Gartner, (1989), The Cretaceous/Tertiary Boundary at Brazos River, East Texas, Abstract, 20th Lunar and Planetary Science Conference, Houston, TX, March 13-17, 1989, p. 428-429.

Huffman, A.R., Fahlquist, D.A., and McCartney, K., (1990), Gravity Effects of Large Mantle Plumes and The Correlation Between Hot-Spot Initiation, Mass Extinctions, and Sea-Level Change, GSA Abstracts with Programs, in press.

Huffman, A. R., and Richard W. Lahann (2008), Geopressure Prediction For Ultradeep Wells: When the Reservoir Becomes The Enemy: Overpressure 2008 Conference, Durham, UK, April 6-9, 2008

Huffman, A. R., R. W. Lahann and W. Kessinger (2008), Geophysical Pressure Prediction In the Presence of Multiple Pressure Mechanisms With Applications To UltraDeep Wells: Overpressure 2008 Conference, Durham, UK, April 6-9, 2008

Huffman, A.R., McCartney, K., and Loper, D.E., (1989), Hot Spot initiation and flood basalts as a cause of catastrophic climatic change and mass extinctions, Abstract, GSA Abstracts with Programs, v. 21, no. 6.

Huffman A.R., Meyer, J., Gruenwald, R., Buitrago, J., Suarez, J., Diaz, C., Munoz, J.M., Dessay, J., (2011), Recent Advances in Pore Pressure Prediction in Complex Geologic Environments, Middle East Oil Show (MEOS) Technical Conference, Manama, Bahrain, March, 2011.

Huffman A.R., Moreno C., Gruenwald, R., Buitrago, J., Suarez, J., Diaz, C., Munoz, J.M., Dessay, J., (2010), Recent Advances in Pore Pressure Prediction in Complex Geologic Environments, Society of Exploration Geophysicists Annual Meeting, Denver, Colorado, November, 2010 Post Convention Workshop on Geohazards.

Huffman, A.R., C. Moreno, R. Gruenwald, J. Buitrago, J. Suarez[2], C. Diaz[2], J.-M. Munoz, and J. Dessay, (2009) Recent Advances in Pore Pressure Prediction in Complex Geologic Environments, SEGAnnual Meeting, Abstracts With Programs, October 27th, 2009, Houston, Texas.

Moreno, C; Castagna, J; Huffman, A; and A. Bertagne, 2003, The Vp/Vs inversion procedure: A methodology for Shallow Water Flow (SWF) prediction from seismic analysis of multicomponent data. Offshore Technology Conference Extended Abstracts #15248,11 pages.

Kronenberg, A.K., Rossman, G.R., Yund, R.A., and Huffman, A.R., (1989), Stationary and mobile hydrogen defects in potassium feldspar, Abstract, EOS Trans, v. 70, in press.

Sharpton, V.L., Huffman, A.R., Murali, A.V., and Kronenberg, A.K., (1989), Shocked quartz at the base of the Deccan Traps: Fact or Fiction?, Abstract, GSA Abstracts with Programs, v. 21, no. 6.

Tilford, N.R., and Huffman, A.R., (1985), Pattern Recognition to Locate Renewed Movement on Basin-Bordering Faults, paper presented at the 80th Meeting, Seismological Society of America, Austin, Texas, April 15, 1985.

Zhu, X., Huffman, A. R., and Castagna, J. P., (2003) Tomography for enhanced geopressure prediction and depth imaging, SEG Beijing, July 2003, in press.

PUBLICATIONS

Chopra, S., and Huffman, A.R., (2006), Velocity determination for pore pressure prediction, CSEG Recorder, v. 31, no. 4: 28-46.

Etemadi, M., Benkovics, L., Moreno, C., Perez, M., Meyer J., and Huffman, A. R., (2009), Hydrocarbon prospecting in deepwater Trinidad using AVO and spectral decomposition, World Oil, September 2009, pp. 37-40.

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PERSONAL HISTORY

Born:	March 7, 1960, Philadelphia, PA
Married:	August 13, 1983, to Maria Beverly Nellett
Wife's Profession:	Registered Nurse (BSN, RN, CCRN)
Children:	One daughter, Andrea Lynn, age 23 years
Health:	Excellent
Citizenship:	U.S.

REFERENCES: available upon request