In re: Oil Spill by the Oil Rig "*Deepwater Horizon*" in the Gulf of Mexico, on April 20, 2010

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF LOUISIANA
JUDGE BARBIER; MAGISTRATE JUDGE SHUSHAN
MDL NO. 2179, SECTION J

Expert Report of Iain Adams

Submitted on Behalf of BP Exploration & Production Inc.

May 10, 2013

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1.0 CREDENTIALS AND EXPERIENCE

My name is Iain Adams. BP Exploration and Production Inc. retained me to provide an expert opinion regarding BP's participation in the Unified Area Command's Response ("the Response") to the loss of well control at the MC-252-1 Well ("the Well") on April 20, 2010 and to review and consider reports filed by the Plaintiffs' Steering Committee as they related to those efforts.

I am an engineer with training and expertise in well design, managing international drilling operations, well control audits, well control risk reviews for insurance underwriters, and well control consulting. Since 1979, I have supervised drilling operations in Angola, Congo, Denmark, Holland, Indonesia, Israel, Ivory Coast, Romania, Russia, Spain, Tunisia, the UK, Ukraine, and the USA. Currently, I am the Managing Director of Norwell, where I manage deepwater and high-pressure operations and provide consulting services for approximately twenty different clients. Norwell are a Project Management and Well Engineering firm established in 1989. Norwell have a track record of providing the design planning and operational supervision for over 200 wells in 30 countries worldwide. Fifty of those wells have been drilled in over 5000 feet of water.

Norwell have been project managing two drillships drilling exploration wells in over 8000 feet of water since 2010. In that time, Norwell have drilled 32 wells in over 8000 feet of water, including the world's record water depth well in approximately 10385 feet of water. Norwell are also project managing a series of offshore High Pressure High Temperature wells and two exploration programmes in Africa.

In addition, Norwell provide technical and well control specialist support to oil companies, drilling contractors, lending institutions and legal firms. Norwell actively support technical and emergency response teams and assist peer review and audit teams. Norwell have conducted independent well examinations on over 500 wells since 1996. Well examinations are a legislative requirement in the United Kingdom, which require an independent review to ensure all wells are adequately designed, constructed, and maintained. The examination process includes a review of the design and planning phase through well operations, production maintenance, and ultimately, well abandonment. Currently, Norwell are providing independent review of active programmes for five major oil companies.

I hold a Bachelors of Science in Engineering from the University of Aberdeen.

Norwell have provided services to BP in the past, but other than this review, are not providing services to BP currently.

I have never served as an expert witness before.

My resume is attached as Appendix B.

2.0 CONCLUSIONS

Based on my review of testimony, documents, interviews with engineers involved in the Response, and my professional judgment and experience, I have drawn the following conclusions about the Response to the *Deepwater Horizon* blowout in 2010:

1. BP's participation in the Unified Command's Response to the *Deepwater Horizon* blowout demonstrated sound engineering judgment, gave appropriate attention to the safety of workers engaged in the Response, and enabled the Unified Command to secure the Well as expeditiously as practicable, taking due account of uncertainties about the condition of the Well and the need to minimize the risk of subsea broaching while mitigating environmental damage to the extent possible.

2. The scale of the Response, was unprecedented by any measure -- manpower, physical and financial resources, and level of co-operation between industry and government. BP fully supported the Response without regard to cost. BP spent over an estimated $1.6 billion on the source control effort.

3. Contrary to the reports by Mr. Gregg Perkin and Dr. Robert Bea, it cannot be said with any degree of engineering certainty that the well could have been shut in "within weeks" of the blowout, in a manner that minimized risk to the environment, even if BP had access to a capping stack prior to April 20, 2010.

3.0 DISCUSSION

First, in section 3.1 I introduce the guiding principles of BP's Response to regain control of the Well. Then, in section 3.2 I address the initial Response efforts and the activation of BP's emergency response plans. Thereafter, I address specific aspects of the Response effort that were made subjects of controversy by the reports of Mr. Gregg Perkin and Dr. Robert Bea on behalf of the Plaintiffs' Steering Committee.

3.1 INTRODUCTION

The *Deepwater Horizon* blowout occurred on the night of April 20, 2010. As the holder of the MC-252 lease, BP immediately accepted its responsibilities and throughout the summer of 2010 exerted itself to mitigate the damage caused by the *Deepwater Horizon* accident.

There were several principles guiding BP's Response efforts.

First, BP accepted its duties as a Responsible Party for the Response under applicable U.S. statutes and regulations. Thus, BP became an integral part of the Unified Command created to respond to the *Deepwater Horizon* incident. [redacted]

Second, BP took steps to ensure the safety of the workers at the surface as serious injuries and deaths had been known to occur on prior blow out responses.[2] For example, efforts were taken to prevent unsafe levels of Volatile Organic Compounds (VOCs) in the air. In addition, intricate planning was necessary to allow the numerous vessels in close quarters to execute their simultaneous operations safely.[3]

Third, with the Well having blown out and thousands of barrels of oil discharged into the waters of the Gulf, BP strove to minimize the environmental harm caused by the blow out as quickly as possible and in a way that would not have unintended consequences. The mantra of the response was "Don't Make It Worse." This, in practice, meant attempting to kill or cap the Well as quickly as practicable and collecting as much oil as practicable as those efforts were under way. It also meant assessing the risks, including to the environment, of specific methods to cap or kill the Well before undertaking those methods. For example, if the Well did not have "integrity" or subsequent actions resulted in a loss of integrity it could allow hydrocarbons to exit the wellbore potentially fracturing the shallow formations and venting at the seabed.[4] Such an outcome could have resulted in hydrocarbons venting from multiple seabed locations, precluding effective collection efforts and

[redacted]

[2] R. Lynch Tr. at 115:14-17.

[3] R. Lynch Tr. at 493:17-494:7.

[4] See Expert Report of Mr. Dan Gibson ("Gibson Expert Report"), May 10, 2010, at 1.

making the eventual killing of the Well more difficult or potentially impossible with known methods.[5] The issue of well integrity was therefore a central concern and response methods were evaluated in light of that concern.

Fourth, and of nearly equal importance, in evaluating whether to undertake a particular source control effort, BP considered how attempting that effort could affect other potential options. The goal here was to avoid, to the extent practicable, undertaking a particular effort if it would preclude other potential source control methods from being executed in the future. For example, if a particular source control method risked making it more difficult to shut in or kill the Well by another means if that method failed, BP brought the risk to the attention of the U.S. government officials in charge of the Response for consideration.

3.2 INITIAL RESPONSE AND STAND-UP OF THE SOURCE CONTROL TEAM

Consistent with the principles outlined above, BP activated its emergency response team shortly after 10:00 pm on April 20, 2010, as required in its regional Oil Spill Response Plan ("OSRP"), which included notifying the U.S. Coast Guard. As described in the OSRP and in conformance with standard industry practice, the team addressing source control included engineers within BP, the well control companies that BP already had under contract, such as Wild Well Control, and other contractors such as Transocean, Cameron, and Halliburton. BP promptly applied to MMS for a permit to drill a relief well, which is part of the generally practiced method of responding to a blown out well.[6] In April 2010, the estimated time frame for completion of the relief well was approximately 90-120 days from the start of the *Deepwater Horizon* incident, depending in part on weather conditions.[7]

In the last subsea well blowout in the Gulf of Mexico -- the blowout in approximately 164 feet of water of the Ixtoc well owned by a Mexican oil company in 1979 -- a relief well did not kill the well until almost ten months had passed. As indicated above, one of BP's guiding principles in the Macondo Response was to minimize further damage to the environment after the loss of the *Deepwater Horizon.* In addition, and in conformity with the OSRP, BP engineering teams (including well control experts from companies like Wild Well Control) developed specific procedures and ordered or fabricated the equipment needed to try to shut in, kill the Well, and to contain oil from the Well prior to the time when a relief well could be completed, to the extent permitted by the Federal On-Scene Coordinators.[8]

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[5] P. Campbell Tr. Vol. 1 at 193-194 (explaining that a broach to the seabed could cause conditions that "won't allow me to kill by conventionally known means").

[6] A relief well is a well drilled to intersect a blowing out well so that kill fluids can be injected into it.

[7] Deposition Exhibit 2292.

[8] Mr. Perkin contends that BP "refused to defer" to Wild Well Control. Perkin Report at 16-17. However, as Wild Well Control testified there were multiple entities whose views needed to be considered including other well control companies and the Government. D. Barnett Tr. at

Those initial Response efforts were under the direction and control of a Federal On-Scene Coordinator beginning the night of April 20, 2010 and the Unified Command upon its establishment on April 23, 2010. As the efforts progressed, the source control efforts also came to be supported by other operators, such as ExxonMobil and Shell, who provided some materials and assistance in reviewing some potential source control methods. Beginning in May, the "Federal Science Team," which consisted of scientists employed by Sandia, Lawrence Livermore and Los Alamos national labs arrived in Houston to provide independent data analysis and support as well as reviewing potential source control options. There was also senior level representation from the Departments of Energy and Interior, often the Secretaries themselves, reviewing source control planning on a daily basis.[9] Each proposed source control effort was reviewed and analyzed at multiple levels within the Unified Command before the Unified Command approved it.

3.3 TOP KILL WAS A REASONABLE EFFORT TO STOP FLOW FROM THE WELL

The "Top Kill" was an effort to kill the Well by pumping mud and bridging material into the *Deepwater Horizon* BOP with the intention of forcing mud into the Well in a quantity sufficient to preclude flow from the reservoir due to the weight of the mud in the Well. The procedure known as "Top Kill" had two parts 1) the pumping of mud, in what is called a momentum kill and 2) the injection of materials into the BOP (also called the "Junk Shot") to, in effect, clog some of the exit points for hydrocarbons to assist a subsequent momentum kill in forcing mud into the well.[10] These techniques for killing wells have previously been successfully executed.[11]

The Top Kill plan was reviewed extensively by federal officials, as were other potential source control options.[12] The plan had the potential to kill the Well, cease all flow to the environment, and provide information about the condition of the Well. In the event Top Kill was not successful, and in the aftermath of its failure, the Unified Command made the decision to rely on collection of oil from the Well while the relief wells were being drilled and as it considered other options.[13]

335-36. And it was Wild Well Control's recommendation that the well not be shut in, but rather collection efforts be undertaken. Deposition Exhibit 3922; P. Campbell Tr. at 34; D. Barnett Tr. at 223 (explaining that Wild Well CEO Pat Campbell had "issued memos where he pointed out that it might be a better course of action to divert and produce as much of the oil as possible and wait for the relief wells.")

[9] R. Brannon Tr. at 38.

[10] D. Barnett Tr. at 324:21-325:1; M. Patteson Tr. at 253:12-21; M. Mazzella Tr. at 106-107.

[11] Watson et al., Advanced Well Control, SPE Handbook Vol. 10 (2003), at 335 ("The momentum kill was introduced in 1976 and the method has been applied successfully to a number of wild wells, many of which would have otherwise required a relief well."); Interview with M. Mazzella.

[12] Deposition Exhibit 9245; BP-HZN-2179MDL05814854; T. Hunter Tr. at 161; L. Herbst Tr. at 122-127; C. Holt Tr. at 549-563.

[13] T. Allen Tr. at 257-259.

While the Top Kill plan was not guaranteed to succeed, the Unified Command's review of the Top Kill showed that with appropriate controls to manage the risks of the procedure, Top Kill had little downside even if unsuccessful.[14] Top Kill was therefore consistent with the guiding principles for the Response summarized above in Section 3.1 of this report, particularly the concept of "Don't Make It Worse" while the relief wells were being drilled. In addition, Top Kill, even if not successful, did not foreclose other source control options being developed simultaneously in May 2010. I believe that in light of the limited risks created by Top Kill, its potential for success, and status of other options at the time of its execution, Top Kill was a reasonable effort to undertake.

The Plaintiffs' Steering Committee contends in a report prepared by Mr. Perkin that the Top Kill "could not succeed" and had various risks identified in Mr. Perkin's report.[15] I disagree that it was known that Top Kill "could not succeed" and as to the risks identified by Mr. Perkin, they were appropriately identified and then mitigated during the development of the procedure, which Mr. Perkin's report ignores.

First, Mr. Perkin's report asserts that if the flow from the Well was in excess of 15,000 barrels per day that Top Kill could not succeed.[16] That is incorrect. Modelling was undertaken during the Response that indicated if responders could pump 50 barrels per minute of mud into the *Deepwater Horizon's* BOP, such a momentum kill could successfully kill the Well if it was flowing at 5,000 barrels per day, but not if it was flowing at 15,000 barrels per day.[17] This modelling, however, only addresses one portion of the Top Kill procedure: the momentum kill. The modelling did not consider the impact of the other half of the Top Kill procedure: the injection of material into the BOP to bridge or clog the flow path (i.e., the Junk Shot procedure). [18]

If the injection of bridging materials is considered, the Top Kill procedure is not limited by flow rate.[19] For example, if the Well was flowing at 30,000 barrels per day and bridging materials succeeded in closing off a portion of the flow path through the BOP it would reduce the flow from the Well.[20] If this reduction in flow rate was sufficient, it

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[14] L. Herbst Tr. at 127 ("I think there were various assumptions by various people as far as the potential for success, but not that it should not be attempted.").

[15] Perkin Report at 9.

[16] Perkin Report at 9.

[17] These modelling scenarios were presented to a team of federal scientists assigned (at BP's request) to evaluate the Top Kill efforts as well as discussed at a daily meeting attended by BP and federal officials, including the Federal Incident Command for the Source Control Command Post. T. Hunter Tr. at 161; Deposition Exhibit 9245; R. Brannon Tr. at 70-71; Deposition Exhibit 10680; Deposition Exhibit 10679.

[18] D. Barnett Tr. at 322-323; O. Rygg Tr. at 204, 207 ("The junk shot hasn't anything to do with this -- this modeling.").

[19] M. Mazzella Tr. at 115-116 ("The -- the bridging material is irrespective of the -- of flow.").

[20] O. Rygg Tr. at 207; L. Herbst Tr. at 139.

could allow a subsequent momentum kill to succeed.[21] Thus, it is incorrect to say that the complete Top Kill procedure could not succeed if the Well was flowing in excess of 15,000 barrels per day as asserted in Mr. Perkin's report.[22] Indeed, the limitations of the momentum kill identified by BP are precisely the reason for the inclusion of "Junk Shot" in the Top Kill procedure.[23]

Mr. Perkin also highlights several risks that BP and others identified during the development of the Top Kill plan.[24] Mr. Perkin's report, however, ignores an important stage of the planning process: the mitigation of identified risks. As explained below, each of the risks indicated by Mr. Perkin was appropriately mitigated such that the procedure could safely proceed:

- ***Risk of Causing Damage to the Well by Pumping***: BP identified early in the process the potential risk of damaging the Well's integrity and allowing hydrocarbons to fracture shallow formations. This was mitigated by a detailed engineering effort, which determined the maximum safe pressure to preclude damaging well integrity. In response, the pumping operations were limited so that pressures during the operation did not exceed that safe pressure.[25]

- ***Risk of Completely Blocking the BOP***: BP identified the risk that the injection of bridging materials could completely block the flow of hydrocarbons through the BOP. This was mitigated in several ways: 1) initial kill efforts did not use bridging material; 2) when bridging material was injected into the BOP, it was done in measured steps while monitoring the pressure response; and 3) in the event that flow through the BOP was completely stopped by the bridging material, BP had the

[21] It should be noted that the only other subsea blowout identified by Dr. Bea, the Ixtoc well in the Gulf of Mexico, the injection of bridging material into the BOP reduced flow rate by an estimated two-thirds. According to NOAA's website, "[i]n July 1979 the pumping of mud into the well reduced the flow [from 30,000 barrels per day] to 20,000 barrels per day, and early in August the pumping of nearly 100,000 steel, iron, and lead balls into the well reduced the flow to 10,000 barrels per day." Available at: http://incidentnews.noaa.gov/entry/508790 (last visited May 7, 2010); http://incidentnews.noaa.gov/incident/6250 (last visited May 7, 2010).

[22] O. Rygg Tr. at 207 ("The junk shot, the -- and the whole purposes of the junk shot is to reduce -- the opening of the flow, meaning that the -- the flow rate, then, is reduced from what it was before they started the operation."); M. Mazzella Tr. at 49, 115-16; C. Holt Tr. at 25-26.

[23] D. Barnett Tr. at 323 ("Q. All right. And the whole purpose of the junk shot portion of the top kill procedure would be to change the orifice size so that a dynamic kill could be successful regardless of what the initial flow rate [] was, correct? A. Right. The idea was to reduce the flow path size by plugging it with various materials.").

[24] Perkin Report at 8.

[25] C. Holt Tr. at 545; D. Barnett Tr. at 324 (Q. Ultimately, you didn't reach the pressure limits that would have caused concerns for the wellbore integrity? A. No.").

ability to vent pressure using the BOP's choke and kill lines in conjunction with the subsea infrastructure being used for Top Kill.[26]

- ***Risk of Compromising the Relief Wells***: If the Well did not have integrity, BP identified a risk of compromising the relief well efforts if the shallow sands that the relief wells needed to be drilled through became "pressurized" during the Top Kill effort. By the time of Top Kill's execution, both relief wells had drilled through the zones of concern and cemented their casing which isolated them from those zones.[27] This mitigated the risk.

- ***Risk of Blocking the Deepwater Horizon BOP's choke and kill lines***: BP identified a risk that the bridging material could become lodged in the *Deepwater Horizon's* BOP choke and kill lines. To mitigate this risk, BP employed an outside engineering firm to test bridging material for its potential to block the choke or kill line during injection.[28] These tests indicated that the material would successfully pass through the choke and kill lines.

- ***Risk of High Pressure Pumping Operations***: The use of high pressure equipment contains risk. This risk was identified and the equipment selected to be used was rated to pressures well above their intended use. These risks are typical to the use of similar equipment used in daily operations throughout the industry. Standard industry practices, for example, ensuring the safe location of workers during pumping operations, bring those risks to known and accepted levels.

Far from "ignoring" the risks as Mr. Perkin's report asserts, BP employed sound engineering practices specifically to identify potential risks of the Top Kill operation and mitigate them. Based on mitigations, the Unified Command was able to safely execute Top Kill such that none of the possible adverse consequences identified and mitigated occurred. With the risks appropriately mitigated, Top Kill provided an opportunity to learn more about the condition of the well and possibly kill it without removing other potential source control options from consideration.

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[26] D. Barnett Tr. at 183 ("I'm trying to recall what -- what we had connected to the choke and kill lines, but I believe there was a way to relieve the pressure through the subsea manifold, if we had to."); C. Holt Tr. at 539, 599-600; M. Patteson Tr. Vol. 2 at 247; Interview with C. Holt; Interview with M. Mazzella; BP-HZN-2179MDL01530769.

[27] M. Patteson Tr. Vol. 2 at 248-249 (explaining risk "was mitigated by the fact that the relief wells pass through the zone and casing was run and cemented prior to the pumping operations beginning"); Interview with C. Holt; Interview with M. Mazzella.

[28] M. Patteson Tr. at 204-205; BP-HZN-2179MDL01513402.

3.4 DEPLOYING COLLECTION EFFORTS MITIGATED ENVIRONMENTAL DAMAGE

As the engineering teams progressed options to cap or kill the Well, the first available options to mitigate the amount of hydrocarbons entering the environment were plans to collect hydrocarbons subsea and bring them to a surface ship able to produce and store them (or otherwise safely dispose of them). At the time of the incident, only one vessel in the Gulf of Mexico, the *Discoverer Enterprise* ("*Enterprise*"), had such processing capacity. Accordingly, it was intended to be used for collection efforts even before it arrived to assist with the Response.[29]

On May 15, the Riser Insertion Tube Tool ("RITT") was inserted into the end of the *Deepwater Horizon* broken riser and began collecting hydrocarbons.[30] The RITT continued to successfully collect hydrocarbons until May 25, when it was removed for the execution of Top Kill.[31]

After the Top Kill efforts concluded, the *Deepwater Horizon* riser that extended from the *Deepwater Horizon*'s LMRP was cut.[32] Remotely operated vehicles ("ROVs") assisted in installing a "Top Hat" collection device. The Top Hat collected oil from the top of the cut riser.[33] Within days, the Top Hat was collecting all the oil that the *Discoverer Enterprise* could process.

Later in the Response, BP collected and processed additional oil using two other vessels -- the *Q4000* and the *Helix Producer 1*. Those two vessels were able to collect oil using part of the apparatus that BP had installed on the sea floor in preparation for Top Kill.[34]

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[29] BP-HZN-2179MDL01448714; T. Allen Tr. at 68-69 (explaining that collection efforts were part of U.S. strategy), 257 ("It was our intent to have capacity and/or redundancy in containment that could proceed simultaneously to any capping and relief wells, so we minimized the impact of oil on the environment.")

[30] Deposition Exhibit 9675 Stipulated Facts Concerning Source Control Events, 10-md-2179-CJB-SS (Rec. Doc. 7076 (Aug. 9, 2012) ("Stipulations") ¶ 69.

[31] Stipulations ¶ 73. The first collection effort to be attempted involved a large pollution dome called the cofferdam. The Unified Command approved the cofferdam procedure on May 5, 2010. Stipulations ¶ 55. As the cofferdam was being moved into place the oil and gas escaping from the end of the riser began to form hydrates on the cofferdam. Hydrates are ice like crystals formed when oil and gas interact with water at certain temperatures and pressures. The formation of hydrates on the cofferdam caused it to become buoyant and prevented its installation. Stipulations ¶ 57.

[32] Stipulations ¶¶ 86, 87, 89-91. The LMRP is the upper half of a BOP stack. It connects to the BOP via a hydraulic connector that is similar to the hydraulic connector used to connect a BOP to a wellhead and contains control pods for the BOP stack.

[33] Stipulations ¶¶ 91-92.

[34] Stipulations ¶¶ 97, 129.

In total, these efforts to collect hydrocarbons resulted in at least 810,000 barrels of oil being collected.[35] These efforts were low-risk and appropriately undertaken.

3.5 BOP-ON-BOP WAS NOT A VIABLE OPTION BEFORE TOP KILL

From the early days of the Response, BP and the Unified Command were developing potential options to cap the well by installing a new well control device on the *Deepwater Horizon* BOP. One of the plans called for building a BOP-like device called a capping stack.[36] An alternative that was developed in parallel with the capping stack was the "BOP-on-BOP" option. The BOP-on-BOP option required removal of the *Deepwater Horizon*'s LMRP to expose the hydraulic connector at the top of the BOP. A different BOP stack would then attempt to latch onto the *Deepwater Horizon* BOP's hydraulic connection.

Mr. Perkin contends that the BOP-on-BOP option could have been fully executed in early-May.[37] My review indicates that a safe and fully considered BOP-on-BOP procedure was not available for execution until after Top Kill was implemented at the end of May 2010.

Mr. Perkin's main contention surrounds a shift in planning for the BOP-on-BOP procedure from the *Enterprise* to the *Development Driller II* ("*DDII*").[38] As noted above, the *Enterprise* was the only vessel in the Gulf of Mexico that could collect hydrocarbons. When an additional vessel, the *DDII*, became available for the BOP-on-BOP option, the planning for the BOP-on-BOP procedure shifted from using the *Enterprise* to using the *DDII*.

The BOP-on-BOP procedure was not ready to be safely implemented with the *Enterprise* at the time of the shift to the *DDII*. Nor did the shift to the *DDII* cause any material delay in the BOP-on- BOP option.[39]

At the time of the shift from the *Enterprise* to the *DDII*, additional engineering work was needed to ensure that the Unified Command could safely and effectively implement the BOP-on-BOP option. One prime example is that at the time of the shift to the *DDII*, no option to vent hydrocarbons to manage pressure existed.[40] This ability was needed to manage pressure in the well, both during the process of shutting the well in with a soft close and after shut in if there were potential well

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[35] Stipulation Mooting BP's Motion for Partial Summary Judgment against the United States, 2:10-md-2179-CJB-SS (Rec. Doc. 8620) (February 19, 2013).

[36] Mr. Perkin asserts that "[b]y April 27, WWCI had provided BP with a BOP-on-BOP remedy for Macondo." Perkin Report at 15. The Wild Well document Mr. Perkin cites is, however, a high level procedure outline for a capping stack that would need to be constructed and does not address a potential BOP-on-BOP solution.

[37] Perkin Report at 17-18.

[38] Perkin Report at 17-18.

[39] J. Wellings Tr. at 447.

[40] J. Wellings Tr. at 166, 323, 441, 488.

integrity issues. And all the necessary tooling was not yet available. For example, the guide frame to safely install another BOP on top of the *Deepwater Horizon* BOP was not available in early May.[41] Additionally, efforts to understand and mitigate potential hydrate formation during installation was underway.[42] Some work that had been undertaken for the BOP-on-BOP option with the *Discoverer Enterprise* had to be revised for the *DDII*, but that progressed in parallel with the ongoing engineering efforts.[43]

Mr. Perkin asserts that pressure could be vented via the BOP choke and kill lines, and presumably, that the choke assembly was not needed.[44] Without substantial modifications, neither the *Deepwater Horizon* BOP's choke and kill lines nor the *Enterprise* BOP's choke and kill lines would have been usable for such a purpose. Upon removal of the *Deepwater Horizon* LMRP, the choke and kill lines on the *Deepwater Horizon* BOP would have failed closed.[45] The standard configuration for the *Enterprise* choke and kill lines would be for them to be connected to the rig for well intervention. It is possible that the lines could have been severed, but there was no plan to do so and no modifications were undertaken. Severing the choke and kill lines would remove the ability to circulate through the *Enterprise* BOP. Furthermore, the planned procedure necessarily called for pumping glycol through the choke and kill lines to prevent hydrates.[46] This hydrate mitigation technique would not be possible under Mr. Perkin's suggested venting option. Mr. Perkin's option would have left open a risk of hydrate formation that could have caused the BOP-on-BOP procedure to fail.

In addition, as of "early May," the Unified Command was still working on a method of cutting the *Deepwater Horizon* riser, and assessing the impact of such a step on the level of oil discharge from the Well. A procedure for riser removal was not approved until May 17.[47] Another necessary step for the BOP-on-BOP procedure would have been removal of the LMRP. The procedure for LMRP removal was not finalized and approved by the Unified Command until May 25th.[48] In addition, Mr. Perkin's claim that the *Enterprise* BOP was ready for use overlooks the fact that as of "early May," there was no approved procedure for use of the *Enterprise* BOP-on-BOP. The

[41] WW-MDL-00004752.

[42] Deposition Exhibit 5370.

[43] J. Wellings Tr. at 446-447 (explaining that the majority of the work to be redone "would not have affected the critical path of actually installing the BOP").

[44] Perkin Report at 17.

[45] The valve systems on the *Deepwater Horizon* BOP stack were not able to be controlled until its control pod had been repaired and reinstalled on the *Deepwater Horizon* LMRP.

[46] BP-HZN-2179MDL02405680.

[47] HCG274-021966.

[48] BP-HZN-2179MDL06497081. The contingency procedure for cutting drill pipe sticking out of the *Deepwater Horizon* BOP after the removal was approved May 27. BP-HZN-2179MDL06482998.

procedure for BOP-on-BOP using the *DDII* was not issued for review until May 27.[49] In the view of the Unified Command, a source control option was not ready until it was approved by the Unified Command.[50]

Mr. Perkin cites two emails from Jim Wellings, a BP engineer who was a leader of the team working on capping options, and testimony from two Transocean employees regarding their belief that the BOP-on-BOP using the *Enterprise* could have been implemented in mid-May. My review leads me to disagree with the views of the Transocean employees based on the ongoing engineering work described above.[51] Mr. Wellings has testified that one of the cited emails is simply erroneous and the other is being misread.[52] It bears noting that the "Peer Assist" that determined BOP-on-BOP to be the preferred capping option on May 15 -- which included different individuals from Transocean -- identified several areas of work still to be done.[53] The engineer who was reporting the results of the peer assist noted, "There is much to be done for the BOP on BOP to be implemented with confidence."[54] That is consistent with my review of the documentation, the testimony of Mr. Wellings, and my experience with subsea operations.[55]

An additional fact that Mr. Perkin's report does not address is that when the riser was cut above the *Deepwater Horizon*'s LMRP and removed, it was discovered that rather than the expected single piece of drill pipe there were two pieces of drill pipe appearing to protrude from the *Deepwater Horizon*'s LMRP. The presence of a single piece of drill pipe in the *Deepwater Horizon*'s stack was one of the risks that had to be addressed for the BOP-on-BOP and the presence of a second piece of drill pipe raised additional risks of substantial adverse consequences from attempting to remove the LMRP. These newly identified risks could have precluded the safe execution of the BOP-on-BOP procedure and, at a minimum, would have required additional work to identify and mitigate risks.

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[49] BP-HZN-2179MDL02405680.

[50] K. Cook. Tr. at 330-331 (explaining that part of procedure preparation was proving to the Unified Command that "the procedures had to be adequately understood, risks mitigated and approval granted so -- they weren't ready until [Unified Command] said they were ready.")

[51] Both Transcocean employees appear to be opining on the timing for installation of a BOP without the ability to vent pressure if necessary.

[52] J. Wellings Tr. at 159-160; 165-166.

[53] The term "Peer Assist" refers to the process used by engineering teams to receive evaluations from individuals insider and outside BP for the identification and mitigation of project's potential risks. Stipulations ¶ 4.

[54] BP-HZN-2179MDL01796033.

[55] Given the activity in the Response, I would expect to see a substantial amount of documentation indicating that a procedure such as BOP-on-BOP was ready to be executed with the *Discoverer Enterprise* in early May if it was, in fact, ready to be executed. I have not seen such documentation and Mr. Perkin only cites a single line in a single email to suggest the contrary.

My review of the testimony and documentary record leads me to conclude that the BOP-on-BOP procedure was not in a state of readiness for execution in early May. The engineering work, analyses, and equipment modification necessary to safely attempt to execute the procedure necessarily was continuing through May.

3.6 TOP KILL DATA INCREASED CONCERNS ABOUT THE INTEGRITY OF THE WELL

As discussed above, one of the ongoing concerns was the integrity of the Well and how that would be impacted by any source control option. Part of the rationale for Top Kill, in addition to potentially killing the Well, was the collection of data that could provide more information about the Well. Once the Top Kill data was collected, BP and U.S. scientists examined it.[56] The interpretation of the data caused the well integrity concerns to be elevated, specifically if the Well was shut in, it could cause oil to exit the wellbore, fracture the shallow formations, and ultimately exit the sea floor.[57] Such an outcome could complicate collection of oil from the reservoir or, worse, could prevent the Well from being killed with any known means and the risk needed to be addressed. As a result of those concerns, the BOP-on-BOP procedure to shut in the Well was not executed and instead efforts focused on collecting as much oil as possible. In light of the risk of broaching and the potential negative impact on collection and kill efforts, I believe that this was a sound decision.

Mr. Perkin is dismissive of these concerns; but he did not engage in any analysis regarding the integrity of the Well. I have reviewed the expert report of Mr. Dan Gibson and believe his analysis used sound and accepted principles. I accept his conclusion that data from Top Kill raised legitimate concerns regarding the integrity of the Well that were also recognized by BP and independently by the Federal Science Team. The review of the data presented a risk of elevated well integrity problems. Even in light of conflicting opinions, I believe that it was appropriate for BP and the Unified Command to consider the elevated risk identified after Top Kill and the potential adverse consequences if the risk was realized in deciding how to move forward with source control options and the lower-risk options to mitigate environmental damage through collection efforts.[58]

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[56] HCG259-005847; LAL098-000104; IES008-088413; LAL097-009708; DSE001-011651 (In a May 30, 2010 e-mail, Secretary Chu, upon his return from Houston where he and his team had monitored the Top Kill Effort, highlighted that "we have been getting the data at the same time as BP engineers, and conducting our own independent analysis of the data so that we can verify the conclusions that BP is making at every step;" "more than 150 personnel from our national laboratories have been contributing to this effort"; and the "decision to move [to a containment strategy] is based both on independent analysis from the federal government and review of BP' s suggested options.")

[57] Deposition Exhibit 9146; T. Hunter Tr. at 202-3.

[58] M. McNutt Tr. at 254 ("It was not a unique interpretation; it was not the only interpretation; it was a plausible interpretation; and as I say, carried such a great risk if it was correct that the -- that was worth taking seriously."); HCG467-000446 (May 29, 2010 e-mail from Carol Browner: "Our scientists have determined that the risks are too great to shut the well in from the top. Eg with the addition of a new BOP."); HGC272-004819 (May 29, 2010 e-mail from

3.7 CAPPING STACK FUNCTIONALITY AND WELL INTEGRITY ASSESSMENT

Days after the *Deepwater Horizon* incident, well control response companies identified the concept of a capping stack as a potential method to secure the Well.[59] In concept, a capping stack consists of either a purpose built or modified BOP stack with multiple blind or blind shear rams.[60] After the *Deepwater Horizon* incident, service companies located capping stacks that had been used in surface operations.[61] However, no one in the industry had constructed a capping stack known to be suitable for use in nearly 5000 ft of water.[62] For example, Wild Well Control considered but did not move forward on construction of a capping stack to control a deepwater blowout in Indonesia in late 2002.[63] Before the *Deepwater Horizon* incident, Wild Well Control determined that each blowout presented unique circumstances and challenges that required event-built equipment.[64] Given the degree of variation in potential blowout scenarios, Wild Well Control had concluded before the incident that pre-fabricated devices were not feasible.[65]

In his Report, Mr. Perkin describes a capping stack as "essentially a smaller version of a BOP Stack."[66] This description ignores significant differences in both the design and functionality between a BOP stack and the three-ram capping stack ultimately used to shut in the Well. On May 29, after heightened concerns about the integrity of the Well post-Top Kill, the Unified Command shifted from efforts to cap or kill the Well to developing the ability to collect the greatest possible amount of hydrocarbons until the Well could be killed via a relief well.[67] To support the Unified Command's directive, the capping stack in development at the time was modified, in addition to its use as a device to shut in the Well, to enhance "off-take" to surface collection vessels or to another reservoir.[68] Additionally, the capping team added pressure measurement equipment to assist in assessing well integrity.[69]

Lieutenant Commander Richard Brannon: "Shutting in the well (BOP on BOP) will likely lead to broaching.")

59 WW-MDL-00015519.

60 Expert Report of Richard Carden, May 10, 2010 ("Carden Expert Report") at 17-21.

61 D. Barnett Tr. at 328.

62 Carden Expert Report at 21-26.

63 D. Barnett Tr. at 155-157. The incident in Indonesia was ultimately resolved using a relief well. D. Barnett Tr. at 332.

64 D. Barnett Tr. at 332-34; Deposition Exhibit 10633.

65 D. Barnett Tr. at 334.

66 Perkin Report at 14.

67 IMT954-013880; Deposition Exhibit 9117; Deposition Exhibit 9118; T. Allen Tr. at 257-259.

68 IMT954-013880; T. Smith Tr. at 165, 263-265, 355-358; H. Banon Tr. at 31-34.

69 T. Smith Tr. at 355-358; BP-HZN-2179MDL01514157-58; BP-HZN-2179MDL05096111-12.

Once the primary focus of the Response shifted to containment, the capping stack containment system differed from the BOP-on-BOP option[70] in several fundamental ways:

- The original capping stack was designed to close in the Well.[71] The modified design provided a sealed system with sufficient off-take points for collection so that all escaping hydrocarbons could be collected by vessels at the surface or flowed to subsea collection areas.[72]

- The three-ram capping stack's outlets were modified from the original design to "fail safe open."[73] This modification was required in the event pressure control was lost. Once the outlets were changed to "fail safe open," the choke and kill lines would then be able to vent any pressure and associated flow to collection facilities.[74] This modification also mitigated the risk of pressure build-up during an inadvertent shut-in.[75]

- Finally, in consultation with Secretary Chu and the Federal Science Team, the capping stack was equipped with pressure monitoring capability.[76] This pressure instrumentation enhanced the Unified Command's ability to assess well integrity during a controlled shut-in.[77]

The above modifications to the three-ram capping stack's design were consistent with the overarching response principles to minimize environmental harm by collecting the greatest amount of hydrocarbons possible and by proceeding expeditiously with a controlled shut-in while maintaining well integrity.

3.8 CUTTING THE RISER IDENTIFIED ADDITIONAL LMRP REMOVAL RISKS

After a blowout, the method of installation of a capping device is determined by (1) the condition of the equipment already on the well, (2) the extent of any damage sustained during the blowout, and (3) the degree of access to the flowing well. While Dr. Bea and Mr. Perkin contend that the Well could have been capped in "a matter of weeks," they fail to consider the potential risks and substantial engineering challenges posed by removing the LMRP of the *Deepwater Horizon* BOP.[78] On June

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[70] Described in Section 3.5.

[71] T. Smith Tr. at 355-358; BP-HZN-2179MDL01514157-58.

[72] T. Smith Tr. at 355-358; BP-HZN-2179MDL01514157-58.

[73] BP-HZN-2179MDL05593215.

[74] T. Smith Tr. at 34.

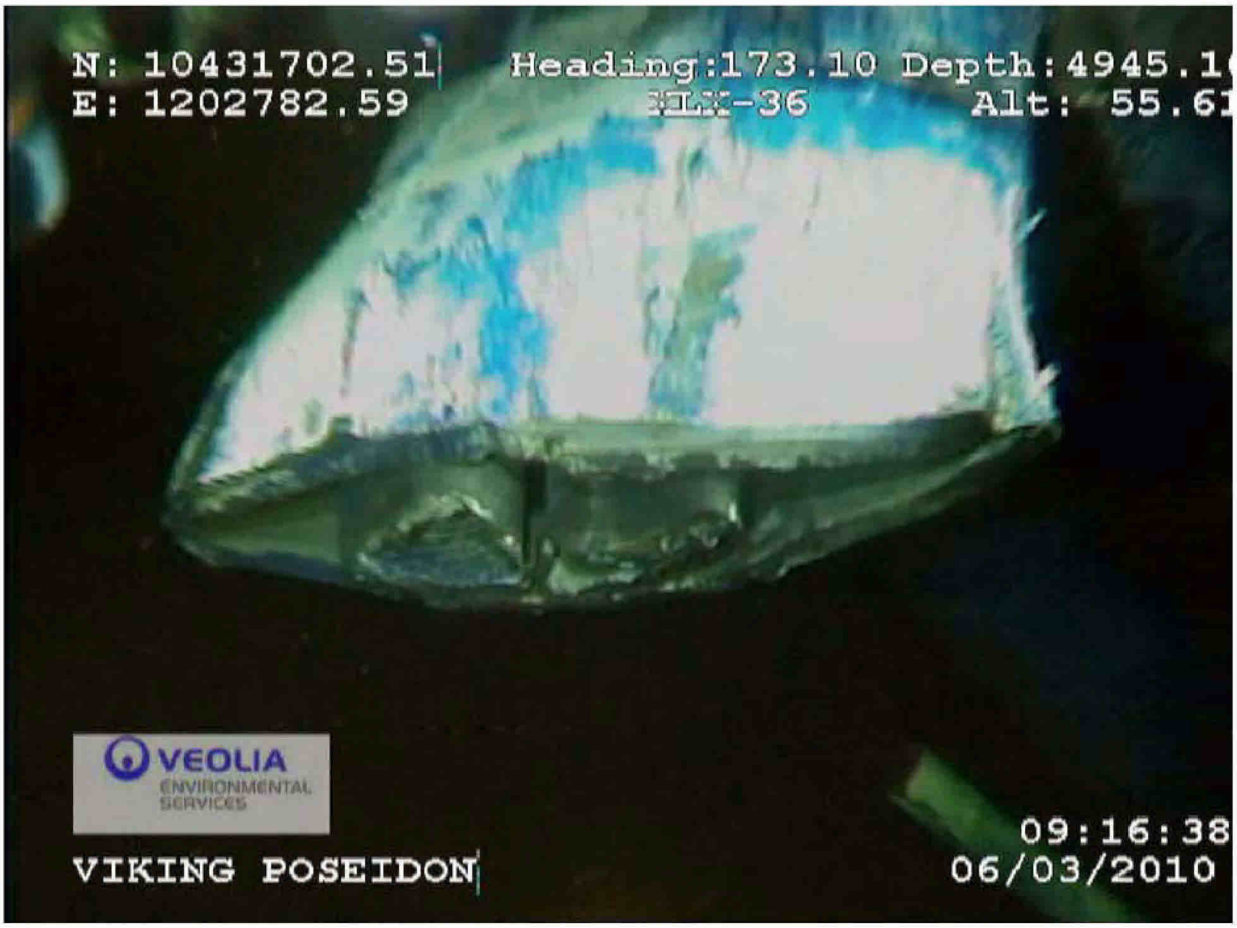
[75] T. Smith Tr. at 34.

[76] BP-HZN-2179MDL05096111-12.

[77] T. Smith Tr. at 355-358; BP-HZN-2179MDL05096111-12

[78] Bea Report at 5-6; Perkin Report at 13.

3, 2010, the riser from the LMRP was cut in preparation for Top Hat collection of hydrocarbons to the *Discoverer Enterprise*.[79] After the riser cut, two pieces of drill pipe extending up from the LMRP were observed by ROVs.[80] The unexpected discovery of the two pieces of drill pipe added new risks to any attempt to pull the LMRP -- the first step required for the initial approach to installing a capping stack, as well as the BOP-on-BOP procedure discussed above in Section 3.5.[81]



ROV Image of Two Pieces of Drill Pipe Inside Cut LMRP Riser (CAM_CIV_0078104)

The presence of two pieces of drill pipe in the LMRP introduced yet another unknown into the system geometry, which posed the following complications:[82]

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[79] Stipulations ¶¶ 90-92.

[80] CAM_CIV0078101-104.

[81] April 27, 2010 E-mail from J. Wellings re Well Control Incident Macondo #1.

[82] R. Lynch Tr. 517-518; T. Smith Tr. at 167-169.

- The risk that the two pieces of drill pipe could wedge, preventing or inhibiting the removal of the LMRP after unlatching. If the LMRP became stuck, it would allow hydrocarbons to escape between the BOP stack and the LMRP. This additional exit point would make further collection efforts difficult and preclude any sealed collection system.

- If the LMRP removal was restricted, erosion could occur on the sealing faces. This would significantly impact the likelihood of obtaining a seal with a BOP or capping stack, or by attempting to re-attach the LMRP.

- The two pieces of drill pipe increased the likelihood of damaging the BOP connector during the removal process, which also could prevent a seal in future containment operations.

- A contingency procedure for the cutting of a single piece of drill pipe had been developed.[83] The presence of a second piece of drill pipe would have impacted the viability of this procedure, particularly if the second piece limited the saw's access.

Based on these additional risks, at worst, the presence of the two pieces of drill pipe in the LMRP riser would have completely precluded any containment options that required removal of the LMRP. At a minimum, the discovery of the two pieces of drill pipe would have required a re-evaluation of the risk (and mitigation if possible) of attempting to pull the LMRP. In light of the risks of LMRP removal it was appropriate to move forward with collection options that did not call for LMRP removal.

[83] BP-HZN-2179MDL05856533-54; BP-HZN-2179MDL06482998.

3.9 ENGINEERING TO LAND THE CAPPING STACK ON THE FLEX JOINT

Considerable challenges faced the capping team beyond the assembly and testing of the base capping stack.[84] These challenges included establishing the structural condition of the existing wellhead and BOP and assessing the impact of adding the additional weight of capping equipment.[85] The challenges also included locating a suitable undamaged connection on which to attach the capping stack.[86] It was also necessary to engineer and to test the transition equipment, and to design hydrate-inhibition mechanisms.[87] Many of the necessary operations for capping stack design and deployment had never been undertaken using ROVs in 5000 ft of water.[88]

Dr. Bea and Mr. Perkin disregard the concerns about removing the LMRP, which in my opinion were valid. Dr. Bea and Mr. Perkin's reports also ignore the substantial engineering work required to land the capping stack on the flex joint.[89]

Even before the riser was cut, there were concerns over removal of the LMRP.[90] The unknown condition and position of the drill pipe within the BOP stack had the potential to inhibit LMRP removal, damage equipment, or keep the LMRP in a partially removed position.[91] Further concerns surrounding LMRP removal included the failure of the LMRP to disconnect after the *Deepwater Horizon* incident (for unknown reasons),[92] whether a sealing gasket would be left on top of the BOP, the potential loss of visibility for the installation team owing to a change in flow stream, an increase in flowrate due to removal of a restriction, and the potential inability to latch back up and obtain a pressure seal on the exposed BOP connector.[93] In light of those concerns, the capping team developed an alternative transition method that

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[84] T. Smith Tr. 355-358.

[85] R. Lynch Tr. at 365-366; T. Smith Tr. at 175.

[86] T. Smith Tr. at 164.

[87] R. Lynch Tr. 363-364; T. Smith Tr. at 355-358; BP-HZN-2179MDL05059166; BP-HZN-2179MDL05905934; BP-HZN-2179MDL07452165; May 31, 2010 E-mail from T. Smith re Flex Joint Connection Options.

[88] Interview with T. Smith.

[89] Bea Report at 2, 5-6; Perkin Report at 7, 15, 28.

[90] BP-HZN-2179MDL01751138-59.

[91] R. Lynch Tr. 517-518; T. Smith Tr. at 167-169. As discussed in Section 3.8 above, those concerns were confirmed when the riser was severed on June 3, 2010.

[92] The LMRP is intended to be released by both the BOP emergency disconnect system (which is initiated on the rig) or the deadman (which is supposed to be triggered by a loss of communication between the BOP and the rig). As the status of those BOP functions were not known at the time, the fact the LMRP had not released raised the possibility that it was being held in place by material inside the stack.

[93] T. Smith Tr. 167-169.

would connect to the flex joint at the top of the *Deepwater Horizon* LMRP.[94] This connection method did not involve LMRP removal, so the team fabricated equipment to engage and seal on top of the flex joint.[95]

Without addressing the many details of each engineering step required to land the capping stack on the flex joint, some of the major requirements for the capping stack ignored in Mr. Perkin and Dr. Bea's Reports are summarized as follows:

- ***Engineer and build transition spool to connect capping stack to flex joint***. After the Top Hat was installed, the uppermost exposed surface above the LMRP was the severed stub of the drilling riser.[96] That surface was not suitable for the installation of the capping stack.[97] Instead, a flange located on top of the flex joint was determined to be capable of supporting the loads imposed by the capping stack.[98] The capping team then engineered, built, and tested a transition spool to make the connection between the capping stack and the flex joint.[99]

- ***Develop procedure to unbolt the flex joint flange from the remaining piece of riser***. The capping team engineered and tested equipment to remove the flex joint bolts and remove the riser stub, leaving a pressure rated flange on which to connect.[100] Adding further complexity to the operation, the unbolting operation had to be conducted in 5000 ft of water using an ROV.[101]

- ***Pressure test transition spool and flex joint***. The flex joint was rated to 5000 psi working pressure.[102] It underwent engineering analysis to determine that the equipment was suitable for use at potential pressures up to 9000 psi.[103] This analysis was necessary to ensure the flex joint could sustain the pressures expected if the Well was shut in.[104]

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[94] The flex joint exists to allow for a range of movement in the drilling riser. It connects the BOP to the drilling unit 5000 ft above as both rig and riser are influenced by the current and weather conditions. May 1, 2010 E-mail from L. McDonald re Transition Spool Option (containing draft design for transition spool for connecting to G-flange above flex joint).

[95] R. Lynch Tr. 363-364; T. Smith Tr. at 355-358.

[96] BP-HZN-2179MDL02730477.

[97] BP-HZN-2179MDL04563046.

[98] R. Lynch Tr. at 365-366; T. Smith Tr. at 164, 175; BP-HZN-2179MDL04563046.

[99] T. Smith Tr. at 358; Stipulations ¶ 104.

[100] R. Lynch Tr. 367-368; T. Smith Tr. at 358; WW-MDL-00051360; May 11, 2010 E-mail from T. Smith re Two Ram Cap HAZID.

[101] T. Smith Tr. 321-322.

[102] May 8, 2010 E-mail from T. Avery re Transition Spool Hydro Test.

[103] T. Smith Tr. at 320-321; May 8, 2010 E-mail from T. Avery re Transition Spool Hydro Test.

[104] T. Smith Tr. at 320-321.

- ***Engineer and build a "mule shoe."*** The capping team identified the possibility that the flange was obstructed by debris and designed a mule shoe to guide the transition spool into the flex joint.[105] After the discovery of two pieces of drill pipe when the riser was cut, and after reviewing the results of testing the initial mule shoe design, the capping team had to re-designed the mule shoe to increase its robustness.[106]

- ***Design, build and test ROV operable equipment to jack the flex joint to an acceptable angle and restrict its further movement***. When the rig sunk, the *Deepwater Horizon* riser which connects the rig to the flex joint pulled the flex joint to its maximum deflection, that is, it was flexed to its limit in one direction.[107] If subjected to the weight of the capping stack and maximum anticipated wellhead pressure while at this angle, the flex joint would have exceeded its safe working limits.[108] The capping team determined that, under the maximum expected load cases, the flex joint angle had to be reduced to two degrees.[109] To achieve the necessary reduction in angle, the capping team developed a jacking system and a procedure to jack the flex joint to an acceptable angle.[110] To allow for capping stack installation, the flex joint was jacked to a final angle of two degrees.[111]

- ***Design, build and test blocks to physically restrain flex joint movement***. Blocks were also developed and tested to ensure the flex joint angle would be maintained, which was an essential element of system integrity.[112]

The capping team accomplished many engineering firsts in record time when they fabricated, tested, and developed the procedures associated with the installation of the capping stack described above.[113] The Federal Science Team was fully engaged in the connection design process and participated in review and analysis of the transition options.[114]

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105 May 12, 2010 E-mail from T. Smith re Isolation Valve Readiness.

106 BP-HZN-2179MDL07452165.

107 R. Lynch Tr. 365-366; BP-HZN-2179MDL04563046.

108 R. Lynch Tr. 365-366; T. Smith Tr. at 358-359.

109 BP-HZN-2179MDL05703395.

110 BP-HZN-2179MDL05703395.

111 BP-HZN-2179MDL07459741; BP-HZN-2179MDL05864511.

112 BP-HZN-2179MDL07462764; BP-HZN-2179MDL05036764; BP-HZN-2179MDL05057726.

113 R. Lynch Tr. 201, 206.

114 BP-HZN-2179MDL01468660-76; BP-HZN-2179MDL05088072-75; BP-HZN2179MDL01513979-4000; BP-HZN-2179MDL04563046.

3.10 SHUTTING IN THE WELL WITH THE CAPPING STACK

To address the continuing concerns about well integrity, a team designed a "Well Integrity Test" procedure to be implemented when the capping stack was landed on top of the *Deepwater Horizon* BOP.[115] The Unified Command gave the final approval for a well integrity test on July 11-12.[116] As detailed in the procedure, the well was closed in on July 15, 2010 with substantial monitoring via seismic vessels for changes in the subsurface geology as well as visual monitoring of the seafloor by ROVs to ensure the well should remain sealed.[117] Following a period of close monitoring to ensure that pressures were stable, a static well kill (pumping mud through the choke and kill manifold to kill the Well and prepare it for cementing) was conducted and the cement plug was set.[118] The Well was determined to be sealed based on the ambient pressure test conducted August 19-21, 2010.[119] On September 16, 2010 the relief well intersected the Well and it was cemented the next day.[120] On September 19, 2010, the National Incident Commander declared the Well dead.[121]

3.11 TIMELINE FOR HYPOTHETICAL PRE-BUILT CAPPING STACK

Both Dr. Bea and Mr. Perkin suggest that the Well could have been capped within three weeks if BP had access to a pre-fabricated capping stack on April 20, 2010.[122] That claim is not supported by the evidence, and I disagree with it.

Admiral Thad Allen, the National Incident Commander, has testified that it was impossible to estimate how long it would have taken to cap the well even if there was a pre-built capping stack.[123] As Admiral Allen explained, there were "too many variables" impacting the potential capping timeline using a pre-built stack.[124] I agree with Admiral Allen's assessment for the following reasons:[125]

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[115] Stipulations ¶ 124.

[116] Stipulations ¶¶ 125-126, 130-131, 137-138.

[117] Stipulations ¶¶ 137-138, 140-141.

[118] Stipulations ¶¶ 150-151.

[119] Stipulations ¶ 157.

[120] Stipulations ¶¶ 163-164.

[121] Stipulations ¶ 165.

[122] Bea Report at 5-6; Perkin Report at 13.

[123] T. Allen Tr. at 60-61.

[124] T. Allen Tr. at 60-61.

[125] An additional unknown in the capping timeline is approval from the Unified Command. Admiral Kevin Cook testified that during the Response, BP believed the capping stack was ready from an equipment standpoint, but the Unified Command had not yet approved the procedure to allow Government scientists additional time for further analysis. Cook Tr. at 328-329. The capping stack was not ready to shut-in the Well until the Unified Command issued its final approval. Cook Tr. at 330-331.

- ***Well Integrity Concerns***: Pat Campbell, the CEO of Wild Well Control, testified that in mid-May 2010, there were too many unknowns about the Macondo wellbore geometry and potential damage sustained during the incident to shut-in the Well using a capping device.[126] Mr. Campbell explained that when downhole conditions are unknown, his company frequently avoids attempting to shut in a well because the risk to well integrity is too great.[127] If a procedure caused hydrocarbons to broach to the seafloor, it would make the situation worse.[128] In Mr. Campbell's view, there was no reason to cap the Well if it was possible to efficiently collect hydrocarbons until well integrity was established.[129]

- ***Connection at the Flex Joint***: The traditional method of connecting two pieces of subsea equipment uses hydraulic connectors like the one at the top of the *Deepwater Horizon* BOP. To use that approach, the installation of a capping stack would have required removal of the LMRP, which rightly did not occur in the Response.[130] Accordingly, even if we suppose that such a capping stack (i.e., one to be landed on the *Deepwater Horizon* BOP following LMRP removal) existed prior to the incident, it would not have had the ability to connect to the flex joint. Up until the time the two pieces of drill pipe were exposed when the riser was cut, it was impossible to determine the condition of the drill pipe and confirm the significant risks posed by removal of the LMRP. With a pre-built capping stack designed to use a hydraulic connection, there would be no reason to anticipate the possibility of landing the capping stack on the flex joint until the riser had been cut. As discussed in Section 3.9, substantial engineering work went into the design of the transition spool and associated procedures required to land the capping stack on the flex joint, including several modifications after the discovery of the two pieces of drill pipe in the riser. Even in a hypothetical scenario where a pre-fabricated capping stack existed, the engineering work required to connect to the flex joint would not have been anticipated until the riser was cut and the presence of the two pieces of drill pipe in the riser was revealed.[131] Mr. Perkin and Dr. Bea ignore this.

- ***Design of Capping Stack Used***: Dr. Bea and Mr. Perkin also do not describe the design of a capping stack that they believe should have been pre-fabricated before April 20, 2010. The design of this hypothetical capping stack has significant implications for the capping timeline. During the response, the capping team originally designed a two-ram stack, later adding a third ram for

[126] Campbell Tr. Vol. II at 22-23, 31; Ex. 3922.

[127] Campbell Tr. Vol. II at 31-32.

[128] Campbell Tr. Vol. II at 187.

[129] Campbell Tr. Vol. II at 31; Ex. 3922.

[130] April 27, 2010 E-mail from J. Wellings re Well Control Incident Macondo #1.

[131] In fact, nearly all post-Macondo capping stacks are designed to use a hydraulic connector rather than land on the flex joint. Interview with T. Smith.

redundancy as well as several other possible options, each with their own set of benefits and risks.[132] Currently, significant differences exist among the pre-fabricated capping stacks that were developed post-Macondo.[133] Post-Macondo stacks are all heavier than the three-ram capping stack used to shut-in the Macondo well.[134] The additional weight would have to have been considered and may have required further engineering modifications to jack the flex joint to an acceptable angle and straighten and strengthen the connection point, as described in Section 3.9.

- ***Post-Macondo Capping Timelines Not Applicable***: Dr. Bea and Mr. Perkin cite several post-Macondo capping timelines to support their suggested timeframe. However, the documents they cite are not applicable to conditions at Macondo for the following reasons:
  - Exhibit 9564: In this document, Richard Harland and Trevor Smith attempt to provide input to Marine Well Containment System ("MWCS"),[135] regarding the potential time frame required to cap a well.

    The document includes several caveats, notably:
    - The MWCS capping scenario contemplated in Exhibit 9564 includes seventeen assumptions:
      - All equipment for suggested response is ready and can be connected at a known interface without further modifications or changes;
      - BOP has integrity and is stable;
      - Flow is as a result of a failure in the BOP system;
      - No broaches have occurred;
      - No weather impact;
      - No VOC impact;
      - Dispersant is applied early to ensure access to the site and control of VOC's;

[132] R. Lynch Tr. at 361, 364-365, 524. BP-HZN-2179MDL01514140; CAM_CIV_0302527; TRN-MDL-02487634; TRN-MDL-07223447.

[133] Interview with T. Smith.

[134] Interview with T. Smith.

[135] MWCC is an independent, not for profit company that provides well containment equipment and technology in the Gulf of Mexico, including the MWCS.

- Construction and drilling vessels are available to respond immediately;
- Marine barges, tankers and hoses are readily available;
- Soil conditions allow for pile placement for recovery systems;
- Minimal downtime due to unforeseen events form a build/equipment/install perspective;
- Removal of the BOP is not catered for;
- Process systems of vessels require minimal modification or change;
- Debris impact is low/minimal;
- Immediate response is to prepare for installation of a capping stack with a parallel activity to install a free standing riser;
- Metocean conditions are not an issue; and
- Final hook up, installation and test of flexible for recovery system takes place after completing closure device (capping stack) installation.

▪ As Richard Harland (whose deposition was taken at the request of the Plaintiffs' Steering Committee) explained in a email about capping timelines for the MWCS: "It is very difficult to envisage all the scenarios and complications likely to take place plus the situation may be very different from that which has been surmised by MWCS."

▪ Trevor Smith (who was deposed in his individual capacity and as a corporate representative): "As discussed, given the number of assumptions associated with the estimate, my concern is that the estimated total durations are of the order of P10 probability or perhaps even more optimistic and could be taken out of context or misunderstood as things stand."

o The additional documents cited by Dr. Bea and Mr. Perkin, Exhibits 9345, 5359, and 5059 were all created post-Macondo and incorporate all technological advancements and lessons learned in the course of the Response. Based on the number of significant "engineering firsts" achieved during the Response that are described throughout my report, it is not realistic to compare post-Macondo scenarios to what might have been developed before the incident.

- Finally, as David Barnett of Wild Well Control testified, each deepwater blowout scenario is unique and presents its own set of challenges, frequently requiring custom-built equipment.[136] Mr. Barnett explained that in a deepwater intervention "the scenarios are so varied, and the small changes from one scenario to the other makes certain things applicable here, completely unapplicable over here."[137]

Based on my review of the record, my training and education as an engineer, and over 30 years of subsea engineering experience, I therefore do not find credible the estimates by Mr. Perkin and Dr. Bea.

[136] D. Barnett Tr. at 334.

[137] D. Barnett Tr. at 334.

3.12 ROV PUMP RATES ARE IRRELEVANT TO THIS REPONSE

Mr. Perkin discusses at length the limitations of ROV pumps in closing BOP rams. However, the initial ROV efforts involved cutting the autoshear trigger pin. Cutting the autoshear trigger pin triggered the accumulators on the BOP stack to close the blind shear ram. That was not dependent on ROV pumping capacities. It is my understanding that there has been broad agreement that when the blind shear ram attempted to close, the drill pipe in the BOP was off-center and thus in a position that it was outside the cutting surface of the blind shear ram. I have no opinion as to what caused that or when it occurred.[138] If the location of the drill pipe prevented the blind shear ram from shutting in the Well, the pumping capacities of ROVs or availability of accumulators would be irrelevant. Given that the BOP had not sealed, and that the location of the drill pipe inside the BOP was unknown, it was appropriate to use the available resources, namely ROVs and subsea accumulators, to attempt to function the BOP. Even if the location of the drill pipe had been conjectured to preclude shutting in the Well, it was still reasonable to use ROVs and accumulators to engage as many barriers within the BOP as possible to reduce flow from the Well, regardless of whether it would completely prevent flow.

[138] Transcript of Nonjury Trial Before the Honorable Carl J. Barbier at 3330 (March 12, 2013).

3.13 CONCLUSION

The opinions that I have expressed in this report are based on my education, training, and experience, and my review of materials in connection with this litigation. I hold these opinions to a reasonable degree of engineering certainty. While I have done my best to review materials in this matter as they have become available, I reserve the right to supplement my opinions based on my review of additional information or reports.

For my services in this matter, I am being compensated at my customary hourly rate of 400 GBP per hour. My compensation does not depend in any way on the outcome of this litigation or the conclusions that I reached.

Prepared by:	Iain Adams	Date
Signed	Iain Adams	May 10, 2013

APPENDIX A: MATERIALS REVIEWED

I have reviewed and/or relied on the materials listed in Appendix A, attached to my Report. In addition, I had access to all MDL depositions and exhibits and all requested information was made available to me.

APPENDIX B: RESUME

NAME:	Iain Adams
NATIONALITY:	British
DATE OF BIRTH:	04.10.59
EDUCATIONAL QUALIFICATION:	BSc Engineering Aberdeen University
FUNCTION:	Project Manager/ Norwell Managing Director

WORK EXPERIENCE:

1995 - present

Norwell

Project Manager/Well Examiner/Technical Advisor

Provided Technical advice and overview as required to Bank of Scotland, BHP, Wintershall, EON, Petronas, Taqa, Cadogan, Regal, Tiway, Helix, Ithica, Talisman various insurers, legal firms and lending institutions

ONGC

Project Manager

Responsible for multi rig ultra deepwater exploration project in ultra deepwater offshore India and multi well HPHT exploration programme

Sterling Resources, Dana, SOCO,

Project Manager

Responsible for delivery of managed projects in Romania, Morocco, Congo and North Sea

Nippon.

Project Manager

Responsible for delivery of semi submersible HPHT exploration well in North Sea.

TNK – BP - Russia

Project Manager

Responsible for delivery of 2 year multi rig sidetrack optimisation programmes with teams in Nizhnevartovsk and Buzuluk.

Ferrexpo – Ukraine

Project Manager

Responsible for delivery of multiwell exploration development drilling programme

Caithness – UK and Morocco

Project Manager

Well Engineering, planning and operational management of UK and Moroccan drilling programme.

Ascent Resources

Project Manager

Well Engineering and management of onshore programme in Italy, Hungary and Spain.

Statoil, CNR, Venture Production, Tuscan Energy

Supervised well engineering and design of extended reach platform and jack-up wells in UKCS.

Lundin

Project Manager for the Oudna subsea development offshore Tunisia

CNR

Drilling Manager

Engineering, procurement and operational planning for ongoing deepwater exploration programme offshore Angola. Managed Subsea field abandonment of Kiame field.

Talisman Energy

Drilling Superintendent

Engineering and supervising offshore drilling operations of Rowan Gorilla 7.

Nimir, Tunisia

Project Manager

Supporting offshore drilling operations.

Ranger Oil

Drilling Manager

Well engineering and planning deepwater drilling programme for ongoing exploration programme offshore Ivory Coast.

Kerr McGee

Drilling Superintendent

Engineering and supervising multiwell exploration drilling programme offshore UK

Ranger Oil Angola

Drilling Manager

Engineering and Supervising Offshore Drilling Operations

Ranger Oil (UK) Ltd

Drilling Superintendent

Supervision of extended well test project on Pierce field.

Engineering and Operations Management of Selkirk HP/HT, Anglia Horizontal and Kyle Salt Diapir Wells

Oilfields Ltd - Israel

Consultant Drilling Superintendent

Supervising operations for one exploration well onshore Israel.

1994 - 1995 **Samedan - Tunisia**

Consultant Drilling Superintendent

Supervising drilling operations offshore Tunisia.

1993 - 1994 **Huffco Brantas - Indonesia**

Consultant Drilling Superintendent / Supervisor

Drilling HP/HT exploration wells onshore East Java and in 1500' of water offshore Bali.

1993	**Samedan and Sovereign Oil and Gas - Tunisia** Consultant Drilling Superintendent / Supervisor Drilled one exploration well and a deepwater development well in the Tazerka field for Samedan and one exploration well for Sovereign.
1991 - 1992	**Lasmo** Consultant Drilling Superintendent / Supervisor Drilling exploration wells in the Southern North Sea. Worked-over and completed subsea wells on the Staffa field, de-suspended and tested wells offshore Holland.
1990 - 1991	**Sovereign Oil and Gas** Consultant Drilling Superintendent / Supervisor Drilled, tested and completed 11 subsea wells. Wells of 60° average angle increasing to horizontal across the reservoir section.
1989	**Ranger Oil - UK** Consultant Drilling Supervisor Drilled one exploration well.
1988 - 1989	**BP/Britoil** Consultant Operations Engineer Specified completion equipment, wrote workover and completion programmes. Onsite well test supervisor.
1979 - 1988	**Chevron** Drilling Supervisor/Engineer Holland Drilling Engineer / Supervisor Set up office, prepared programmes and supervised workovers onshore Holland. California and Alaska Drilling Supervisor / Engineer

Drilling directional production wells in the Santa Barbara Channel and onshore Bakersfield and Rio Vista Preparing programmes for recent Gulf Oil Co acquisition. Planned wells and supervised operations in the Beluga River gas field in Alaska.

UK and Denmark/Spain

Drilling Supervisor

Drilling, completing and working over wells in the Ninian Field. Drilling Exploration wells in Denmark, the North Sea & S.W. approaches to the English Channel and delineation wells on Alba Field. Deepwater exploration drilling (2500`) in Spain.

Louisiana

Training assignment/Drilling Supervisor

Trained on gas wells in the Gulf of Mexico, progressed onto high pressure gas condensate wells with vertical depths in excess of 20,000'.

AREAS WORKED: Denmark, Angola, Congo, Indonesia, Israel, Spain, Tunisia, UK, Ivory Coast, Holland, USA, Russia, Ukraine and Romania.

Appendix A: Iain Adams Materials Reviewed

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