

## Endnotes

### Chapter 1

<sup>1</sup> Executive Order No. 13543, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 75 Fed. Reg. 29,397, May 21, 2010.

<sup>2</sup> *Ibid.*

<sup>3</sup> Press Release, National Commission, Fred Bartlit Named Chief Counsel, July 22, 2010.

### Chapter 3

<sup>1</sup> Internal Department of Interior document (OSC-DWH BOEM-WDC-Bo1-00002-00004).

<sup>2</sup> Internal BP document (BP-HZN-MBI 13494).

<sup>3</sup> David Sims (BP), interview with Commission staff, December 14, 2010.

<sup>4</sup> Internal BP document (BP-HZN-MBI 13494).

<sup>5</sup> U.S. Geological Survey official, interview with Commission staff, October 21, 2010.

<sup>6</sup> Internal BP document (BP-HZN-OSC 4259).

<sup>7</sup> Internal BP document (BP-HZN-OSC 4663).

<sup>8</sup> Testimony of Paul Johnson (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 352. However, some forms of maintenance, including BOP maintenance, were exempt from this provision. Internal BP document (BP-HZN-MBI 4254).

<sup>9</sup> Testimony of David Sims (BP), Testimony of before the Deepwater Horizon Joint Investigation Team, August 26, 2010, 191; Internal BP document (BP-HZN-MBI 126763).

<sup>10</sup> Nonpublic BP document (presentation to the Commission, August 9, 2010), 6.

<sup>11</sup> CNN Money, “Global 500,” *Fortune*, July 11, 2010.

<sup>12</sup> *Ibid.*

<sup>13</sup> Eduard Gismatullin, “BP Makes ‘Giant’ Oil Discovery in Gulf of Mexico.” *Bloomberg*, September 2, 2009.

<sup>14</sup> Internal BP document (BP-HZN-OSC 7093).

<sup>15</sup> Internal BP document (BP-HZN-BLY 47279).

<sup>16</sup> Internal BP document (BP-HZN-MBI 100315).

<sup>17</sup> Testimony of David Sims, 123.

<sup>18</sup> Internal BP document (BP-HZN-MBI 190507).

<sup>19</sup> Testimony of David Sims, 123.

<sup>20</sup> Internal BP document (BP-HZN-MBI 190507).

<sup>21</sup> Sims, interview.

<sup>22</sup> Internal BP document (BP-HZN-MBI 190507).

<sup>23</sup> Internal Transocean document (TRN-HCJ 93526).

<sup>24</sup> Testimony of Brett Coteles (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 11.

<sup>25</sup> Internal BP document (BP-HZN-MBI 177777).

<sup>26</sup> *Ibid.*

<sup>27</sup> Transocean, "Our Company," accessed November 17, 2010, <http://www.deepwater.com/fw/main/Our-Company-2.html>.

<sup>28</sup> Internal Transocean document (TRN-USCG-MMS 30428).

## Chapter 4.1

<sup>1</sup> Such evidence includes, but is not limited to, the following: pressure and fluid data from BP's September 16, 2010 *Development Driller III* relief well intersection of the Macondo well, ongoing analysis of cement "rocks" found on the *Damon Bankston* after the blowout, and information on the internal and external pressure testing of the connections used in the Macondo well.

<sup>2</sup> BP and Halliburton agree that cement in the annulus did not isolate the hydrocarbon-bearing zones. Transocean has so far deferred to BP and Halliburton on this issue. Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 196-97, 326, 328-29; Testimony of Richard Vargo (Halliburton), Hearing before the National Commission, November 8, 2010, 196-97, 326, 328-29; Testimony of Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 196-97, 326, 328-29; BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 54.

<sup>3</sup> Internal BP document (BP-HZN-MBI 138868).

<sup>4</sup> Steve Lewis (Expert witness), interview with Commission staff, September 15, 2010.

<sup>5</sup> John Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252* (July 1, 2010), 20; Testimony of Richard Vargo, 271; BP, *Deepwater Horizon Accident Investigation Report*, app. M, 3, 15-19.

<sup>6</sup> BP, *Deepwater Horizon Accident Investigation Report*, 38.

<sup>7</sup> *Ibid.*, 74; Confidential industry expert, interview with Commission staff.

<sup>8</sup> Confidential industry expert, interview.

<sup>9</sup> Testimony of Mark Hafle (BP), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 77; Confidential source, interview with Commission staff.

<sup>10</sup> John Smith (Expert witness), interview with Commission staff, September 17, 2010. Of 34 loss of well control incidents in offshore wells in U.S. federal waters from 1992 to 2002, 19 (56%) were caused by annular flows associated with the cementing process. American Petroleum Institute, *Recommended Practice 65, Part 2: Isolating Potential Flow Zones During Well Construction* (May 2010), 57 ("API RP 65 part 2"). The API has identified annular flow as a "common problem" with "grave consequences." *Ibid.*, 48. Indeed, on August 16, 2000, MMS presented safety concerns on uncontrolled annular flows to a new API Work Group on Annular Flow Prevention and Remediation. In response, the group developed two recommended practices to document industry best practices to improve zonal isolation, and help prevent annular flow incidents prior to, during, and after cementing operations, to mitigate and prevent annular flows. *Ibid.*

<sup>11</sup> John Martinez, William McDonald and C. Ray Williams, *Study of Cementing Practices Applied to the Shallow Casing in Offshore Wells* (October 1980), ii.

<sup>12</sup> For example, in the August 21, 2009 blowout at the Montara wellhead platform, hydrocarbons entered through the cemented casing shoe. David Borthwick, *Report of the Montara Commission of Inquiry* (The Montara Commission of Inquiry, Australia, June 2010), 6-7. The May 19, 2010 loss of well control incident at Gullfaks C involved a hole in the 13<sup>3</sup>/<sub>8</sub>-inch casing. Statoil, *Gullfaks C Report* (April 11, 2010), 6. Similarly, a BP injection well in Azerbaijan sustained a leak in its tubing as a result of debris in the seal of a connection; the leaking connection had been made up improperly. Steve Morey (BP), interview with Commission staff, December 23, 2010.

<sup>13</sup> John Guide (BP), interview with Commission staff, September 17, 2010; David McWhorter (Cameron), interview with Commission staff, August 10, 2010; Doug Blankenship (DOE), interview with Commission staff, October 26, 2010; Testimony of Richard Vargo, 274-75; Internal BP document (BP-HZN-CEC 18892). Some of the containment operations were designed with annular flow as a starting assumption. Stephen Wilson, *Macondo Radius of Failed Zone at Intercept Depth* (June 22, 2010). Indeed, BP used OLGA well flow modeling to model the flow rates for both scenarios (flow up the production casing and flow in the annulus around the production casing). Internal BP document (BP-HZN-BLY 48212).

<sup>14</sup> Confidential industry expert, interview; Confidential source, interview.

<sup>15</sup> BP, *Deepwater Horizon Accident Investigation Report*, 68-69.

<sup>16</sup> Testimony of Bill Ambrose, 185-86.

<sup>17</sup> Testimony of Richard Vargo, 187-94, 266, 270. Halliburton has declined to provide any documentation or written explanation of its theory of annular flow.

<sup>18</sup> Tommy Roth (Halliburton), interview with Commission staff, August 17, 2010; Testimony of Richard Vargo, 187-94, 266, 270.

<sup>19</sup> The Chief Counsel's team takes the three companies' conclusions with a healthy grain of salt. BP and Halliburton in particular each advance flow path explanations that happen to coincide with their own financial and litigation interests. Nevertheless, the companies' explanations and evidence in support of their theories have been helpful to the Chief Counsel's team's analysis.

<sup>20</sup> BP conducted several well interventions after the April 20 blowout and before the October forensic operations. These included the August static kill and the September bottom kill, where BP pumped mud and cement into the Macondo well. These operations could have affected the condition of the Macondo well annulus.

<sup>21</sup> Erosion is expected in light of the force and speed of hydrocarbon flow during the blowout. Testimony of Bill Ambrose, 244.

<sup>22</sup> Trace amounts of hydrocarbons in the annulus might be expected even where flow went through the shoe track and up the production casing, if the annular mud had been exposed to the formation and stray hydrocarbons displaced some of the mud in the annulus during flow. Blankenship, interview; David Trocquet (MMS), interview with Commission staff, October 1, 2010. Alternatively, it is possible that the annular mud was never exposed to the formation or hydrocarbon flow if, for example, the cap cement remained intact as a barrier. BP legal team, interview with Commission staff, January 12, 2011.

<sup>23</sup> Internal BP document (BP-HZN-NAE 2412).

<sup>24</sup> The BP report estimates the density of hydrocarbons as 5.18 ppg at 239 degrees Fahrenheit at 12,000 psi. BP, *Deepwater Horizon Accident Investigation Report*, app. G, 215.

<sup>25</sup> Internal BP document (BP-HZN-NAE 2412).

<sup>26</sup> This flow-out occurs because the gas compresses until the pressures balance. If the annulus is full of liquid and able to withstand the increased hydrostatic pressure of the fluid inside the production casing, there would be no flow. Steve Lewis (Expert witness), email to Commission staff, December 28, 2010.

<sup>27</sup> Internal BP document (BP-HZN-NAE 2412).

<sup>28</sup> Blankenship, interview.

<sup>29</sup> BP, *Deepwater Horizon Accident Investigation Report*, 56.

<sup>30</sup> Internal BP document (BP-HZN-NAE 2412).

<sup>31</sup> Blankenship, interview.

<sup>32</sup> Internal BP document (BP-HZN-NAE 2419).

<sup>33</sup> Internal BP document (BP-HZN-NAE 2426).

<sup>34</sup> *Ibid.*

<sup>35</sup> *Ibid.*

<sup>36</sup> Internal BP document (BP-HZN-NAE 2436).

<sup>37</sup> Doug Blankenship, interview. For the sake of completeness, it is worth noting that on September 22, 2010, BP had Schlumberger perform an acoustic log of the fluid in the annulus of the Macondo well from the wellhead to 9,318 feet using an isolation scanner. The results suggested there was lighter density fluid in the annulus outside of the 9<sup>7</sup>/<sub>8</sub>-inch production casing. Internal BP document (BP-HZN-NAE 2406). Given that the results of the perforation test and the sampling do not support the presence of hydrocarbons, it is likely that the log (which is an indirect measurement of annular fluid density) was erroneous.

<sup>38</sup> Testimony of John Sprague (BP), Hearing before the Deepwater Horizon Joint Investigation Team, December 8, 2010, part 2, 91.

<sup>39</sup> Testimony of Bill Ambrose, 244 “[The flow in t]his particular case, just to put it in perspective, was a 550-ton freight train hitting the rig floor. Things happened very quickly, and then it was followed by what we estimate to be a jet engine’s worth of gas coming out of the rotary.” *Ibid.*

<sup>40</sup> Internal BP document (BP-HZN-NAE 2438).

<sup>41</sup> Dril-Quip representatives, interview with Commission staff, October 27, 2010.

<sup>42</sup> *Ibid.*

<sup>43</sup> *Ibid.* The flow passages are approximately 1 inch in diameter. Given that diameter, the total area for flow coming through the 18 flow passages absent erosion would have been only 14 square inches. *Ibid.*

<sup>44</sup> Dril-Quip legal team, email to Commission staff, November 2, 2010.

<sup>45</sup> Blankenship, interview; Dril-Quip representatives, interview.

<sup>46</sup> Nonpublic BP document (presentation to Commission staff on flow rate estimates, October 22, 2010), 16; Nonpublic BP document (presentation to Commission staff on BOP, September 8, 2010), 7; Blankenship, interview; Internal BP document (BP-HZN-NAE 2432-35).

<sup>47</sup> Dril-Quip representatives, interview.

<sup>48</sup> Blankenship, interview; Dril-Quip representatives, interview. Dril-Quip has made representations to the Commission staff that the evidence is “conclusive.” Dril-Quip representatives, interview.

<sup>49</sup> Dril-Quip representatives, interview. “It looks pretty good.” Testimony of Richard Vargo, 273.

<sup>50</sup> Dril-Quip representatives, interview.

<sup>51</sup> *Ibid.*

<sup>52</sup> Internal BP document (BP-HZN-NAE 2388); Testimony of John Sprague, 89.

<sup>53</sup> Internal BP document (BP-HZN-NAE 2388); Testimony of John Sprague, 89. “The hanger was properly landed and the seal assembly was in the place it was supposed to be in.” *Ibid.*

<sup>54</sup> Dril-Quip representatives, interview; Merrick Kelley (BP), interview with Commission staff, October 22, 2010.

<sup>55</sup> Kelley, interview.

<sup>56</sup> Internal BP document (BP-HZN-NAE 2392). “TEST 9 7/8” PRODUCTION CASING, WELHEAD CONNECTOR & UPPER BSR. WITH 13.2 PPG SOBM. TEST TO 250 PSI LOW FOR 5 MINUTES STRAIGHT LINE ON CHART & 4,100 PSI FOR 30 MINUTES STRAIGHT LINE ON CHART. PRESSURE UP DOWN KILL LINE @ ½ BPM. TOTAL BBLs PUMPED 6, ISIP 4,270 PSI, FINAL SIP 4,158 AFTER 30 MINUTES. BLED OFF PRESSURE. RECOVERED 5.25 BBLs. TEST LOWER BSR TO 250 PSI LOW & 4,100 PSI HIGH FOR 5 MINUTES EACH STRAIGHT LINE ON CHART.” *Ibid.*

<sup>57</sup> Benjamin Powell (BP legal team), letter to Commission staff, November 1, 2010, 2; Testimony of John Sprague, 90. “Prior to running the lockdown sleeve, we actually tested the seal assembly and hanger to 1000 PSI and got a good test, which indicated to us that the seals were intact.” Testimony of John Sprague, 90.

<sup>58</sup> Internal BP document (BP-HZN-NAE 2398).

<sup>59</sup> Testimony of John Sprague, 90. “We ran the lockdown sleeve, set it, pressure tested it, I think, to 5400 PSI, which meant both the lockdown sleeve and the seal assembly and the hanger had integrity.” *Ibid.*

<sup>60</sup> Powell, letter.

<sup>61</sup> Donald Godwin (Halliburton), letter to Commission staff, December 9, 2010, 1.

<sup>62</sup> *Ibid.* Halliburton references the relevant time frame as 00:22 to 00:36. *Ibid.* These timestamps are mere reference points on the chart contained in Halliburton’s post-cement-job report, not the actual times of the relevant events during the cement job. Lewis, email, December 28, 2010; Internal Halliburton document (HAL\_28543). “Graph created from Sperry’s data, time of events are not correct.” Internal Halliburton document (HAL\_28543).

<sup>63</sup> Steve Lewis (Expert witness), email to Commission staff, December 12, 2010. “Well bore geometry, when related to a finite element hydrostatic balance calculation reveals a sequence of changing pressure balance over the last eighty one minutes of the displacement which parallels the trend and approximates the magnitude pump pressure response during this period.... A mathematic analysis of the hydrostatic balance of

the MC-252#1 cement displacement produces results which move in concert with the observed surface pressure.” *Ibid.*

<sup>64</sup> *Ibid.*

<sup>65</sup> Internal Halliburton document (HAL\_11005). The model’s predicted numerical pressures do not appear to match precisely with the observed data. This may be due to the predictive nature of the model or imprecise inputs. Testimony of John Gisclair (Halliburton), Hearing before the National Academy of Engineering, September 26, 2010, 40. But the model does predict the general downward trend observed.

<sup>66</sup> Internal BP document (BP-HZN-MBI 129053)(“Just wanted to let everyone know the cement job went well. Pressures stayed low, but we had full returns the entire job, saw 80 psi lift pressure and landed out right on the calculated volume.”); Internal Halliburton document (HAL\_28538)(“Cement job pumped as planned.”); Mark Bly (BP), interview with Commission staff, September 8, 2010; Kris Ravi (Halliburton), interview with Commission staff, September 19, 2010 (circulating pressures appear to be in the correct ranges).

<sup>67</sup> Testimony of Richard Vargo, 276. “All of that information has to be explained as to why the pressure drop occurred during the displacement of the cementing operation and potentially why there isn’t a lot of damage here.” *Ibid.*

<sup>68</sup> Dril-Quip representatives, interview.

<sup>69</sup> *Ibid.*

<sup>70</sup> *Ibid.*

<sup>71</sup> Internal BP document (BP-HZN-OSC 8844); Internal BP document (BP-HZN-OSC 8845).

<sup>72</sup> Internal BP document (BP-HZN-OSC 8842); Internal BP document (BP-HZN-OSC 8844).

<sup>73</sup> Internal BP document (BP-HZN-OSC 8842); Internal BP document (BP-HZN-OSC 8840)(“The data set supports a hypothesis of a casing and drill pipe flow path.”); Internal BP document (BP-HZN-OSC 8843); Internal BP document (BP-HZN-OSC 113099)(“Flowpath tracker indicate that flow path was inside the casing only.”).

<sup>74</sup> New evidence about the geometry of the wellbore continues to emerge after the static kill. For example, in October, BP obtained new information about the presence of drill pipe above the crossover joint. BP legal team, interview.

<sup>75</sup> The observed data showed a divergence and then a spike in surface pressure after several hundred barrels were pumped. Internal BP document (BP-HZN-OSC 8842); Internal BP document (BP-HZN-OSC 113132). Some have suggested that the spike might indicate a breach at the crossover joint. Another explanation for the spike is that mud hit the formation earlier than modeled. Blankenship, interview; John Smith (Expert witness), email to Commission staff, January 13, 2011; Internal BP document (BP-HZN-OSC 113091-93). “It was expected that the operational results would differ from these theoretical curves due to a strong out transition zone between the Macondo oil and the kill mud.... The early increase in pressure at around 500 bbls pumped is assumed to be due to a long transition zone and ‘roping’ of mud. The gradual increase in pressure is expected to be due to mud gradually packing off the Macondo reservoir sand face.” Internal BP document (BP-HZN-OSC 113091-93). BP’s offshore kill and cement team retained uncertainty: “After pumping 330 bbls of mud into the well, there was a significant deviation from the predicted BOP pressure suggesting a flow path outside of the assumptions and geometries incorporated into the diagnostic model.... Based on the actual kill data divergence from the predicted pressure schedule, multiple flow path options exist for the lower portion of the well, below the 9633.5’ MD.” Internal BP document (BP-HZN-OSC 113128).

<sup>76</sup> John Smith (Expert witness), email to Commission staff, December 26, 2010. It also appears that the modeling did not account for the volume of the shoe track or the annulus below the float collar. Steve Lewis (Expert witness), email to Commission staff, December 19, 2010.

<sup>77</sup> Internal BP document (Macondo well schematic).

<sup>78</sup> Internal BP document (BP-HZN-BLY 48255, 48259-60).

<sup>79</sup> Internal BP document (BP-HZN-MBI 98759).

<sup>80</sup> *Ibid.*; Morey, interview. Connections are designed to withstand the same external pressures as the pipe body. Morey, interview.

<sup>81</sup> Internal BP document (BP-HZN-MBI 98759).

<sup>82</sup> Testimony of Lance John (Weatherford), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 243. “We have a thread rep on location which is usually the connection – whatever connection we’re running there and also we have our Jam system that we monitor to make up torques and turns. Q. And did you verify that all the connections were to your standard? A. Correct. Well, right away the thread rep is there also looking at the graph as it’s being – the connection’s being made up.” *Ibid.*

<sup>83</sup> Internal Weatherford documents (WFT 38, 43, 49); Steve Lewis (Expert witness), email to Commission staff, January 6, 2011. “I saw nothing in the WFD data or reports that would make me question their statement that all the joints that they made up or checked were made to specification and within normal variable limits.” Lewis, email, January 6, 2011.

<sup>84</sup> The logs made available to the investigative team did not contain a record of the connections made up onshore. Those include the reamer shoe, the centralizer subs, the float collar, and the crossover joint. Lewis, email, January 6, 2011.

<sup>85</sup> Testimony of Lance John, 255. “They pulled a connection out of the box. The driller picked up on it. It pulled the connection. It’s a wedge-type connection, so when it pulled it out, it sprung back in and damaged the one below it so we laid those out and replaced them with new joints.... We had – one of them was a double, so we had to lay out the double and we put a single and we replaced them with new joints.... The driller, when he slacked off into the box, slacked off too much and the pipe fell to the side and he was straightening it back up and as he was straightening it, is when he pulled it out of the box.” *Ibid.*

<sup>86</sup> *Ibid.* That action would have resolved the issue. Morey, interview.

<sup>87</sup> Since the blowout, at least one BP engineer involved with the well has testified that there could have been a breach in the production casing, namely through one or more of the threaded connections between casing joints. “Every joint of casing is screwed together, and there were several joints having a thread that any of those threads could leak.” Testimony of Mark Hafle, 77. Transocean’s internal investigator does not consider a break in the casing above the float mechanism a possibility because he views that component as being a stronger connection than the “internal guts” of the float assembly. Bill Ambrose (Transocean), interview with Commission staff, November 2, 2010.

<sup>88</sup> Testimony of Nathaniel Chaisson (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 432-34.

<sup>89</sup> *Ibid.*

<sup>90</sup> Confidential source, interview.

<sup>91</sup> Testimony of Nathaniel Chaisson, 432-34 (“Phone calls were made to BP in Houston and all of those phone calls and discussions were handled between BP personnel.”); Confidential source, interview; Internal BP document (BP-HZN-MBI 129068)(Guide, Morel, and Kaluza considered the possibility of a casing breach).

<sup>92</sup> Internal BP document (BP-HZN-MBI 129068). Clawson was unsure of the meaning of the email, but he did not have a follow-up conversation about it with Morel. Bryan Clawson (Weatherford), interview with Commission staff, October 28, 2010.

<sup>93</sup> Confidential source, interview.

<sup>94</sup> *Ibid.*

<sup>95</sup> After the cement job, the rig crew performed a positive pressure test on the well to test the integrity of the production casing. They pumped 2,500 psi of pressure into the production casing, which held steady for 30 minutes. The fact that the positive pressure test passed makes a casing breach unlikely but does not definitively rule out a breach. The positive pressure test assesses whether the production casing can hold pressure from the inside. It does not test whether the casing can withstand pressure exerted from the outside. The positive pressure test also did not test the casing below the top wiper plug. Finally, a casing breach could have occurred after the positive pressure test was complete.

<sup>96</sup> Smith, email, December 26, 2010. Certain other data that BP employs as the basis for its conclusion that there was shoe track flow is similarly insufficiently sensitive to distinguish a casing breach near the bottom of the production casing from a failure of the shoe track cement. For example, BP argues that the increase (rather than decrease) in drill pipe pressure prior to the blowout indicates that flow came up through the production casing and pushed mud up around the drill pipe. BP, Deepwater Horizon *Accident Investigation Report*, app. G, 221. Hydrocarbons entering through a breach near the bottom of the production casing could be responsible for pushing up the mud.

<sup>97</sup> Internal Weatherford documents (WFT 38, 43, 49). The logs made available to the investigative team did not contain a record of the connections made up onshore. Those include the reamer shoe, the centralizer subs, the float collar, and the crossover joint. Lewis, email, January 6, 2011.

## Chapter 4.2

<sup>1</sup> Steve Lewis (Expert witness), interview with Commission staff, September 21, 2010.

<sup>2</sup> *Ibid.*

<sup>3</sup> “In the drilling business it is standard practice to always have multiple barriers in place in the wellbore at any given time.... Only when at least two mechanical barriers are in place, and sufficiently tested, can the drilling fluid be removed as a barrier.” Hearing to Review Recent Issues in Offshore Oil and Gas Development, Before the S. Comm. on Energy and Natural Resources, 111th Cong. (May 11, 2010)(statement of F.E. Beck, Texas A&M University). Shell’s standard “specifies that all planned well operations must normally be executed under the protection of two independent barriers between the reservoir and the environment....” Joseph Leimkuhler (Shell), letter to Commission staff, September 22, 2010. Indeed, BP’s own Drilling and Well Operations Practice manual specifies that (1) “During well construction and maintenance activities, operations shall be conducted with one active barrier and one contingent barrier installed to address critical operational risks and contain the well,” and (2) “Prior to breaking containment of any well control equipment such as the removal of a tree, BOP or any component, there shall be two independent mechanical barriers to flow fitted in all wells.” Internal BP document (BP-HZN-MBI 130846, 130875).

<sup>4</sup> Gregg Walz (BP), interview with Commission staff, October 6, 2010.

<sup>5</sup> Internal BP document (BP-HZN-MBI 13494).

<sup>6</sup> David Sims (BP), interview with Commission staff, December 14, 2010.

<sup>7</sup> Guide described the Macondo well as a production well with an exploration tail. John Guide (BP), interview with Commission staff, September 17, 2010. So did Walz and Sims. Walz, interview; Sims, interview.

<sup>8</sup> Guide, interview, September 17, 2010.

<sup>9</sup> *Ibid.*

<sup>10</sup> *Ibid.*

<sup>11</sup> Steve Morey (BP), interview with Commission staff, December 22, 2010; Patrick O’Bryan (BP), interview with Commission staff, December 17, 2010.

<sup>12</sup> Testimony of Mark Hafle (BP), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 60.

<sup>13</sup> Sims, interview.

<sup>14</sup> Morey, interview.

<sup>15</sup> Internal BP document (BP-HZN-BLY 47277-84).

<sup>16</sup> Internal BP document (BP-HZN-BLY 47280-81).

<sup>17</sup> Technically, the 16-inch pipe is a “liner” rather than a “casing,” because it hangs 160 feet below the wellhead. Casing runs all the way up to the wellhead, where it hangs from a “casing hanger.” A liner does not run all the way up to the wellhead and instead hangs from a “liner hanger” placed farther down in the well. For simplicity’s sake, and because individuals in the oil and gas industry often use the terms interchangeably, this Report nevertheless refers to the 16-inch pipe as a “casing.”

<sup>18</sup> Internal BP document (BP-HZN-MBI 98759).

<sup>19</sup> *Ibid.*

<sup>20</sup> *Ibid.*

<sup>21</sup> *Ibid.*

<sup>22</sup> Internal BP document (BP-HZN-MBI 118210).

- <sup>23</sup> It is worth noting that some refer to the production casing as a protective casing, in that it protects the production tubing during later production. Guide, interview, September 17, 2010; John Smith (Expert witness), interview with Commission staff, September 7, 2010.
- <sup>24</sup> Testimony of Steve Lewis (Expert witness), Hearing before the National Commission, November 9, 2010, 52; Confidential industry expert, interview with Commission staff. On the relief well, 13<sup>5</sup>/<sub>8</sub>-inch casing ran all the way to the wellhead to help ensure better pressure integrity for the dynamic kill. Ronnie Sepulvado (BP), interview with Commission staff, August 20, 2010.
- <sup>25</sup> Ronnie Sepulvado, interview, August 20, 2010; Confidential industry expert, interview.
- <sup>26</sup> Ronnie Sepulvado, interview, August 20, 2010. From the beginning, the 16-inch casing was not supposed to be seated in the high-pressure housing of the wellhead. And the 13<sup>5</sup>/<sub>8</sub>-inch casing was not supposed to be tied back. Guide, interview, September 17, 2010.
- <sup>27</sup> A 13<sup>5</sup>/<sub>8</sub>-inch protective casing would have eliminated the value of the burst disks in the 16-inch casing. Guide, interview, September 17, 2010. Almost every exploration well will have an intermediate long string at 13<sup>5</sup>/<sub>8</sub> inches; Macondo was different because it had a production casing long string. Sims, interview.
- <sup>28</sup> Testimony of Mark Bly (BP), Hearing before the National Academy of Engineering, September 26, 2010; Ronnie Sepulvado (BP), interview with Commission staff, October 26, 2010.
- <sup>29</sup> Ronnie Sepulvado, interview, August 20, 2010. To the contrary, BP drilling engineer Brian Morel commented, in an email, that BP would “come back to run the tieback” “at a later date.” Internal BP document (BP-HZN-MBI 199432).
- <sup>30</sup> Testimony of Micah Burgess (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 117. The *Horizon* crew encountered more problems than usual. E.C. Thomas (Expert witness), interview with Commission staff, October 27, 2010.
- <sup>31</sup> Internal BP document (BP-HZN-OSC 1449).
- <sup>32</sup> Internal BP document (BP-HZN-OSC 4094).
- <sup>33</sup> *Ibid.*; Allen Seraile (Transocean), interview with Commission staff, January 7, 2011.
- <sup>34</sup> John Guide (BP), interview with Commission staff, January 19, 2011.
- <sup>35</sup> Internal BP document (BP-HZN-OSC 1490); Internal BP document (BP-HZN-OSC 1493).
- <sup>36</sup> Guide, interview, September 17, 2010.
- <sup>37</sup> Internal BP document (MC 252-1 DDR).
- <sup>38</sup> Thomas, interview.
- <sup>39</sup> Internal BP document (MC 252-1 DDR).
- <sup>40</sup> Internal BP document (BP-HZN-MBI 324854).
- <sup>41</sup> Internal BP document (BP-HZN-MBI 109949).
- <sup>42</sup> Internal BP document (BP-HZN-MBI 197837).
- <sup>43</sup> One BP engineer said, “We have been encountering issues on Macondo and the well design is rapidly changing.” Internal BP document (BP-HZN-MBI 110317).
- <sup>44</sup> Internal BP document (BP-HZN-MBI 109949).
- <sup>45</sup> Guide, interview, January 19, 2010.
- <sup>46</sup> Internal BP document (BP-HZN-CEC 8723).
- <sup>47</sup> Internal BP document (BP-HZN-MBI 173605); Internal BP document (BP-HZN-CEC 18891).
- <sup>48</sup> Internal BP document (BP-HZN-MBI 173605); Internal BP document (BP-HZN-CEC 18891).
- <sup>49</sup> Internal Transocean document (TRN-USCG\_MMS 11596).
- <sup>50</sup> Internal BP document (BP-HZN-MBI 126338); Guide, interview, January 19, 2011.
- <sup>51</sup> Internal Transocean document (TRN-USCG\_MMS 11597).



<sup>52</sup> Internal BP document (BP-HZN-MBI 126338).

<sup>53</sup> *Ibid.*

<sup>54</sup> *Ibid.*

<sup>55</sup> *Ibid.*

<sup>56</sup> *Ibid.*

<sup>57</sup> Erick Cunningham (BP), interview with Commission staff, January 19, 2011. As discussed in [Chapter 4.4](#), at this meeting the group also considered the merits of using nitrogen foamed cement at the bottom of the Macondo well.

<sup>58</sup> *Ibid.*

<sup>59</sup> *Ibid.*

<sup>60</sup> *Ibid.*

<sup>61</sup> *Ibid.*

<sup>62</sup> *Ibid.*

<sup>63</sup> Confidential source, interview with Commission staff.

<sup>64</sup> *Ibid.*; Walz, interview. BP engineers raised this concern with Gagliano, and Gagliano followed up with other Halliburton personnel to run down the cause of the error. Confidential source, interview.

<sup>65</sup> Confidential source, interview.

<sup>66</sup> Sims, interview; Walz, interview.

<sup>67</sup> Walz, interview.

<sup>68</sup> Internal BP document (BP-HZN-MBI 127267).

<sup>69</sup> *Ibid.*

<sup>70</sup> Internal BP document (BP-HZN-MBI 127266).

<sup>71</sup> Ronnie Sepulvado, interview, August 20, 2010.

<sup>72</sup> Internal BP document (BP-HZN-MBI 255906).

<sup>73</sup> Testimony of Paul Johnson (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 360.

<sup>74</sup> *Ibid.*

<sup>75</sup> Cunningham, interview.

<sup>76</sup> Confidential source, interview.

<sup>77</sup> It is not clear whether an accurate Halliburton cementing model—with all the correct inputs—was ever run. The engineers turned off the faulty part of the model, manually input logging data, and reran the model. ECD levels went down but were still too high. Cunningham suggested adding a small amount of base oil in front of the spacer fluid in order to lower ECD. Cunningham, interview; Confidential source, interview.

<sup>78</sup> The completion engineers do not appear to have been aware of the final decision at that point. “[N]o one told us what the actual decision was, so we thought y’all were going with the liner until Doris called me for a green light on the MoC.” Internal BP document (BP-HZN-MBI 254886).

<sup>79</sup> Internal BP document (BP-HZN-BLY 125443).

<sup>80</sup> Walz, interview.

<sup>81</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 76.

<sup>82</sup> Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 183.

<sup>83</sup> Internal BP document (BP-HZN-MBI 143292).

<sup>84</sup> Testimony of Mark Bly, 306. There was some uncertainty among the team members as to whether a formal management of change process was even required because the original well design had included a long string production casing, the original well design had already been peer-reviewed, and the team had never actually switched the plan in the interim to a liner. Guide, interview, September 17, 2010; Sims, interview. Nevertheless, Sims suggested that the team use the process as a vehicle to capture and record the issues discussed in the previous few days (April 13 to 15) because there had been a great deal of conversation about different options. Sims, interview.

<sup>85</sup> Internal BP document (BP-HZN-MBI 143259).

<sup>86</sup> *Ibid.*

<sup>87</sup> *Ibid.*; Internal BP document (BP-HZN-MBI 143292).

<sup>88</sup> BP, *Deepwater Horizon Accident Investigation Report*, app. O, 1-2; Testimony of Charlie Williams (Shell), Hearing before the National Commission, November 9, 2010, 40; Confidential industry expert, interview.

<sup>89</sup> Anadarko representatives assert, after the blowout, that they would not have installed a long string in the Macondo well, given the cement job. Anadarko representatives, interview with Commission staff, September 29, 2010. The risk of using a long string depends on how reliable the cement job is. According to one industry expert, the cement job here should not have been relied on because of inadequate rock strength, repeated incidents of lost circulation, slow pump rates, small cement volume, and wiper plugs in tapered casing. Confidential industry expert, interview. "If you're concerned that you will lose returns or might lose returns when you're cementing, running the liner is in my view more straightforward on reestablishing the barriers." Testimony of Charlie Williams, 42-43.

<sup>90</sup> Bill Ambrose (Transocean), interview with Commission staff, September 21, 2010.

<sup>91</sup> Confidential industry expert, interview; Bill Ambrose (Transocean), interview with Commission staff, November 2, 2010; Testimony of Tommy Roth (Halliburton), Hearing before the National Academy of Engineering, September 26, 2010; Confidential source, interview with Commission staff. To be sure, industry engineers usually wipe long string production casings with two wiper plugs, whereas it is common practice to wipe a liner with only one wiper plug. In that case, the difference in contamination would be reduced.

<sup>92</sup> Erik B. Nelson and Dominique Guillot, eds., *Well Cementing*, 2nd ed. (Sugar Land, TX: Schlumberger, 2006), 497.

<sup>93</sup> Confidential industry expert, interview. Another reason for this may be wellbore geometry. Mark Bly (BP), interview with Commission staff, September 8, 2010.

<sup>94</sup> Murry Sepulvado (BP), interview with Commission staff, December 10, 2010.

<sup>95</sup> Confidential industry expert, interview.

<sup>96</sup> Testimony of Charlie Williams, 42; Confidential industry expert, interview.

<sup>97</sup> Testimony of Charlie Williams, 42.

<sup>98</sup> Kris Ravi (Halliburton), interview with Commission staff, September 19, 2010; Ambrose, interview, November 2, 2010.

<sup>99</sup> Patrick O'Bryan, interview.

<sup>100</sup> Internal BP document (BP-HZN-OSC 5558). Nonproductive time counts against the performance rating of the rig and its personnel. Internal BP document (BP-HZN-OSC 8995); Internal BP document (BP-HZN-MBI 117622).

<sup>101</sup> Paul Tooms (BP), interview with Commission staff, October 13, 2010; Internal Department of the Interior document (OSC-DWH BOEM-WDC-Bo6 0001-0007), 133-34.

<sup>102</sup> Internal Department of the Interior document (OSC-DWH BOEM-WDC-Bo6 0001-0007), 133-34.

<sup>103</sup> Internal Department of Energy document (presentation on mud flow, June 1, 2010); Internal Department of the Interior document (OSC-DWH BOEM-WDC-Bo6 0001-0007), 133.

<sup>104</sup> Coast Guard official, interview with Commission staff; MMS official, interview with Commission staff; Senior administration official, interview with Commission staff.

<sup>105</sup> Tooms, interview.

- <sup>106</sup> Coast Guard official, interview; MMS official, interview; Senior administration official, interview.
- <sup>107</sup> Government science advisor, interview with Commission staff; Senior administration official interview; Internal Department of Energy document (presentation on mud flow).
- <sup>108</sup> Senior administration official, interview.
- <sup>109</sup> Internal Department of the Interior document (OSC-DWH BOEM-WDC-Bo6 0001-0007), 166-68; Nonpublic BP document (presentation to the Department of Energy, May 25, 2010), 3-5; BP legal team, letter to Commission staff, November 2, 2010, att.
- <sup>110</sup> Internal Department of the Interior document (OSC-DWH BOEM-WDC-Bo6 0001-0007), 135; Doug Suttles (BP), interview with Commission staff, October 13, 2010. One government official told Commission staff that another concern with installing a second BOP was weight: The existing BOP stack was listing at 2 degrees from vertical, and there was a risk that adding weight to its top would lead to further damage or collapse. Senior administration official, interview.
- <sup>111</sup> BP, letter.
- <sup>112</sup> BP, letter; Richard Lynch (BP), interview with Commission staff, October 13, 2010; Tooms, interview.
- <sup>113</sup> Government science advisor, interview with Commission staff.
- <sup>114</sup> Government science advisor, interview with Commission staff.
- <sup>115</sup> Confidential industry expert, interview.
- <sup>116</sup> O'Bryan, interview.
- <sup>117</sup> *Ibid.*; Guide, interview, September 17, 2010.
- <sup>118</sup> Guide, interview, September 17, 2010.
- <sup>119</sup> Morey, interview.
- <sup>120</sup> Guide, interview, September 17, 2010; Mike Zanghi (BP), interview with Commission staff, December 15, 2010.
- <sup>121</sup> O'Bryan, interview; Internal BP document (BP-HZN-OSC 8007).
- <sup>122</sup> Morey, interview.
- <sup>123</sup> Walz, interview.
- <sup>124</sup> BP, *Deepwater Horizon Accident Investigation Report*, 75.
- <sup>125</sup> Confidential industry expert, interview.

## Chapter 4.3

- <sup>1</sup> Erik Nelson and Dominique Guillot, eds., *Well Cementing*, 2nd ed. (Sugar Land, TX; Schlumberger, 2006), 143, 445.
- <sup>2</sup> *Ibid.*, *Well Cementing*, 148.
- <sup>3</sup> American Petroleum Institute, *Recommended Practices for Isolating Potential Flow Zones in Well Construction*, 1st ed. (May 2010) (“API RP 65 - Part 2 § 4.8.2.1”).
- <sup>4</sup> Norman Hyne, *Nontechnical Guide to Petroleum Geology, Exploration, Drilling, and Production* (Tulsa, Oklahoma; PennWell, 2004), 297-328.
- <sup>5</sup> Nelson and Guillot, eds., *Well Cementing*, 445.
- <sup>6</sup> *Ibid.*, 445. American Petroleum Institute, *Technical Report on Selection of Centralizers for Primary Cementing Operations*, 1st ed. (May 2008) (“API 10TR4 § 2.1”). Poor centralization can also lead to gas flow during the cement job. Gas flow may occur as the cement begins to set. As the cement gels, it no longer transmits the full amount of hydrostatic pressure from the fluids above it in the well. This can allow gas to flow into the cement, weakening it. Halliburton legal team, interview with Commission staff, July 27, 2010. While inadequate centralization can cause both channeling and gas flow, the two effects are different.

Halliburton legal team, interview with Commission staff, August 17, 2010. Testimony of Jesse Gagliano (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 416-17.

<sup>7</sup> Nelson and Guillot, eds., *Well Cementing*, 188.

<sup>8</sup> This is a simplified classification of centralizers for the purposes of this section. The API lists seven different types of centralizers falling into three main categories. One expert categorized centralizers as being of two types, either bow spring or rigid, each of which could be placed in two ways, either as a “sub” screw-on or “slip-on” that is secured by stop collars. Steve Lewis (Expert witness), email to Commission staff, October 14, 2010.

<sup>9</sup> Nelson and Guillot, eds., *Well Cementing*, 137.

<sup>10</sup> *Ibid.*, 164.

<sup>11</sup> *Ibid.*, 445.

<sup>12</sup> *Ibid.*, 446.

<sup>13</sup> Testimony of Daniel Oldfather (Weatherford), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, 44-45.

<sup>14</sup> Testimony of Steve Lewis (Expert witness), Hearing before the National Commission, November 9, 2010, 112-13.

<sup>15</sup> BP, Deepwater Horizon *Accident Investigation Report* (September 8, 2010), 70.

<sup>16</sup> Testimony of Ronnie Sepulvado (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 72.

<sup>17</sup> API RP 65 - Part 2 § 4.8.4.

<sup>18</sup> Nelson and Guillot, eds., *Well Cementing*, 148.

<sup>19</sup> The use of an auto-fill tube permits mud to flow up the casing as the casing is lowered. This means “old mud” is also inside of the casing, and not only in the annular space. If the crew circulates bottoms up after converting the float equipment, the old mud that was inside the casing is forced into the annular space. In order to completely purge the system to entirely “new mud,” inside the casing and in the annular space, it is necessary to pump new mud “surface to surface.” That is, pump a volume of new mud equal to the volume of the casing plus the volume of the annulus.

<sup>20</sup> Nelson and Guillot, eds., *Well Cementing*, 1.

<sup>21</sup> American Petroleum Institute, *Technical Report on Cement Sheath Evaluation*, 2nd ed. (September 2008), 1 (“API 10TR § 2”).

<sup>22</sup> API 10TR § 2, 1.

<sup>23</sup> Testimony of Ronnie Sepulvado, 112.

<sup>24</sup> *Ibid.*, 112-13.

<sup>25</sup> John Guide (BP), interview with Commission staff, September 17, 2010; Confidential source, interview with Commission staff.

<sup>26</sup> Lift pressure calculations can provide a rough estimate of the top of cement.

<sup>27</sup> Electric line logs are a type of wire line logs which conduct data to the surface as they are run. Tubing conveyed logs may also be used, which are logs run on drill pipe, tubing work string, or coiled tubing.

<sup>28</sup> “Cement Bond Log,” Schlumberger Oilfield Glossary, <http://www.glossary.oilfield.slb.com/Display.cfm?Term=cement%20bond%20log>.

<sup>29</sup> Nelson and Guillot, eds., *Well Cementing*, 561-63.

<sup>30</sup> *Ibid.*

<sup>31</sup> David Johnson and Kathyne Pile, *Well Logging in Non-technical Language*, 2nd ed. (Tulsa, OK; PennWell, 2004), 196.

<sup>32</sup> Nelson and Guillot, eds., *Well Cementing*, 562.

<sup>33</sup> *Ibid.*, 583-85.

- <sup>34</sup> “Cement Bond Log,” Schlumberger Oilfield Glossary, <http://www.glossary.oilfield.slb.com/Display.cfm?Term=cement%20bond%20log>.
- <sup>35</sup> Nelson and Guillot, eds., *Well Cementing*, 583.
- <sup>36</sup> API 10TR § 10, 75-77.
- <sup>37</sup> See, e.g., Nelson and Guillot, *Well Cementing*, 7.
- <sup>38</sup> Confidential industry expert, interview with Commission staff.
- <sup>39</sup> Testimony of Richard Vargo (Halliburton), Hearing before the National Commission, November 8, 2010, 320.
- <sup>40</sup> Nelson and Guillot, eds., *Well Cementing*, 24-25.
- <sup>41</sup> American Petroleum Institute, *Recommended Practice for Testing Well Cements 10B-2 (2005)(API RP 10B - Part 2)*.
- <sup>42</sup> Nelson and Guillot, eds., *Well Cementing*, 299-300.
- <sup>43</sup> Internal Transocean document (TRN-USCG-MMS 11597)(April 9, 2010).
- <sup>44</sup> Internal BP document (BP-HZN-MBI 126338).
- <sup>45</sup> *Ibid.*
- <sup>46</sup> Internal BP document (BP-HZN-MBI 198602).
- <sup>47</sup> Brett Clanton, “New tactic might seal leaking well sooner, BP CEO says,” *Houston Chronicle*, May 5, 2010.
- <sup>48</sup> Internal Schlumberger document (SLB-EC 1-2); Internal BP document (BP-HZN-MBI 136824)(April 10, 2010); Internal BP document (BP-HZN-MBI 136829)(April 11, 2010); Internal BP document (BP-HZN-MBI 136833)(April 12, 2010); Internal BP document (BP-HZN-MBI 136837)(April 13, 2010); Internal BP document (BP-HZN-MBI 136841)(April 14, 2010); Internal BP document (BP-HZN-MBI 136845)(April 15, 2010). Schlumberger ran a “triple-combo” log that measured formation density, porosity and resistivity, natural gamma radiation, hole size, and fluid temperature; a combinable magnetic resonance (CMR) tool that could estimate the distribution of pore sizes, an elemental capture spectroscopy (ECS) sonde to measure formation lithology, an oil-base microimager (OBMI) tool to visualize the formation, a modular formation dynamics tester (MDT) tool to collect samples and make pressure measurements, and coring tools to take sidewall samples.
- <sup>49</sup> Internal Transocean document (TRN-USCG\_MMS 11626)(April 16, 2010).
- <sup>50</sup> Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 150.
- <sup>51</sup> Internal BP document (BP-HZN-MBI 129617).
- <sup>52</sup> Confidential source, interview with Commission staff.
- <sup>53</sup> Internal BP document (BP-HZN-MBI 21304).
- <sup>54</sup> **Chapter 4.4** explains that BP may originally have chosen to use nitrogen foamed cement for other reasons.
- <sup>55</sup> Internal BP document (BP-HZN-MBI 193550).
- <sup>56</sup> *Ibid.*
- <sup>57</sup> Guide, interview, September 17, 2010.
- <sup>58</sup> A number of BP personnel have suggested or stated that APB was a factor in determining TOC at Macondo. David Sims (BP), interview with Commission staff, December 14, 2010; Guide, interview, September 17 2010; Confidential source, interview; Erick Cunningham (BP), interview with Commission staff, January 19, 2011. BP’s technical guidance also states that APB may be a factor in determining TOC. Internal BP document (BP-HZN-OSC 8007). However, according to Gregg Walz, the engineering team leader, APB concerns did not drive TOC or cement volume decisions at Macondo. Gregory Walz (BP), interview with Commission staff, October 6, 2010. This view is supported by answers Morel received to questions about APB concerns. Limiting TOC was not given as a method to mitigate APB. Internal BP document (BP-HZN-BLY 66793).
- <sup>59</sup> BP, *Deepwater Horizon Accident Investigation Report*, 54.

- <sup>60</sup> Internal BP document (BP-HZN-MBI 143300). The Bly report states that the top hydrocarbon zone was 17,788 feet. BP, *Deepwater Horizon Accident Investigation Report*, 54.
- <sup>61</sup> Internal BP document (BP-HZN-CEC 20234).
- <sup>62</sup> Guide, interview, September 17, 2010.
- <sup>63</sup> BP's April 14 Application for Permit to Drill shows TOC at 17,300. Internal BP document (BP-HZN-MBI 23746). The Bly report states that the TOC was at 17,260 feet. BP, *Deepwater Horizon Accident Investigation Report*, 54.
- <sup>64</sup> Internal BP document (BP-HZN-MBI 143259).
- <sup>65</sup> *Ibid.*
- <sup>66</sup> *Ibid.*
- <sup>67</sup> *Ibid.*
- <sup>68</sup> Internal BP document (BP-HZN-MBI 143291). In that comment, Sims also told Hafle: "Need to change the reviewers to Walz, Reiter, Mix and the approvers to Sims, Sprague, Frazelle."
- <sup>69</sup> Internal BP document (BP-HZN-MBI 143292).
- <sup>70</sup> Internal BP document (BP-HZN-CEC 22667). BP made this decision out of concern that cement above the float collar might interfere with logging.
- <sup>71</sup> Internal Halliburton document (HAL\_11002).
- <sup>72</sup> Internal BP document (BP-HZN-MBI 143295); Internal BP document (BP-HZN-CEC 22663); BP, *Deepwater Horizon Accident Investigation Report*, 34.
- <sup>73</sup> API RP 65 - Part 2 § 4.6.5.2.
- <sup>74</sup> API RP 65 - Part 2 § 4.6.5.2.
- <sup>75</sup> Internal BP document (BP-HZN-MBI 127537-39); Internal Halliburton document (HAL\_11196).
- <sup>76</sup> The September 2009 and January 2010 drilling programs called for a **minimum** of 5 bpm. Internal BP document (BP-HZN-CEC 8860)(September 2009 Drilling Program); Internal Transocean document (TRN-HCJ 93593)(January 2010 Drilling Program). Later versions reduced the displacement rate. The April 12 drilling plan called for a minimum of 3 bpm. Internal BP document (BP-HZN-CEC 21265). The April 15 drilling plan called for pump rates of 2 to 4 bpm. Internal BP document (BP-HZN-CEC 17626-27).
- <sup>77</sup> Gagliano claimed that Morel made the decision to use foamed cement, though there is conflicting information on this point. Internal BP documents (BP-HZN-BLY 61276); Internal BP document (BP-HZN-BLY 61294); Confidential source, interview.
- <sup>78</sup> Internal BP document (BP-HZN-MBI 218202).
- <sup>79</sup> *Ibid.*
- <sup>80</sup> API 10TR4 § 1; American Petroleum Institute, *Recommended Practice for Centralizer Placement and Stop-collar Testing*, Part 2, 1st ed. (August 2004)("API 10D2 § 4"). API does set forth a formula to calculate standoff ratios, even though it has no specific recommended ratio. API did have a "minimum standard" ratio of 67% standoff for performance of casing bow spring centralizers. But that 67% ratio is simply a means to help manufacturers produce API-quality centralizers. No centralization standoff ratio standards, or a standard for the distance of centralized casing, were found in API RP 10D-2, API Technical Report 10TR4e1 or the post-blowout Recommend Practice 65.
- <sup>81</sup> Internal BP document (BP-HZN-MBI 193557). BP cementing expert Cunningham explained that a "distinct permeable zone" could be hydrocarbons or water. For Halliburton, Halliburton engineer Gagliano stated that "you view a percentage standoff and usually shoot for about 70 or above for standoff." Jesse Gagliano (Halliburton), interview with the U.S. House of Representatives Committee on Energy and Commerce, June 11, 2010.
- <sup>82</sup> Cunningham, interview.
- <sup>83</sup> Internal BP document (BP-HZN-CEC 8858). BP actually set forth three different formulas in this document, but all result in the running of at least 16 centralizers at the eventual total depth of the well. Presumably because every joint to 100 feet above the highest "permeable zone" would be centralized,

modeling would reflect that this was sufficiently “centralized pipe.” Internal BP documents (BP-HZN-CEC 8857-58, 8863).

<sup>84</sup> Internal Transocean document (TRN-HCJ 93591).

<sup>85</sup> Internal BP document (BP-HZN-MBI 193557). ETP calls for “centralised pipe” 100 feet above permeable zone. The original 2009 plan called for centralizers every joint to 500 feet above production interval. As 500 feet above the production interval also happens to be 100 feet above the highest permeable zone, the 2009 plan appears to comply with BP’s internal guidance. The January 2010 plan, however, calls for centralizers “every other joint” after the first five joints (and the first five joints do not reach 100 feet above the highest permeable zone). If centralizers “every other joint” reflected sufficient standoff in modeling, this would comply. If centralizers “every other joint” did not show sufficient standoff, it would not comply.

<sup>86</sup> Internal BP document (BP-HZN-BLY 66450-51).

<sup>87</sup> *Ibid.*; Bryan Clawson (Weatherford), interview with Commission staff, October 28, 2010. Clawson told the Chief Counsel’s team that manufacturing normally takes two to three weeks and that rush jobs can be completed in just seven to 10 days.

<sup>88</sup> Confidential source, interview; Internal BP document (BP-HZN-MBI 126184)(April 12, 2010). No basis was given for this decision. A later cement model was prepared that supported this decision, but this was not available to the BP team when they decided six centralizers would be sufficient. Internal BP document (BP-HZN-MBI 126815). Wells team leader Guide stated that the decision that six centralizers were sufficient was made by Morel or Hafle. John Guide, interview with Commission staff, January 19, 2011.

<sup>89</sup> Testimony of Brett Coteles (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 89.

<sup>90</sup> Internal BP document (BP-HZN-MBI 126815-34); BP, *Deepwater Horizon Accident Investigation Report*, 62.

<sup>91</sup> Internal BP document (BP-HZN-MBI 126815-34); BP, *Deepwater Horizon Accident Investigation Report*, 62.

<sup>92</sup> Gagliano, interview.

<sup>93</sup> *Ibid.*

<sup>94</sup> *Ibid.*; Testimony of Jesse Gagliano, 253; Internal BP document (BP-HZN-MBI 127363).

<sup>95</sup> Cunningham, interview.

<sup>96</sup> Testimony of John Guide, July 22, 2010, 87.

<sup>97</sup> Internal BP document (BP-HZN-CEC 22433). Walz emailed Guide to tell him of the decision made in his absence.

<sup>98</sup> *Ibid.* This is what Walz meant when he wrote of his decision, “we needed to be consistent with honoring the model.” Testimony of Gregory Walz (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, part 1, 164.

<sup>99</sup> Testimony of Jesse Gagliano, 129-30; Internal BP document (BP-HZN-BLY 61327).

<sup>100</sup> Internal BP document (BP-HZN-MBI 127363).

<sup>101</sup> Internal Halliburton document (HAL\_10648); Gagliano, interview.

<sup>102</sup> Internal BP document (BP-HZN-BLY 61327); Internal Halliburton document (HAL\_10604); Internal Halliburton document (HAL\_10608); Internal Halliburton document (HAL\_10713); Internal Halliburton document (HAL\_10717). Besides assuming different numbers of centralizers, the two modeling runs differed in other ways as well; they assumed different standoff values above the centralized casing section and used wellbore survey data in different ways.

<sup>103</sup> Testimony of Brett Coteles, 267; Gagliano, interview. Coteles was not given instructions regarding what type of centralizers to order for the production casing. In a series of phone calls, Clawson told Coteles that that there were 32 centralizers (Coteles remembered 31) that were in BP’s inventory. Clawson also told Coteles that these were bow spring centralizers with stop collars. Clawson, interview; Testimony of Brett Coteles, 267. Gagliano’s testimony suggests that his cement models drove the decision to specifically use 15 additional centralizers, rather than the capacity of the helicopter. Gagliano, interview. However, Walz stated that he asked Gagliano to run model with 15 additional centralizers after having determined what could be procured. Internal BP document (BP-HZN-BLY 61327).

<sup>104</sup> Testimony of Brett Cocales, 216.

<sup>105</sup> Many BP personnel believed that the Thunder Horse centralizers had integrated stop collars. Guide, interview, September 17, 2010; Confidential source, interview; Internal BP document (BP-HZN-CEC 22433); BP, *Deepwater Horizon Accident Investigation Report*, 63.

<sup>106</sup> Internal BP document (BP-HZN-MBI 127478-80). Gregg Walz stated that he and David Sims looked at the schematics and that both interpreted them as having integrated stop collars. Internal BP document (BP-HZN-BLY 61328).

<sup>107</sup> Internal BP document (BP-HZN-CEC 22433-34).

<sup>108</sup> Testimony of Daniel Oldfather, 6-7.

<sup>109</sup> *Ibid.*, 6-9, 11. Because the BP team thought that centralizers had an integrated design, they did not realize that a box that Weatherford had delivered with the centralizers contained the stop collars. Instead they assumed the box contained equipment and tools. For this reason the team did not consider it a problem that the box was shipped by boat, even though shipping the stop collars by this slower method defeated the purpose of flying the centralizers by helicopter. Internal BP document (BP-HZN-BLY 61328). The accessories' arrival was delayed and did not arrive at the rig until just before running casing. Internal BP document (BP-HZN-CEC 20268).

<sup>110</sup> Testimony of Daniel Oldfather, 9-10; Clawson, interview.

<sup>111</sup> Confidential source, interview.

<sup>112</sup> *Ibid.*

<sup>113</sup> Internal BP document (BP-HZN-MBI 255668).

<sup>114</sup> *Ibid.*

<sup>115</sup> Internal BP document (BP-HZN-CEC 22433).

<sup>116</sup> BP, *Deepwater Horizon Accident Investigation Report*, 63. Guide was concerned about this scenario because it recently happened on another well in the Gulf of Mexico. Testimony of John Guide, July 22, 2010, 373-74. Guide's concern was not unique. The API indicates that "throughout the industry, concerns have been expressed regarding every type of centralizer installation." API 10TR4 § 3.9.

<sup>117</sup> In explaining the decision not to run additional centralizers, Cocales stated that there was concern over the cost involved. He stated to BP investigators that in addition to concern about the centralizers coming off in the well, the centralizers were not installed "due to time required and labor involved." Internal BP document (BP-HZN-BLY 61225). Hafle stated that the installation would have taken even longer, from 12 to 18 hours. Internal BP document (BP-HZN-BLY 61368). However, Walz told investigators that "time or costs were not discussed as a consideration" in a phone call with Guide following the order to cancel the installation of additional centralizers. Internal BP document (BP-HZN-BLY 61328).

<sup>118</sup> Internal BP document (BP-HZN-BLY 61328-29). Guide said that earlier that morning, when everyone believed that the centralizers had integrated stop collars but no one was certain when they would arrive, he stated that the rig crew could stop operations to wait for their arrival. But Guide was unwilling to wait when he learned they had separate stop collars. He explained that the hole can deteriorate while waiting to run casing. Given that the hole had already been open for several days of logging, however, it is unclear how urgent it was to run the production casing.

<sup>119</sup> Testimony of John Guide, July 22, 2010, 312; Internal BP document (BP-HZN-CEC 22433); Internal BP document (BP-HZN-CEC 22666). According to Walz, this type of centralizer had only been used twice before. On one of those two occasions, the rig crew had problems as they were running the casing into the hole. Internal BP document (BP-HZN-MBI 61328); BP, *Deepwater Horizon Accident Investigation Report*, 63.

<sup>120</sup> Internal BP document (BP-HZN-MBI 127087).

<sup>121</sup> Internal Halliburton document (HAL\_10648).

<sup>122</sup> Internal BP document (BP-HZN-MBI 128316-17).

<sup>123</sup> Confidential source. Morel may have used the 3-D model to make his centralizer placements, but it appears he did not receive it until after he had made his final centralizer adjustments to the casing tally. The reference to the 3-D model in Morel's correspondence suggests it was only used to argue that 21 centralizers



were unnecessary in a straight hole. Internal BP document (BP-HZNMBI 128430-35); Internal BP document (BP-HZN-MBI 128316).

<sup>124</sup> Internal Halliburton document (HAL\_10649); Internal Halliburton document (HAL\_10713); Internal BP document (BP-HZN-MBI 127087); Internal BP document (BP-HZN-MBI 128316).

<sup>125</sup> Internal BP document (BP-HZN-CEC 22669).

<sup>126</sup> Testimony of Brett Coteles, 59-60; Testimony of John Guide, October 7, 2010, part 2, 111-12; Testimony of Jesse Gagliano, 264, 284; Gagliano, interview.

<sup>127</sup> Internal BP document (BP-HZN-CEC 22670).

<sup>128</sup> Transocean was not involved in the determination of how many centralizers to use. Testimony of Jimmy Harrell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 95.

<sup>129</sup> Gagliano, interview; Internal BP document (BP-HZN-MBI 128489).

<sup>130</sup> Internal BP document (BP-HZN-MBI 128708); BP, *Deepwater Horizon Accident Investigation Report*, 64; Testimony of Richard Vargo, 322.

<sup>131</sup> Testimony of Gregory Walz, 53-54. Walz also stated that he “has a vague recollection that Jesse Gagliano made an off-hand comment about gas flow potential” during that conversation. Internal BP document (BP-HZN-BLY 61332).

<sup>132</sup> Testimony of Greg Walz, 53-54. Walz stated that his discussions with Guide that morning centered around the increased ECD, channeling, the potential for lost circulation and the contingent use of a CBL in that event. There was a brief discussion of the “SEVERE” gas flow potential but that they believed the foamed cement slurry design would protect against gas migration. Internal BP document (BP-HZN-BLY 61332).

<sup>133</sup> Testimony of Jesse Gagliano, 331.

<sup>134</sup> BP, *Deepwater Horizon Accident Investigation Report*, 64; Internal Halliburton document (HAL\_10990).

<sup>135</sup> Internal BP document (BP-HZN-MBI 129221); Internal Halliburton document (HAL\_11003).

<sup>136</sup> BP admits this. BP, *Deepwater Horizon Accident Investigation Report*, 63.

<sup>137</sup> Internal Halliburton document (HAL\_11010); Gagliano, interview.

<sup>138</sup> Internal BP document (BP-HZN-MBI 136936)(April 18); Internal BP document (BP-HZN-MBI 136946).

<sup>139</sup> Testimony of Daniel Oldfather, 45.

<sup>140</sup> Internal BP document (BP-HZN-MBI 198504).

<sup>141</sup> Guide, interview, September 17, 2010.

<sup>142</sup> *Ibid.*

<sup>143</sup> Internal BP document (BP-HZN-MBI 129226).

<sup>144</sup> Internal BP document (BP-HZN-BLY 62079).

<sup>145</sup> Internal BP document (BP-HZN-MBI 137743).

<sup>146</sup> Testimony of Steve Lewis, 91.

<sup>147</sup> Calculation based on Internal BP document (BP-HZN-MBI 129229).

<sup>148</sup> Internal BP document (BP-HZN-MBI 136941). BP’s Engineering Technical Practices call for rig personnel to convert the float equipment before the casing reaches the hydrocarbon zones. Internal BP document (BP-HZN-MBI 130799, 130846). However, BP requested a dispensation from MMS from this step in their January 2010 well plan, citing the need to reduce surge pressure given the narrow pore pressure and fracture gradient at Macondo. Internal Transocean document (TRN-HCJ 93610).

<sup>149</sup> Internal BP document (BP-HZN-MBI 136941).

<sup>150</sup> *Ibid.*

<sup>151</sup> *Ibid.*

<sup>152</sup> Internal BP document (BP-HZN-MBI 128966).

<sup>153</sup> Clawson, interview. According to John Guide, BP wanted to confirm the rated pressure of the float collar and check the compressibility of the mud to ensure they were in fact pressuring up against the float collar and not another piece of equipment. They verified the compressibility of the mud, which was consistent with pressures expected when pressuring up against the float collar. Testimony of John Guide, July 22, 2010, 197.

<sup>154</sup> Clawson, interview. Independent experts understand this recommendation to mean 6,800 psi was the highest differential pressure that could safely be applied to the equipment.

<sup>155</sup> Internal BP document (BP-HZN-MBI 21330). If the ports on the auto-fill tube are completely clogged such that there is no circulation, the pressure differential can build up to levels that will cause the brass pins in the collar to fail, pushing the ball through the end of the float equipment. Clawson indicated this would occur if a pressure differential of 1,300 psi existed.

<sup>156</sup> Internal BP document (BP-HZN-MBI 21330).

<sup>157</sup> Internal BP document (BP-HZN-MBI 136941).

<sup>158</sup> Internal BP document (BP-HZN-BLY 61364). Kaluza said Guide gave permission to go to 3,000 psi. Internal BP document (BP-HZN-MBI 129616). Testimony is inconsistent as to who from the rig was calling Guide to discuss problems converting. Both Morel and Kaluza stated they called Guide. However, Guide testified he spoke with Morel regarding float conversion. Testimony of John Guide, July 22, 2010, 197.

<sup>159</sup> Internal BP document (BP-HZN-MBI 129068).

<sup>160</sup> *Ibid.*

<sup>161</sup> Testimony of Nathaniel Chaisson (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 432. In addition, Gagliano was informed of the multiple conversion attempts, stating that “I guess the concern was after the fact that it took so much pressure to convert the float that they may have broke something else down or something else happened.” Gagliano, interview.

<sup>162</sup> Internal BP document (BP-HZN-MBI 257031).

<sup>163</sup> Testimony of Jesse Gagliano, 287.

<sup>164</sup> Internal BP document (BP-HZN-MBI 137367).

<sup>165</sup> Halliburton cementer Nathaniel Chaisson testified before the U.S. Coast Guard/BOEMRE Joint Investigation “concern was shown by many people on the rig floor.” Testimony of Nathaniel Chaisson, 432.

<sup>166</sup> Confidential source, interview.

<sup>167</sup> *Ibid.*

<sup>168</sup> Testimony of Brett Coteles, 70-71. Maxie Doyle of M-I SWACO reviewed the modeling with John Guide and could not estimate pressures as low as those seen on the drill pipe. Doyle later emailed Brett Coteles, John Guide, Mark Hafle, Brian Morel, and Gregg Walz and informed them “I have had several individuals double check and critique[] my inputs and still cannot explain the difference.” Internal BP document (BP-HZN-MBI 129104).

<sup>169</sup> Testimony of Brett Coteles, 72; Internal BP document (BP-HZN-MBI 137367); Internal BP document (BP-HZN-MBI 136941).

<sup>170</sup> Internal BP document (BP-HZN-MBI 136941); Internal BP document (BP-HZN-BLY 61355).

<sup>171</sup> Internal BP document (BP-HZN-MBI 137367).

<sup>172</sup> Internal BP document (BP-HZN-MBI 137367).

<sup>173</sup> *Ibid.* Another source indicated 390 psi. Internal BP document (BP-HZN-MBI 136941); Internal BP document (BP-HZN-MBI 129616).

<sup>174</sup> Internal BP document (BP-HZN-MBI 137367).

<sup>175</sup> *Ibid.*

<sup>176</sup> Internal BP document (BP-HZN-MBI 129221). MMS approved a regulatory dispensation that modified the standard testing regime for the diverter sealing element at Macondo. Internal BP document (BP-HZN-

OSC 512). The Chief Counsel's team has not found evidence suggesting that this dispensation affected the ability of the diverter sealing element.

<sup>177</sup> Internal BP document (BP-HZN-MBI 21304). The rig crew closed the lower annular and pumped down the drill pipe, taking returns up the choke and kill lines. They then shut off the pumps and monitored the flow line for losses. The rig crew determined the diverter was closed. Internal BP document (BP-HZN-OSC 4027); Internal BP document (BP-HZN-MBI 136942); Internal BP document (BP-HZN-MBI 21304).

<sup>178</sup> Testimony of Nathaniel Chaisson, 432. Morel was similarly unsure how they established circulation. Internal BP document (BP-HZN-MBI 129068).

<sup>179</sup> Confidential source, interview. The engineers thought upcoming pressure tests after cementing would confirm the integrity of the system. During a positive pressure test, additional fluid is pumped into the well, which is then sealed and monitored for pressure changes. Constant pressure confirms the casing, seal assembly, and BOP do not contain holes or leaks and can therefore hold pressure. But a positive pressure test does not confirm the integrity of the casing below the top wiper plug. On April 20 between 10:30 a.m. and noon, the crew conducted two positive pressure tests, both of which indicated the well was holding pressure. A negative pressure test similarly tests the well system for leaks, but the negative pressure test at Macondo did not indicate well integrity.

<sup>180</sup> Testimony of Brett Coteles, 72-73.

<sup>181</sup> Confidential source, interview.

<sup>182</sup> Internal BP document (BP-HZN-MBI 129616).

<sup>183</sup> API, *Recommended Practices for Isolated Potential Flow Zones During Well Construction*, part 2, 1st ed. (May 2010), 65 ("API RP 65 § 4.8.4"). The relevant portion of the second edition (§ 5.8.7) is not as prescriptive.

<sup>184</sup> Gagliano, interview.

<sup>185</sup> Steve Lewis (Expert witness), email to Commission staff, November 19, 2010. The precise calculation is 2,757.2 barrels.

<sup>186</sup> Testimony of Jesse Gagliano, 341-342. The actual pre-cement circulation time took roughly half an hour. *Ibid.*, 343.

<sup>187</sup> Internal BP document (BP-HZN-CEC 8860); Internal Transocean document (TRN-HCJ 93593).

<sup>188</sup> Internal BP document (BP-HZN-CEC 21445).

<sup>189</sup> Internal BP document (BP-HZN-CEC 21265). This pipe capacity equals 883.82 barrels. Internal BP document (BP-HZN-CEC 21445).

<sup>190</sup> Internal BP document (BP-HZN-CEC 17626).

<sup>191</sup> Testimony of John Guide, July 22, 2010, 150.

<sup>192</sup> BP legal team, interview with Commission staff, August 9, 2010.

<sup>193</sup> Testimony of Gregory Walz, 10-11.

<sup>194</sup> *Ibid.*, 11.

<sup>195</sup> Testimony of John Guide, July 22, 2010, 150; Guide, interview, September 17, 2010.

<sup>196</sup> Testimony of Nathaniel Chaisson, 437-38.

<sup>197</sup> Internal BP document (BP-HZN-CEC 21448). This document was prepared on April 17 by BP well site leaders Don Vidrine, Bob Kaluza, BP engineer Brian Morel, Halliburton cementer Nathaniel Chaisson, Halliburton foam team leader Paul Anderson, and Terry Leblue of Blackhawk. Testimony of Nathaniel Chaisson, 436.

<sup>198</sup> Testimony of Nathaniel Chaisson, 436.

<sup>199</sup> Sperry-Sun data, April 19, 2010, 16:15 – 16:30. When this circulation was established, the rig crew believed the float equipment had converted.

<sup>200</sup> Internal BP document (BP-HZN-CEC 21448). Halliburton concluded 346 barrels were circulated prior to cementing. Sperry-Sun data, April 20, 2010, 19:20. An independent expert calculated a circulation of

approximately 352.25 bbl; 350 bbl represents the approximate average, 349.125, of these two figures. Steve Lewis (Expert witness), email to Commission staff, November 17, 2010.

<sup>201</sup> Internal BP document (BP-HZN-CEC 21448).

<sup>202</sup> This volume is also significantly lower than the 4,140 bbl, or 1.5 annular volume, recommended by API. The Chief Counsel's team disagrees with BP witness testimony indicating the volume pumped at Macondo is in accord with the API RP 65. Testimony of Brett Cocola, 209.

<sup>203</sup> Internal Halliburton document (HAL\_11196-97).

<sup>204</sup> Commission calculation based on internal Halliburton document (HAL\_11196-97).

<sup>205</sup> Commission calculation based on internal Halliburton document (HAL\_10994); Lewis, email, November 19, 2010.

<sup>206</sup> API RP 65 §4.8.4.

<sup>207</sup> Commission calculation based on internal Halliburton document (HAL\_10994); Steve Lewis, email, November 19, 2010.

<sup>208</sup> Internal BP document (BP-HZN-CEC 8860).

<sup>209</sup> Internal Transocean document (TRN-HCJ 93593).

<sup>210</sup> Calculated based on internal BP document (BP-HZN-CEC 21445). Using the internal volume calculated by independent experts, 900 barrels,  $1.5 \times$  pipe volume would be 1,350 bbl.

<sup>211</sup> Internal BP document (BP-HZN-CEC 21265).

<sup>212</sup> Internal BP document (BP-HZN-CEC 21445). Independent experts calculated total internal volume at 900 barrels.

<sup>213</sup> Internal BP document (BP-HZN-CEC 17626). Independent experts calculated total internal volume at 900 barrels.

<sup>214</sup> Internal BP document (BP-HZN-CEC 21445).

<sup>215</sup> Internal BP document (BP-HZN-CEC 21448).

<sup>216</sup> Internal BP document (BP-HZN-MBI 137364).

<sup>217</sup> *Ibid.*

<sup>218</sup> Internal Halliburton document (HAL\_11196-97).

<sup>219</sup> Internal BP document (BP-HZN-MBI 137368).

<sup>220</sup> 39 barrels unfoamed, 48 bbl after foaming. Internal Transocean document (TRN-USCG\_MMS 11640); Internal BP document (BP-HZN-MBI 137365)

<sup>221</sup> Internal BP document (BP-HZN-MBI 137368)

<sup>222</sup> Internal BP document (BP-HZN-MBI 137365).

<sup>223</sup> Internal BP document (BP-HZN-MBI 137365).

<sup>224</sup> Internal BP document (BP-HZN-MBI 129068); Internal BP document (BP-HZN-MBI 137369).

<sup>225</sup> Internal BP document (BP-HZN-MBI 137370).

<sup>226</sup> Internal BP document (BP-HZN-MBI 139592).

<sup>227</sup> Internal BP document (BP-HZN-MBI 21305).

<sup>228</sup> *Ibid.*

<sup>229</sup> Cathleenia Willis (Sperry Drilling), interview with Commission staff, October 21, 2010; Testimony of Nathaniel Chaisson, 411-12.

<sup>230</sup> Internal BP document (BP-HZN-MBI 137370).

<sup>231</sup> Guide, interview, September 17, 2010.

- <sup>232</sup> Internal BP document (BP-HZN-MBI 137370); Internal BP document (BP-HZN-MBI 129052).
- <sup>233</sup> Internal Halliburton document (HAL\_11208).
- <sup>234</sup> Internal BP document (BP-HZN-MBI 137370); Internal Halliburton document (HAL\_11208).
- <sup>235</sup> Internal BP document (BP-HZN-MBI 129052).
- <sup>236</sup> Internal BP document (BP-HZN-MBI 129141).
- <sup>237</sup> Internal BP document (BP-HZN-MBI 129055).
- <sup>238</sup> Testimony of John Guide, July 22, 2010, 321-22.
- <sup>239</sup> Testimony of Steve Lewis, 110-11.
- <sup>240</sup> Testimony of Vincent Tabler (Halliburton), Hearing before the Joint Investigation Team, August 25, 2010, 21-22.
- <sup>241</sup> Confidential source, interview; Internal BP document (BP-HZN-CEC 21449).
- <sup>242</sup> Internal BP document (BP-HZN-CEC 20234); Testimony of Vincent Tabler, 21-22.
- <sup>243</sup> Testimony of Vincent Tabler, 22, 33-34.
- <sup>244</sup> Testimony of Vincent Tabler, 21-22; Confidential source, interview; Internal BP document (BP-HZN-CEC 21449); Internal BP document (BP-HZN-CEC 20234).
- <sup>245</sup> Internal BP document (BP-HZN-MBI 136947).
- <sup>246</sup> Internal BP document (BP-HZN-MBI 143304); Internal BP document (BP-HZN-CEC 21665).
- <sup>247</sup> BP's decision tree is based on the MMS regulation about cement bond logs. 30 C.F.R. § 250.428 states that if "you encounter...lost returns, cement channeling, or failure of equipment...[t]hen you must (1) Pressure test the casing shoe; (2) Run a temperature survey; (3) Run a cement bond log; or (4) Use a combination of these techniques." BP's decision tree meets that regulation and was apparently designed in light of it. Gagliano, interview. However, the decision tree violates another provision of the MMS regulations. 30 C.F.R. § 250.421 requires that cement be at least 500 feet above a pay zone. Here, BP's decision tree permitted the cement to be as little as 100 feet above the pay zone.
- <sup>248</sup> Randy Ezell (Transocean), interview with Commission staff, September 16, 2010. Gagliano agreed with this focus, stating that "it was critical that we design the cement job to have full returns because of the fact that if we lost returns during the cement job, they would have to run a cement bond log to see where the top of the cement was and then potentially remediation would be required." Gagliano, interview.
- <sup>249</sup> Internal BP document (BP HZN CEC 21288); Internal BP document (BP-HZN-MBI 255705).
- <sup>250</sup> Testimony of Ronnie Sepulvado, 21; Internal BP document (BP-HZN-MBI 126867).
- <sup>251</sup> Confidential source, interview with Commission staff.
- <sup>252</sup> Internal BP document (BP-HZN-MBI 127104).
- <sup>253</sup> Internal BP document (BP-HZN-MBI 126867).
- <sup>254</sup> Internal BP document (BP-HZN-MBI 127104).
- <sup>255</sup> Internal Schlumberger document (SLB-EC 02); Internal Transocean document (TRN-USCG\_MMS 30414)(April 18, 2010); Internal Transocean document (TRN-USCG\_MMS 30422)(April 19, 2010).
- <sup>256</sup> Testimony of Vincent Tabler, 23.
- <sup>257</sup> Testimony of John Guide, July 22, 2010, 43-44. According to Walz, who was on the call, Guide noted that the indications that they had met their plan and that the CBL had only been a contingency. "Guide concluded that there was no reason to run the CBL and [everyone] on the call agreed." Internal BP document (BP-HZN-BLY 61333).
- <sup>258</sup> Internal Schlumberger document (SLB-EC 02).
- <sup>259</sup> Confidential source, interview with Commission staff.

<sup>260</sup> Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 326; Testimony of Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 326; Testimony of Richard Vargo, 326.

<sup>261</sup> Greg Meeker (USGS), interview with Commission staff, January 27, 2011.

<sup>262</sup> Craig Gardner (Chevron), letter to Commission staff, October 26, 2010.

<sup>263</sup> Testimony of Richard Vargo, 331; Testimony of Jesse Gagliano, 321, 337.

<sup>264</sup> Testimony of Richard Vargo, 329, 355.

<sup>265</sup> Many would dispute the assumption the model is accurate. Testimony of John Guide, July 22, 2010, 275. Gagliano stated that BP “questioned the validity of the model.” Testimony of Jesse Gagliano, 386. BP’s cementing specialist Erick Cunningham stated that there are limitations to all such models and that their results always require the application of sound engineering judgment. Cunningham, interview. Moreover, had BP run the cement job on the basis of the 21-centralizer design April 18 model, BP would apparently have *relied* on the model’s inaccuracy. That model predicted that the final two barrels of the cement job would have exceeded the fracture gradient. Internal BP document (BP-HZN-BLY 61327). For that reason, Walz alluded to disagreement over the accuracy of the model. Internal BP document (BP-HZN-CEC 22433).

<sup>266</sup> BP, *Deepwater Horizon Accident Investigation Report*, 65.

<sup>267</sup> *Ibid.*, 35. Internal BP document (BP-HZN-CEC 8858); Internal BP document (BP-HZN-CEC 8858); Internal Transocean document (TRN-HCJ 9351); Internal Transocean document (TRN-HCJ 93526).

<sup>268</sup> One of BP’s representatives stated that Halliburton’s cement modeling was little more than a marketing tool.

<sup>269</sup> Internal BP document (BP-HZN-MBI 136849).

<sup>270</sup> Testimony of John Guide, July 22, 2010, 289.

<sup>271</sup> Halliburton observes circulating full bottoms up is a Halliburton “best practice.” Testimony of Jesse Gagliano, 263.

<sup>272</sup> BP, *Deepwater Horizon Accident Investigation Report*, 66.

<sup>273</sup> Confidential source, interview.

<sup>274</sup> Internal BP document (BP-HZN-MBI 143295); Internal BP document (BP-HZN-CEC 22663); *see also* Guide, interview, September 17, 2010; Internal BP document (BP-HZN-CEC 22666). In the April 14 meeting discussing the design of the cement job however, neither BP nor Halliburton raised concerns about the volume of cement to be used. Internal BP document (BP-HZN-BLY 61326).

<sup>275</sup> BP, *Deepwater Horizon Accident Investigation Report*, 67. At the same time, BP’s cementing engineer pointed out that there was little additional volume that could have been added. The TOC was reasonably close to the previous casing string and the entire annular volume was nearly full of cement. Nevertheless, the design would have been different had the well constraints been different. Cunningham, interview.

<sup>276</sup> Gagliano indicated that BP told him to keep ECD below 14.7 ppg. In order to do that the pump rate needed to be 4 bbl per minute or less. Testimony of Jesse Gagliano, 282; Testimony of Richard Vargo, 345-46. One expert estimates the cement flow rate could have been up to twice as fast as the rate pumped at Macondo. Steve Lewis (Expert witness), email to Commission staff, October 21, 2010.

<sup>277</sup> Testimony of Jesse Gagliano, 283-284.

<sup>278</sup> Confidential sources, interviews with Commission staff; Testimony of Tommy Roth (Halliburton), presentation to the National Academy of Engineering, September 26, 2010.

<sup>279</sup> Internal BP document (BP-HZN-MBI 117537).

<sup>280</sup> Guide, interview, September 17, 2010.

<sup>281</sup> *Ibid.*; Internal BP document (BP-HZN-CEC 21261).

<sup>282</sup> Testimony of Jesse Gagliano, 259.

<sup>283</sup> Both BP and Transocean personnel testified that additional pressure and multiple attempts at conversion are not unusual, particularly where equipment is clogged with debris. John Guide had previously experienced cuttings getting stuck between the ball and the tube, and believed this required applying

additional pressure. Testimony of John Guide, July 22, 2010, 147-48. Transocean offshore installation manager (OIM) Jimmy Harrell stated he was not concerned with additional pressure and that it is not usual that several attempts at higher pressures were needed to convert. Testimony of Jimmy Harrell, 85, 122. And Transocean senior toolpusher Randy Ezell also stated that the applied pressures were not too high due to debris that needed to be cleared. Ezell, interview. Another failure mode could be created by interference of the diverter ball, though this seems unlikely. After the casing is installed, the rig crew drops a 1.625-inch brass ball to close the hole, which closes the diverter gate and seals the inside of the casing from the annular space. The ball eventually lands on the float equipment. Email communications indicate the rig crew considered this scenario. It appears unlikely the diverter ball prevented conversion, as even with the diverter ball there would be more than 2 inches of space for fluid to circulate around the ball and through the float equipment. Internal BP document (BP-HZN-MBI 127277). BP's post-blowout tests simulated the diverter ball on top of the float equipment. BP tests where the Allamon ball was on top of the float collar established circulation at 3,210 psi and the float equipment converted at 11.5 bpm in the subsequent flow surge. Internal BP document (BP-HZN-BLY 62214-15).

<sup>284</sup> Internal BP document (BP-HZN-CEC 8860).

<sup>285</sup> Internal Transocean document (TRN-HCJ 93593).

<sup>286</sup> Internal BP document (BP-HZN-CEC 21265).

<sup>287</sup> Internal BP document (BP-HZN-CEC 17626).

<sup>288</sup> Internal BP document (BP-HZN-MBI 129226-32).

<sup>289</sup> Commission calculation based on internal BP document (BP-HZN-MBI 129229); Lewis, email, October 21, 2010. Evidence has indicated mud weight as both 14.0 or 14.17 ppg. For purposes of this calculation, an independent expert used a mud weight of 14.1 ppg. A mud weight in this range would require a flow rate of approximately 6 bpm to create a differential pressure of approximately 600 psi to convert the float equipment.

<sup>290</sup> Lewis, email, October 21, 2010; Testimony of Steve Lewis, 95.

<sup>291</sup> Testimony of Steve Lewis, 93.

<sup>292</sup> Internal BP document (BP-HZN-MBI 136941).

<sup>293</sup> Testimony of Steve Lewis, 96; BP, *Deepwater Horizon Accident Investigation Report*, 70.

<sup>294</sup> Commission calculation based on internal BP document (BP-HZN-MBI 129229).

<sup>295</sup> Stress Engineering conducted performance tests including flow endurance tests, steady-state flow conversion tests, flow-surge conversion tests, flow-surge tests on already converted float equipment, and mechanical failure tests of auto-fill tubes. Internal BP document (BP-HZN-BLY 62187).

<sup>296</sup> Internal BP document (BP-HZN-BLY 62156).

<sup>297</sup> Internal BP document (BP-HZN-MBI 136941).

<sup>298</sup> Internal BP document (BP-HZN-BLY 62087). Stress Engineering could not simulate field conditions of the surge accurately enough for results to be conclusive. Internal BP document (BP-HZN-BLY 62066).

<sup>299</sup> Testimony of Steve Lewis, 112-13.

<sup>300</sup> BP, *Deepwater Horizon Accident Investigation Report*, 71. So does wells team leader John Guide, who stated that the team could have been fooled that the floats held because the u-tube pressure during the check was so low. Guide, interview, January 19, 2011.

<sup>301</sup> Internal Halliburton document (HAL\_11004). The Chief Counsel's team's expert calculated an even lower pressure differential. Based on figures in the final cement plan, fluids inside the casing and in the annulus may have been in almost perfect balance with only a 0.8 psi differential. Steve Lewis (Expert witness), email to Commission staff, December 14, 2010.

<sup>302</sup> Lewis, email, December 14, 2010.

<sup>303</sup> Testimony of Daniel Oldfather, 49.

<sup>304</sup> Testimony of Steve Lewis, 110.

<sup>305</sup> Internal BP document (BP-HZN-MBI 137753).

<sup>306</sup> Internal BP document (BP-HZN-MBI 21304).

<sup>307</sup> Ronnie Sepulvado (BP), interview with Commission staff, August 20, 2010.

<sup>308</sup> An obstruction in the reamer shoe could cause pressure to be the same above and below the auto-fill tube, which would mean there would be insufficient differential pressure to dislodge the tube.

<sup>309</sup> Testimony of Richard Sears, Hearing before the National Commission, November 9, 2010, 324.

<sup>310</sup> Internal BP document (BP-HZN-MBI 21330).

<sup>311</sup> According to BP's John Guide, he and Brian Morel did not discuss this possibility. Testimony of John Guide, October 7, 2010, 179-80.

<sup>312</sup> Testimony of Steve Lewis, 99; Clawson, interview.

<sup>313</sup> BP, *Deepwater Horizon Accident Investigation Report*, 70.

<sup>314</sup> Testimony of Steven Robinson (BP), Hearing before the Joint Investigation Team, December 8, 2010, part 1, 39-40; Guide, interview, September 17, 2010. There is some disagreement as to whether float equipment constitutes a barrier. An expert retained by the Commission considers float equipment a barrier, but only to its pressure rating. Steve Lewis (Expert witness), interview, September 15, 2010.

<sup>315</sup> Clawson, interview.

<sup>316</sup> API RP 65 - Part 2 §4.4.3.

<sup>317</sup> API RP 65 - Part 2 §3.4.

<sup>318</sup> Testimony of John Guide, July 22, 2010, 289.

<sup>319</sup> Ezell, interview; Testimony of Jimmy Harrell, 95.

<sup>320</sup> Internal BP document (BP-HZN-CEC 22670).

<sup>321</sup> Joseph Leimkuhler (Shell), letter to Commission staff, September 22, 2010.

<sup>322</sup> BP's own report appears to agree that better risk identification and assessment would have helped avoid the accident. The Bly report states that a "formal risk assessment might have enabled the BP Macondo well team to identify further mitigation options to address risks...." BP, *Deepwater Horizon Accident Investigation Report*, 36; Testimony of Mark Bly, 345.

<sup>323</sup> Internal BP document (BP-HZN-CEC 17626)(April 15 Drilling Program).

<sup>324</sup> Testimony of Steve Lewis, 103; Steve Lewis, email, October 31, 2010.

<sup>325</sup> Clawson, interview.

<sup>326</sup> *Ibid.* BP would have known of the need for 7-inch centralizers at the time they decided to run a 9<sup>7</sup>/<sub>8</sub>-inch liner. That liner was specified nearly a week earlier in the March 25 APD that BP filed to MMS. Steve Lewis (Expert witness), email to Commission staff, January 1, 2011; Internal BP document (BP-HZN-MBI 23666). When asked by BP investigators why he did not order additional centralizers at the time the APD was submitted, Walz stated that he could not recall any specific discussion about centralizers but thought he "had a conversation with Brian Morel about ordering what they normally ordered." Internal BP document (BP-HZN-BLY 61329). Morel promptly ordered other 7-inch casing equipment but not centralizers. On March 25, for instance, he asked a BP materials coordinator, "Can you have (2) cross-over made for 7" x 9-7/8" with a rush on it (2 weeks or less)?" Internal BP document (BP-HZN-BLY 64818).

<sup>327</sup> Confidential source, interview. The "7-10" range was generated within the BP drilling team based on a rough estimate for what was needed to cover the pay zone given hole conditions. But it is unclear why the goal of the well plan or the well conditions would have been any different than when the original plan was designed.

<sup>328</sup> Weatherford sales representative Bryan Clawson indicated that in the case of BP's final production casing, Weatherford would have been able to manufacture additional centralizers in time, had they been promptly asked. Clawson, interview. Other BP rig well teams faced simultaneous centralizer needs that Weatherford could not fill, and approached other suppliers. Internal BP document (BP-HZN-MBI 252278).

<sup>329</sup> The Bly report states that the Macondo team "erroneously believed they had received the wrong centralizers." BP, *Deepwater Horizon Accident Investigation Report*, 63. This statement is ambiguous. The well team "erroneously believed" that it had ordered one-piece centralizers and therefore did not expect to



receive centralizers with separate stop collars. But the team was correct to conclude that the centralizers Weatherford shipped were not, in fact, one-piece centralizers.

<sup>330</sup> Internal BP document (BP-HZN-MBI 255906). The “flying by the seat of our pants” quote was apparently made by well site leader Vidrine, who was concerned that with all of the special deliveries, crucial pieces might be missing for operations. Guide believed that the logistics changes were making things much more difficult on the well site leaders. Guide, interview, January 19, 2011.

<sup>331</sup> BP, Deepwater Horizon *Accident Investigation Report*, 63. By contrast, BP had decided to use a long string using a management of change process—and that management of change process had been based on a 70% standoff ratio. Internal BP document (BP-HZN-BLY 61198).

<sup>332</sup> Testimony of Daniel Oldfather, 9-15. Oldfather had installed centralizers on 10 different occasions, and at no time had centralizers gotten hung up in the well. He had heard of other jobs, with different types of centralizers, where the centralizers had been damaged. Testimony of Daniel Oldfather, 67, 72. In his defense, Guide notes that his personal experience is based on running hundreds of casing strings. Guide, interview, January 19, 2010.

<sup>333</sup> BP, Deepwater Horizon *Accident Investigation Report*, 63.

<sup>334</sup> Testimony of Jesse Gagliano, 295; Testimony of Gregg Walz, 71.

<sup>335</sup> BP, Deepwater Horizon *Accident Investigation Report*, 64. As discussed, however, the cement modeling was rerun on Halliburton’s initiative.

<sup>336</sup> Testimony of John Guide, July 22, 2010, 275.

<sup>337</sup> Internal BP document (BP-HZN-CEC 22666).

<sup>338</sup> Testimony of Daniel Oldfather, 12.

<sup>339</sup> *Ibid.*, 57.

<sup>340</sup> *Ibid.*, 14.

<sup>341</sup> Gagliano, interview.

<sup>342</sup> *Ibid.*

<sup>343</sup> Testimony of Jesse Gagliano, 259; Internal BP document (BP-HZN-MBI 128489).

<sup>344</sup> If the rig crew believed the gauge was inaccurate, they could have compared pressure readings from that gauge to other sources of drill pipe pressure readings on the rig. Rigs typically have several different drill pipe pressure gauges, including electronic and analog gauges. The rig crew could have also observed drill pipe pressure on gauges at the cementing unit. Darryl Bourgoyne, email to Commission staff, January 1, 2011.

<sup>345</sup> Testimony of Steve Lewis, 105. However, applying back pressure can be undesirable for other reasons. Nelson and Guillot, eds., *Well Cementing*, 366.

<sup>346</sup> Ronnie Sepulvado (BP), interview with Commission staff, September 1, 2010.

<sup>347</sup> Internal BP document (BP-HZN-MBI 193558).

<sup>348</sup> *Ibid.*

<sup>349</sup> Guide, interview, September 17, 2010.

<sup>350</sup> When asked by BP investigators if he was aware of BP’s technical guidance regarding lift pressures, Walz stated that at the time he “didn’t make the connection” but now “understands that the mud weight differentials were not high enough to get a valid confirmation of good cement placement. Internal BP document (BP-HZN-BLY 61332).

<sup>351</sup> Confidential industry experts, interview with Commission staff.

<sup>352</sup> Steve Lewis (Expert witness), interview with Commission staff, September 21, 2010.

<sup>353</sup> Richard Sears (Expert witness), email to Fred Bartlit, September 20, 2010; Confidential industry experts, interviews.

<sup>354</sup> BP, *Deepwater Horizon Accident Investigation Report*, 36. BP investigator Mark Bly elaborated that using those criteria, “in hindsight, those could have caused the team to think a bit more carefully about it.” Testimony of Mark Bly, 202-03, 375.

<sup>355</sup> Internal BP document (BP-HZN-MBI 195582).

<sup>356</sup> See, e.g., Steve Lewis (Expert witness), email to Commission staff, October 13, 2010. Not surprisingly, Halliburton has stated since the blowout that a cementing operation cannot be successfully concluded without performing a cement bond log. Testimony of Richard Vargo, 318-19, 321.

<sup>357</sup> Gregg Walz, interview with Commission staff, October 16, 2010.

<sup>358</sup> Gagliano, interview; Testimony of Jesse Gagliano, 270-71; Nelson and Guillot, eds., *Well Cementing*, 583.

<sup>359</sup> See, e.g., Tommy Roth (Halliburton), House Energy and Commerce Committee Staff Briefing, June 3, 2010; Testimony of Tommy Roth, presentation to NAE; Testimony of Richard Vargo, 325.

<sup>360</sup> Testimony of Gregg Walz, 53-54.

<sup>361</sup> Gagliano, interview.

<sup>362</sup> *Ibid.*

<sup>363</sup> Testimony of Jesse Gagliano, 335, 360.

<sup>364</sup> Gagliano interview. Gagliano stated that “I was never directly involved with those conversations. That’s usually a decision made by BP. I was in a room when some of those conversations took place, but they weren’t actually talking directly to me. So I have really no decision in that.” *Ibid.*

<sup>365</sup> Testimony of Nathaniel Chaisson, 432.

<sup>366</sup> Testimony of Jesse Gagliano, 249-50; Testimony of Nathaniel Chaisson, 442.

<sup>367</sup> Internal Halliburton document (HAL\_11010). One Macondo well site leader, for instance, did not know that the jagged lines indicated channeling. The report did indicate a “SEVERE” potential for gas flow, which while not an indication of channeling, can be a product of insufficient centralization.

<sup>368</sup> Testimony of Ronnie Sepulvado, 133; Murry Sepulvado, interview with Commission staff, December 10, 2010.

<sup>369</sup> Testimony of Nathaniel Chaisson, 440. In addition, the Halliburton post-job report indicated that the TOC was at 17,300 feet, where it would have been expected without any channeling. Internal Halliburton document (HAL\_11195). However, Halliburton has indicated that this figure is a “volumetric calculation” designed simply to reflect full returns and was not an “engineering analysis.” Halliburton legal team, interview with Commission staff, September 18, 2010.

## Chapter 4.4

<sup>1</sup> Erik B. Nelson and Dominique Guillot, eds., *Well Cementing*, 2nd ed. (Sugar Land, TX: Schlumberger, 2006), 256.

<sup>2</sup> *Ibid.*, 256. “Pounds per gallon” (ppg) units are used here for consistency rather than the more technically precise “pounds-mass per gallon” (lbm/gal).

<sup>3</sup> Jean de Rozieres and Remi Ferriere, “Foamed Cement Characterization Under Downhole Conditions and Its Impact on Job Design,” *SPE Production Engineering* (August 1991), 298.

<sup>4</sup> S.L. Pickett and S.W. Cole, “Foamed Cementing Technique for Liners Yields Cost-Effective Results,” *Society of Petroleum Engineers* 27679 (1994), 521-24. “Failure to stabilize foam will...cause the [nitrogen] bubbles to coalesce and form interconnected flow paths.” *Ibid.*, 523-24.

<sup>5</sup> D.S. Kulakofsky, P.G. Creel, and D.L. Kellum, “Techniques for Planning and Execution to Improve Foam Cement Job Performance,” *Society of Petroleum Engineers* 15519 (1986), 1-2.

<sup>6</sup> Michael T. Olanson, “Application of Foam Cements in Alberta,” *Journal of Canadian Petroleum Technology* (October 1985), 51.

- <sup>7</sup> N.R. Loeffler, “Foamed Cement: A Second Generation,” *Society of Petroleum Engineers* 12592 (1984), 2. “[A]ccurate foam slurry design as confirmed by laboratory testing is an indispensable prerequisite to effective placement design engineering.” *Ibid.*
- <sup>8</sup> American Petroleum Institute, *Recommended Practice on Preparation and Testing of Foamed Cement Slurries at Atmospheric Pressure 10b-4* (July 2004)(“API RP 10b-4”).
- <sup>9</sup> *Ibid.*, § 9.3.4.
- <sup>10</sup> BP and Halliburton used foamed cement on the 28-inch casing and the 22-inch casing. Internal BP document (BP-HZN-OSC 603); Internal BP document (BP-HZN-MBI 14118); Internal BP document (BP-HZN-MBI 14193).
- <sup>11</sup> Internal Halliburton document (GOM foamed cement jobs).
- <sup>12</sup> Erick Cunningham (BP), interview with Commission staff, January 17, 2011.
- <sup>13</sup> *Ibid.*; Internal BP document (BP-HZN-BLY 61276).
- <sup>14</sup> Internal BP document (BP-HZN-MBI 218202).
- <sup>15</sup> Jesse Gagliano (Halliburton), interview with Commission staff, September 10, 2010.
- <sup>16</sup> *Ibid.*
- <sup>17</sup> The February recipe included more retarder than the final recipe because in February BP expected Macondo to be a hotter well than it eventually proved to be. High well temperatures increase the speed at which cement cures. And if cement cures prematurely, it may become impossible to pump before it reaches the bottom of the well. One way to solve this problem is by adding retarder to the cement recipe.
- <sup>18</sup> Internal Halliburton document (HAL\_DOJ 61-62, 67-68).
- <sup>19</sup> Confidential industry expert, interview with Commission staff.
- <sup>20</sup> Internal BP document (BP-HZN-MBI 109218, 109223-24).
- <sup>21</sup> Internal BP document (BP-HZN-MBI 117603).
- <sup>22</sup> *Ibid.*
- <sup>23</sup> Gagliano, interview; Internal Halliburton document (HAL DOJ 35).
- <sup>24</sup> Gagliano, interview.
- <sup>25</sup> Internal Halliburton document (HAL DOJ 35-36).
- <sup>26</sup> Halliburton contends that its lab personnel performed this April 13 test improperly. Donald Godwin (Halliburton), letter to Commission staff, November 18, 2010.
- <sup>27</sup> Internal BP document (BP-HZN-OSC 6224).
- <sup>28</sup> Internal BP document (BP-HZN-MBI 128542).
- <sup>29</sup> Internal BP document (BP-HZN-BLY 47095).
- <sup>30</sup> *Ibid.*
- <sup>31</sup> Internal BP document (BP-HZN-OSC 6224).
- <sup>32</sup> Internal Halliburton document (HAL DOJ 42-43).
- <sup>33</sup> API RP 10b-4 § 7.2(j).
- <sup>34</sup> Internal Halliburton document (HAL DOJ 43). Cement laboratories routinely process samples around the clock in response to the intense time pressures in the drilling industry.
- <sup>35</sup> Donald Godwin (Halliburton), letter to Commission staff, January 7, 2011, 2.
- <sup>36</sup> Halliburton document (presentation to the National Academy of Engineers, September 26, 2010), 7. “The foam slurry was transferred to a stability test cell and cured for 48 hours.” *Ibid.*
- <sup>37</sup> Internal BP document (BP-HZN-MBI 136947).

- <sup>38</sup> Testimony of Richard Vargo (Halliburton), Hearing before the National Commission, November 8, 2010, 367-68.
- <sup>39</sup> Donald Godwin (Halliburton), letter to Commission staff, January 10, 2011, 1; Godwin, letter, January 7, 2011, 2.
- <sup>40</sup> Godwin, letter, January 10, 2011, 2.
- <sup>41</sup> Godwin, letter, January 7, 2011, 2.
- <sup>42</sup> Internal BP document (BP-HZN-MBI 171151).
- <sup>43</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 55-60, 66-68.
- <sup>44</sup> BP, *Deepwater Horizon Accident Investigation Report*, 58. At the time BP issued its report, it was only aware of the results of the final April foam stability test conducted by Halliburton on or about April 18. BP apparently had not yet realized that its personnel had also received testing data from Halliburton on March 8, let alone that Halliburton had not reported the results of two foam stability tests to BP at all.
- <sup>45</sup> *Ibid*, app. K.
- <sup>46</sup> *Ibid*, 59.
- <sup>47</sup> *Ibid*, 60.
- <sup>48</sup> Craig Gardner (Chevron), letter to Commission staff, October 26, 2010.
- <sup>49</sup> Donald Godwin (Halliburton), statement to Commission staff, October 12, 2010.
- <sup>50</sup> Gardner, letter, 2.
- <sup>51</sup> Confidential industry experts, interviews with Commission staff.
- <sup>52</sup> Testimony of Richard Vargo, 360-61.
- <sup>53</sup> Godwin, letter, November 18, 2010.
- <sup>54</sup> Fred Bartlit, letter to Donald Godwin, November 23, 2010.
- <sup>55</sup> American Petroleum Institute, Recommended Practice for Testing Well Cements 10b-2 (January 2007) (“API RP 10b-2”).
- <sup>56</sup> Bartlit, letter, November 23, 2010.
- <sup>57</sup> Confidential industry experts, interviews.
- <sup>58</sup> Nelson and Guillot, eds., *Well Cementing*, 257.
- <sup>59</sup> Internal BP document (BP-HZN-MBI 171151).
- <sup>60</sup> Testimony of Richard Vargo, 362.
- <sup>61</sup> Press Release, Halliburton, Halliburton Comments on National Commission Cement Testing, October 28, 2010; Godwin, letter, November 18, 2010.
- <sup>62</sup> Testimony of Richard Vargo, 363. Halliburton expert Richard Vargo admitted that “based on those [February] results, I would not have, at that time on February 17th, chosen to run that [design] in the well.” *Ibid*.
- <sup>63</sup> *Ibid.*, 366.
- <sup>64</sup> Godwin, letter, November 18, 2010; Donald Godwin (Halliburton), letter to Commission staff, December 9, 2010 (citing HAL DOJ 35, 41, 44).
- <sup>65</sup> If the latter is true, the Chief Counsel believes that Halliburton personnel may have been motivated in part by the fact that a slurry redesign could have required Halliburton to discard the dry blend that was on the *Deepwater Horizon* and deliver a new dry blend to the rig. That process might have cost time and money—especially if Halliburton first realized the problem just before pumping the job.
- <sup>66</sup> Internal BP document (BP-HZN-MBI 130830); Internal BP document (BP-HZN-OSC 6225).
- <sup>67</sup> Internal BP document (BP-HZN-MBI 117603); Internal BP document (BP-HZN-MBI 6225).
- <sup>68</sup> Internal BP document (BP-HZN-MBI 255509).

<sup>69</sup> Internal BP document (BP-HZN-MBI 128542).

<sup>70</sup> Internal BP document (BP-HZN-BLY 47093-95).

<sup>71</sup> Internal BP document (BP-HZN-MBI 257237).

<sup>72</sup> Internal BP document (BP-HZN-MBI 218202).

<sup>73</sup> Internal BP document (BP-HZN-OSC 6224).

<sup>74</sup> BP, *Deepwater Horizon Accident Investigation Report*, 68. “The investigation team saw no evidence that the BP Macondo well team confirmed that all relevant lab test results had been obtained and considered by the Halliburton in-house cementing engineer before cement placement proceeded.” *Ibid.*

<sup>75</sup> Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 388.

<sup>76</sup> BP’s own report admits that “stronger quality assurance by the BP Macondo well team might have identified potential flaws and weaknesses in the slurry design.” BP, *Deepwater Horizon Accident Investigation Report*, 68.

<sup>77</sup> Internal BP document (BP-HZN-MBI 110151).

<sup>78</sup> John Guide (BP), interview with Commission staff, January 19, 2011.

<sup>79</sup> Cunningham, interview.

<sup>80</sup> *Ibid.*

<sup>81</sup> Internal BP document (BP-HZN-OSC 9337).

## Chapter 4.5

<sup>1</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 72.

<sup>2</sup> 30 C.F.R. § 250.1721.

<sup>3</sup> BP repeated the explanation in its internal investigation report, framing certain steps as “required,” without critically analyzing or questioning them. BP, *Deepwater Horizon Accident Investigation Report*, 72. “To install the lockdown sleeve, 100,000 lbs of weight was required on the running tool. This required approximately 3,000 ft. of drill pipe to be run below the running tool. Allowing for this length of drill pipe determined the final cement plug setting depth. In turn, the cement plug setting depth 3,000 ft. below the wellhead influenced the differential pressure created during the negative-pressure test.” *Ibid.*

<sup>4</sup> John Guide (BP), interview with Commission staff, January 19, 2011; Gregory Walz (BP), interview with Commission staff, October 6, 2010; Confidential source, interview with Commission staff; Testimony of Ross Skidmore (Swift), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 61.

<sup>5</sup> Testimony of Ronnie Sepulvado (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 145; BP, *Deepwater Horizon Accident Investigation Report*, 72; Confidential source, interview; Guide, interview, September 17, 2010.

<sup>6</sup> Skidmore, interview; Testimony of Ross Skidmore, 248-49; Walz, interview; Ronnie Sepulvado, interview; David Sims (BP), interview with Commission staff, December 14, 2010; Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 299.

<sup>7</sup> Guide, interview, September 17, 2010; Ronnie Sepulvado, interview; Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 210, 310. A February 11 email discussing an earlier surface plug at Macondo suggests that even that plug “was set in seawater to prevent contamination.” Internal BP document (BP-HZN-MBI 196335).

<sup>8</sup> Ronnie Sepulvado, interview. BP explained this in a filing with the MMS. Internal BP document (BP-HZN-MBI 127909). “The requested surface plug depth deviation is for minimizing the chance for damaging the LDS sealing area.” *Ibid.*

<sup>9</sup> BP’s temporary abandonments of previous wells bear this out, as do interviews with several BP engineers. Internal BP document (BP-HZN-OSC 6083); Internal BP document (BP-HZN-OSC 6158); Murry Sepulvado (BP), interview with Commission staff, December 10, 2010; Ross Skidmore (Swift), interview with

Commission staff, December 21, 2010; John Guide (BP), interview with Commission staff, September 17, 2010.

<sup>10</sup> Ronnie Sepulvado (BP), interview with Commission staff, October 26, 2010; Merrick Kelley (BP), interview with Commission staff, October 22, 2010.

<sup>11</sup> Murry Sepulvado, interview; Skidmore, interview; Guide, interview, September 17, 2010; Kelley, interview.

<sup>12</sup> Kelley, interview; Internal BP document (BP-HZN-OSC 112833); Internal BP document (BP-HZN-OSC 113043).

<sup>13</sup> Internal BP document (BP-HZN-MBI 119062).

<sup>14</sup> *Ibid.*

<sup>15</sup> *Ibid.*

<sup>16</sup> Internal BP document (BP-HZN-MBI 100448).

<sup>17</sup> *Ibid.*

<sup>18</sup> Internal BP document (BP-HZN-MBI 100447).

<sup>19</sup> Internal BP document (BP-HZN-MBI 100445-46). "5.5 rig days at \$400,000 = \$2,200,000." *Ibid.*

<sup>20</sup> Internal BP document (BP-HZN-MBI 100446).

<sup>21</sup> In early January, Hafle inquired: "I was told the LDS could be installed off critical path with an intervention type vessel. Is this possible?" Kelley responded: "We are building the necessary components to convert the Thunderhorse open water tool for use on a H-4 wellhead at present. We plan to use this tool for the Isabela LDS mid this year. Not sure how successful we will be but will have to rely on the rig as a contingency if necessary." Internal BP document (BP-HZN-MBI 100447).

<sup>22</sup> Internal BP document (BP-HZN-MBI 100446). "For the open water cost of installing the LDS...\$480,000." *Ibid.* "If you do it with the rig at the time of the original drilling...\$600,000." *Ibid.*

<sup>23</sup> *Ibid.* "The risk you are exposed to is if the LDS does not land out correctly or the nose seals are damaged and the LDS has to be retrieved (can happen but has not happened to us in the past 5 years)." *Ibid.*

<sup>24</sup> *Ibid.*

<sup>25</sup> Internal BP document (BP-HZN-MBI 127907).

<sup>26</sup> Internal BP document (BP-HZN-MBI 119061).

<sup>27</sup> *Ibid.*

<sup>28</sup> Internal BP document (BP-HZN-MBI 199123).

<sup>29</sup> Internal BP document (BP-HZN-MBI 126145).

<sup>30</sup> *Ibid.*

<sup>31</sup> Internal BP document (BP-HZN-MBI 199123).

<sup>32</sup> Internal BP document (BP-HZN-MBI 126333).

<sup>33</sup> *Ibid.* The next day, Morel forwarded Kelley's email to Gregg Walz. *Ibid.*

<sup>34</sup> Internal BP document (BP-HZN-MBI 126450).

<sup>35</sup> Internal BP document (BP-HZN-MBI 126495).

<sup>36</sup> BP's internal investigator acknowledges that there were multiple changes in plan. Testimony of Mark Bly, 305.

<sup>37</sup> Internal BP document (BP-HZN-MBI 199122).

<sup>38</sup> Internal BP document (BP-HZN-MBI 126180); Internal BP document (BP-HZN-MBI 126189-90).

<sup>39</sup> Internal BP document (BP-HZN-MBI 126585-86).

<sup>40</sup> Internal BP document (BP-HZN-MBI 126982). BP has asked the Commission to disregard this procedure because, among other reasons, it was an email sent to a rig clerk (rather than the engineering team).

However, it was also sent to one of the well site leaders on the rig, Ronnie Sepulvado, and Morel specifically asked for feedback on the procedure.

<sup>41</sup> Internal BP document (BP-HZN-MBI 126982).

<sup>42</sup> *Ibid.*

<sup>43</sup> Internal BP document (BP-HZN-BLY 61203).

<sup>44</sup> Internal BP document (BP-HZN-CEC 21281, 21288). Transocean has claimed that conducting a negative pressure test on the shoe track rather than the cement plug is unusual. In the January 2010 abandonment of the Kodiak well, for instance, the negative pressure test was not done until the cement plug was set. Given the risk factors associated with the production casing cement job, it was prudent for BP to conduct a negative pressure test before setting the cement plug. It is unclear, however, whether that was the reason that BP switched the order of the negative pressure test.

<sup>45</sup> Internal BP document (BP-HZN-CEC 21281-88).

<sup>46</sup> Internal BP document (BP-HZN-CEC 20263); Guide, interview, January 19, 2011.

<sup>47</sup> Internal BP document (BP-HZN-CEC 21281-88). Morel was not the only one who thought that MMS might not approve it. Drilling engineer Mark Hafle emailed Morel and told him, “I really don’t think MMS will approve deep surface plug. We’ll see.” Internal BP document (BP-HZN-MBI 127489). BP’s concern that MMS might not have approved such a deep surface plug suggests that BP may have recognized the risks attendant to setting such a deep plug.

<sup>48</sup> Internal BP document (BP-HZN-MBI 127907). The APM said that the test would be conducted with “seawater gradient equivalent”; base oil is understood to be such an equivalent. This change, of course, also allowed the rig crew the flexibility to use seawater instead of base oil. Murry Sepulvado, interview.

<sup>49</sup> Internal BP document (BP-HZN-BLY 69066-67); Internal BP document (BP-HZN-MBI 127906).

<sup>50</sup> Proponents of this interpretation point to the very plain order provided on the APM: “1. Negative Test...2. TIH [Trip in Hole] with a 3-1/2” stinger to 8367; 3. Displace to seawater.” Internal BP document (BP-HZN-OSC 1436). They note that procedures are meant to be followed sequentially and, as an aside, state that if a different order were intended, this procedure was very poorly written. They also note that the order is in keeping with the April 15 well plan (which called for a negative pressure test at the wellhead), circulated the same day that the APM was prepared. Finally, they note that although a negative pressure test may have made most sense at a depth of 8,367 feet to mimic the underbalanced condition of an abandoned well, negative pressure tests could be conducted at higher depths in a staged testing process—as the BP engineering team in fact planned. Internal BP document (BP-HZN-BLY 61379-80).

<sup>51</sup> BP drilling engineer Brett Cocales and Wells Team Leader John Guide read the second and third steps as subsets of the negative pressure test. Testimony of John Guide, 329-331; Guide, interview, January 19, 2011. Cocales has testified that there would otherwise be no way to know at what depth to conduct the negative pressure test. Testimony of Brett Cocales (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 128-29. Moreover, they believe that 8,367 feet is the only depth at which a negative pressure test would make sense, as that is the only depth at which the test would simulate the temporary abandonment of the well. *Ibid.*, 129.

<sup>52</sup> There may not be much significance beyond that. Conducting the negative pressure test at the wellhead rather than at 8,367 feet would probably not have prevented the blowout. In such a test, the pressure buildup, if any, would have been much more subtle than the 1,400 psi seen on the drill pipe. Given that the rig crew proceeded with abandonment despite observing 1,400 psi on the drill pipe, it is unlikely that they would have stopped the operation upon observing even smaller pressures on the drill pipe. John Smith (Expert witness), interview with Commission staff, October 22, 2010. In addition, there is no reason to think that MMS would have rejected a permit that explicitly stated the negative pressure test would take place at a depth of 8,367 feet. Frank Patton (MMS), interview with Commission staff, October 1, 2010.

<sup>53</sup> Internal BP document (BP-HZN-CEC 20273).

<sup>54</sup> Internal BP document (BP-HZN-BLY 61379-80); Internal BP document (BP-HZN-BLY 20087).

<sup>55</sup> Walz, interview.

<sup>56</sup> Internal BP document (BP-HZN-BLY 61380).

<sup>57</sup> Internal BP document (BP-HZN-BLY 70087).

<sup>58</sup> Guide, interview, January 19, 2011.

<sup>59</sup> Morel sent a second Ops Note within 10 minutes after the first one. It added details and did not change the order of the procedures. Internal BP document (BP-HZN-MBI 195579-80).

<sup>60</sup> Testimony of Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 315.

<sup>61</sup> This would not be a change if one accepted the interpretation that the negative pressure test in the April 16 APM would follow displacement. Internal BP document (BP-HZN-MBI 195579-80).

<sup>62</sup> *Ibid.*

<sup>63</sup> The Ops Note says, “With seawater in kill close annular and do a negative test ~2350 psi differential.” Internal BP document (BP-HZN-MBI 139532). The 2,350 psi is not an expected drill pipe pressure. It describes the reduction in pressure at the bottom of the well by replacing the mud with water in the drill pipe and drill pipe-casing annulus down to 8,367 feet. Although the initial drill pipe pressure at the beginning of the negative pressure test was 2,325 psi, an independent expert has stated that the expected pressure at the beginning of the negative pressure test should have been 1,610 psi. John Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252* (July 1, 2010), 9.

<sup>64</sup> According to Mark Hafle, John Guide made a conscious decision not to notify the MMS of the change. Internal BP document (BP-HZN-BLY 61380). For his part, Guide said he had difficulty remembering any discussion or decision regarding notifying MMS, but agreed that MMS did not need to be notified in this situation. Guide believed that the plan had always been to conduct the negative pressure test at 8,367 feet. Guide, interview, January 19, 2011. Gregg Walz suggested that Hafle may have been the one to make the decision not to notify MMS of the change. Walz, interview. This assertion seems to be in tension with the fact that Hafle called Kaluza on April 20 out of concern that the new procedure departed from the one approved by MMS. Internal BP document (BP-HZN-CEC 20185, 200, 204).

<sup>65</sup> According to his supervisor Gregg Walz, Hafle probably did not seek permission from MMS for deviating from the APM because the deviation resulted in a stricter test. Walz, interview. Conducting a negative pressure test at 8,367 feet would underbalance the well to a much greater degree than conducting a negative pressure test at the wellhead. However, displacing so much mud with seawater to conduct the test still entailed a level of risk.

<sup>66</sup> Internal BP document (BP-HZN-OSC 6158). As at Macondo, this well altered the procedure to shift from (a) conduct negative pressure test, set plug in mud, then displace to seawater, to (b) partially displace, conduct negative pressure test, finish displacement, set plug in seawater. This application also stated that the reason for combining the displacement and negative pressure test was “to improve rig efficiency.” *Ibid.*

<sup>67</sup> Internal BP document (BP-HZN-CEC 20185, 20200, 20204).

<sup>68</sup> This may have been so if rig personnel had conducted a negative pressure test before displacing the well. Prior to displacement, there is neither spacer nor drill pipe in the wellbore. So there would have been no spacer in the well to potentially clog the kill line. And the crew would have sealed the well using the blind shear rams—not the annular preventer—eliminating any suggestion of a “bladder effect.” Darryl Bourgoyne (Expert witness), interview with Commission staff, January 26, 2010; Darryl Bourgoyne (Expert witness), email to Commission staff, January 26, 2010.

<sup>69</sup> BP representatives agree that displacing 8,367 feet of mud from the wellbore increased the underbalance but do not agree that the severity of the underbalance increased risk. “There’s no reason at all to believe that increases the risk.” Testimony of Mark Bly, 209, 215-17. BP is wrong. Greater underbalance in the well places greater stress on the bottomhole cement. More broadly, there was no need to create an underbalance in the first place or to create one before putting more barriers in place.

<sup>70</sup> John Smith (Expert witness), interview with Commission staff, September 7, 2010; Murry Sepulvado, interview; John Guide, interview, January 19, 2011.

<sup>71</sup> The depth of the surface cement plug at Macondo was extremely unusual—perhaps one-of-a-kind. Anadarko representatives, interview with Commission staff, September 29, 2010; Testimony of Richard Vargo (Halliburton), Hearing before the National Commission, November 8, 2010, 212 (has set thousands of plugs in his career and has “never seen it set this deep before”); Walz, interview (cannot recall setting one that deep before); Bill Ambrose (Transocean), interview with Commission staff, November 2, 2010 (unusually deep); Murry Sepulvado, interview (never seen one this deep before); Ronnie Sepulvado, interview (deeper than he had ever seen); Confidential source, interview (deepest in experience); Randy Ezell (Transocean), interview with Commission staff, September 16, 2010 (unusual); Testimony of John Guide, 298 (“it was deeper than normal”); Testimony of Ross Skidmore, 60 (a lot deeper than he had probably seen before); Testimony of Leo Lindner (M-I SWACO), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 316 (“much further down than usual”); Allen Seraile (Transocean),



interview with Commission staff, January 7, 2011 (unusual, hadn't done that before); Transocean legal team, interview with Commission staff, September 21, 2010 (poll of 25 Transocean rigs revealed average displacement depth of 150 feet below mudline).

<sup>72</sup> Testimony of Mark Bly, 308.

<sup>73</sup> BP representatives admit this too. *Ibid.*, 312-13.

<sup>74</sup> BP representatives acknowledge this point as well. *Ibid.*, 308-09; Murry Sepulvado, interview.

<sup>75</sup> Anadarko representatives, interview; Confidential industry expert, interview with Commission staff; Testimony of Merrick Kelley (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 298; Testimony of Ross Skidmore, 250, 259; Steve Lewis (Expert witness), interview, October 20, 2010.

<sup>76</sup> At least one major operator typically sets the lockdown sleeve prior to the surface plug. Confidential industry expert, interview. At least one BP well site leader has done so in the past. Murry Sepulvado, interview. But BP wells team leader John Guide stated that, of the 17 lockdown sleeves he has set in his career, he set all of them last, and doing so was BP's standard practice. Guide, interview, September 17, 2010. It is worth noting that all of those 17 lockdown sleeves were a different model than the one set at Macondo and did not require downward setting force. Guide, interview, January 19, 2011.

<sup>77</sup> BP engineers state that they needed to set the lockdown sleeve last to avoid damaging it. But BP could have managed the risk of damage in other ways and has done so in the past. Kelley, interview. Alternative precautions include installing a seat protector and running pipe more carefully. *Ibid.*

<sup>78</sup> BP, Deepwater Horizon *Accident Investigation Report*, 72; Confidential industry expert, interview; Internal BP document (BP-HZN-MBI 316347) ("Often times this ring is removed."); Internal BP document (BP-HZN-BLY 61330) ("the OD lock-down ring on casing hanger seal assembly was optional and not being run routinely by the E&A team in all wells...it was a common practice").

<sup>79</sup> Joint Industry Task Force to Address Offshore Operating Procedures and Equipment, "Recommendations for Improving Offshore Safety," May 17, 2010, 4.

<sup>80</sup> Internal BP document (BP-HZN-MBI 196718).

<sup>81</sup> Internal BP document (BP-HZN-MBI 119061).

<sup>82</sup> Internal BP document (BP-HZN-MBI 126145); Internal BP document (BP-HZN-CEC 21268).

<sup>83</sup> Skidmore, interview.

<sup>84</sup> Internal BP document (BP-HZN-MBI 126928).

<sup>85</sup> Skidmore, interview. Skidmore approached Morel or Vidrine, or both. *Ibid.*

<sup>86</sup> Internal BP document (BP-HZN-MBI 199250). "DRIL-QUIP recommends running 100,000 lb of weight below the Running Tool.... Weight above the Running Tool can be substituted for weight below the Running Tool." *Ibid.*

<sup>87</sup> Kelley, interview.

<sup>88</sup> Dril-Quip legal team, email to Commission staff, December 27, 2010; Internal BP document (BP-HZN-MBI 44875). "DRIL QUIP recommends running 100,000 lb of weight below the Running Tool.... Weight above the Running Tool can be substituted for weight below the Running Tool." Internal BP document (BP-HZN-MBI 44875).

<sup>89</sup> Internal BP document (BP-HZN-MBI 44858).

<sup>90</sup> Internal BP document (MC 129 #3 APM 82712).

<sup>91</sup> Internal BP document (BP-HZN-OSC 6118).

<sup>92</sup> *Ibid.*

<sup>93</sup> Kelley, interview.

<sup>94</sup> *Ibid.* (recommended 1,250 to 1,350 feet below the mudline).

<sup>95</sup> Internal BP document (BP-HZN-MBI 196174). "MU & GIH w/ lockdown sleeve on 6-5/8" landing string w/ drill collars below." *Ibid.* On November 12, 2009, BP engineer Tippetts told Dril-Quip representative

Patterson, “We will be using [drill collars] for the tailpipe on Macondo.” Internal BP document (BP-HZN-MBI 119061).

<sup>96</sup> Internal BP document (BP-HZN-MBI 196174). On February 22, Tippetts asked BP operations engineer Brett Coteles whether the *Horizon* had the equipment necessary to run the planned drill collars. Coteles informed Tippetts the next day that the *Horizon* did not have the requested equipment and that Tippetts should plan to get it from a supplier. Internal BP document (BP-HZN-MBI 196720).

<sup>97</sup> Internal BP document (BP-HZN-MBI 196719).

<sup>98</sup> In the April 14 forward plan, BP lists the supply vessel *M/V Hilda Lab* as being en route to the rig with nine 6½-inch drill collars on board. Internal BP document (BP-HZN-MBI 199282).

<sup>99</sup> Internal BP document (BP-HZN-MBI 252071). “I keep coming back to sequence of setting casing, set the wear bushing, do the T&A work, pull the bushing, pick drill collars and RIH to set the lock down sleeve.” *Ibid.*

<sup>100</sup> Internal BP document (BP-HZN-CEC 21268).

<sup>101</sup> Internal BP document (BP-HZN-MBI 199229, 199239)(~18 6½-inch range 2 drill collars from Alice Chalmers listed for use in tailpipe; “The tail pipe consisting of HT 55 Drill Pipe & 6 ½” drill collars will be used for achieving the required weight down for the Lock Down Sleeve Installation”).

<sup>102</sup> Internal BP document (BP-HZN-MBI 199282).

<sup>103</sup> Guide, interview, January 19, 2010. Guide stated that the suggestion to use heavyweight drill pipe instead of drill collars came from Transocean senior toolpusher Randy Ezell. *Ibid.*

<sup>104</sup> According to Guide, making up drill collars would not necessarily *add* time because the drill collars could be made up offline. *Ibid.*

<sup>105</sup> On this, all parties (including BP) agree. Testimony of Mark Bly, 211, 213; Testimony of Richard Vargo, 211; Testimony of Bill Ambrose, 214.

<sup>106</sup> Confidential industry expert, interview; Murry Sepulvado, interview; Steve Lewis (Expert witness), interview with Commission staff, October 29, 2010. Chemicals in oil-based mud can cause more disruption to the physical properties of cement, which is water-based, than seawater. Lewis, interview, October 29, 2010.

<sup>107</sup> Internal BP document (BP-HZN-MBI 196335).

<sup>108</sup> Lewis, interview, October 29, 2010; Testimony of Charlie Williams (Shell), Hearing before the National Commission, November 9, 2010, 45.

<sup>109</sup> BP’s internal investigator acknowledges that the company could set mechanical plugs. Testimony of Mark Bly, 310. Many in the industry believe mechanical plugs should be incorporated into routine well design. Confidential industry experts, interview with Commission staff; Murry Sepulvado, interview; Steve Lewis (Expert witness), email to Commission staff, September 20, 2010; Confidential industry expert, interview.

<sup>110</sup> Testimony of Charlie Williams, 44.

<sup>111</sup> An earlier surface cement plug at Macondo appeared to have been “set in seawater to prevent contamination,” but when the rig returned to resume drilling, they found that “the surface plug was not hard” because of “a cement/water [contamination] issue.” That earlier cement plug had been set using a parabow (a metal retainer), which held the cement in place but presented separate complications. Internal BP document (BP-HZN-MBI 196335).

<sup>112</sup> *Ibid.*

<sup>113</sup> *Ibid.*

<sup>114</sup> *Ibid.*

<sup>115</sup> Testimony of Mark Bly, 213. “There’s engineering choices that you make, and I think setting it in mud is something that happens sometimes and sometimes people choose to set them in seawater.” *Ibid.*

<sup>116</sup> Testimony of Mark Bly, 214. “It’s an engineering tradeoff decision.” *Ibid.*

<sup>117</sup> Walz, interview; Internal BP document (BP-HZN-OSC 6083), Internal BP document (BP-HZN-OSC 6158).

<sup>118</sup> Internal BP document (BP-HZN-MBI 126928).

<sup>119</sup> These include the Halliburton Fas Drill (drillable bridge plug), Baker Hughes GT plug (retrievable bridge plug), and parabow (retrievable retainer). Internal BP document (BP-HZN-OSC 6083); Internal BP document (BP-HZN-OSC 6158).

<sup>120</sup> Notably, BP used GT plugs in at least two other wells in 2010, including MC 822 #5 and MC 877 #22. Internal BP document (BP-HZN-MBI 198612). BP engineers also considered running a Halliburton Fas Drill plug. Internal Transocean document (TRN-HCJ 93590); Internal BP document (BP-HZN-OSC 112974) (“We are considering a Fas-Drill retainer for the TA plug, vs a GT plug in the 9-7/8” casing.”).

<sup>121</sup> Internal BP document (BP-HZN-MBI 198666).

<sup>122</sup> Internal BP document (BP-HZN-MBI 198602). “Thanks for confirming the decision to use the GT Plug for abandonment.” *Ibid.* In late February, BP set up a meeting where Morel and Hafle would “go over the necessary Macondo data and needs” and Baker Hughes representative Mark Plante would then make a presentation about the GT plug and procedure. Internal BP document (BP-HZN-MBI 196642). The meeting was originally scheduled for March 3, then postponed “probably until the week of March 8th” because Morel and Hafle were “very busy,” and finally scheduled for March 10. *Ibid.*; Internal BP document (BP-HZN-MBI 196652); Internal BP document (BP-HZN-MBI 196643). In April, Morel indicated that there was “[s]till some discussion on” whether to use the GT plug and that John Guide would be following up. Internal BP document (BP-HZN-MBI 198762). According to Guide, he was not involved in the decision of whether to use a GT plug but has stated that Morel would have known that Guide opposes setting GT plugs. Guide, interview, January 19, 2011.

<sup>123</sup> Internal BP document (BP-HZN-MBI 198666); Internal BP document (BP-HZN-MBI 198910). “Met with Baker today on this issue, and they are going to come back with a proposal based on fixed and firm commitment from BP for the use of these plugs on a longer term basis. Details are TBD, but we talked about some high level options and quantities based on your feedback for upcoming/ongoing work at Macondo, Atlantis and TH.” Internal BP document (BP-HZN-MBI 198910).

<sup>124</sup> Internal BP document (BP-HZN-MBI 199275).

<sup>125</sup> Internal BP document (BP-HZN-MBI 129149-51).

<sup>126</sup> *Ibid.*

<sup>127</sup> Internal BP document (BP-HZN-MBI 128957). “We are at the end of the week and our district would like to know if there is going to be any decision made soon on whether or not the GT packer is going to be run and if so. When it is going to be called out. We just want to make sure you are covered in case something comes up in the weekend.” *Ibid.*

<sup>128</sup> Internal BP document (BP-HZN-MBI 128957).

<sup>129</sup> Internal BP document (BP-HZN-MBI 198919).

<sup>130</sup> Internal BP document (BP-HZN-CEC 21269).

<sup>131</sup> Internal BP document (BP-HZN-MBI 128957).

<sup>132</sup> Internal BP document (BP-HZN-MBI 128959).

<sup>133</sup> Internal BP document (BP-HZN-MBI 129145).

<sup>134</sup> This comment was made on April 14 to the BP engineer negotiating the Baker Hughes contract. Internal BP document (BP-HZN-BLY 68031).

<sup>135</sup> *Ibid.*

<sup>136</sup> Internal BP document (BP-HZN-MBI 251262); Confidential source, interview; Walz, interview; Guide, interview, January 19, 2011; Internal BP document (BP-HZN-OSC 6083); Internal BP document (BP-HZN-OSC 6158); Internal BP document (BP-HZN-MBI 252171).

<sup>137</sup> Testimony of Steve Lewis (Expert witness), Hearing before the National Commission, November 9, 2010, 53-55.

<sup>138</sup> Confidential industry expert, interview with Commission staff; Steve Lewis (Expert witness), interview with Commission staff, September 28, 2010.

<sup>139</sup> BP’s Drilling and Well Operations Practice manual discusses the use of kill weight fluid as a barrier before breaking containment but discusses it as a replacement for (instead of addition to) one of the two required mechanical barriers. Internal BP document (BP-HZN-MBI 130875).

<sup>140</sup> Confidential industry expert, interview with Commission staff; Testimony of Charlie Williams, 45.

<sup>141</sup> As far as after the displacement and abandonment of the well, mud would not remain a barrier indefinitely. Over time, when left static in the wellbore and not circulated, mud suffers from barite fallout and loses its integrity. Therefore, “mud can only be considered a temporary barrier with a restricted life span dependent on the mud weight and temperature.” Joseph Leimkuhler (Shell), letter to Commission staff, September 22, 2010.

<sup>142</sup> BP concedes this. Testimony of Mark Bly, 311, 314.

<sup>143</sup> Internal BP document (BP-HZN-OSC 6083); Internal BP document (BP-HZN-OSC 6158).

<sup>144</sup> Testimony of Charlie Williams, 43-44 (Shell sets three to five plugs); Ezell, interview (normally will set several plugs in addition to the bottomhole cement); Seraile, interview (normally will set two or three plugs before displacing).

<sup>145</sup> Guide, interview, January 19, 2011 (does not recall anyone on the Macondo team suggesting that they should run more than one plug). This may be because setting multiple, intermediate plugs can complicate later re-entry and completion of the well, since retrieving or drilling out the plugs would take time and could disperse debris in the well. *Ibid.* Nevertheless, BP appears to have addressed or accepted these complications in other wells where they have set numerous plugs. Internal BP document (BP-HZN-OSC 6083); Internal BP document (BP-HZN-OSC 6158).

<sup>146</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, September 10, 2010; Steve Lewis (Expert witness), interview with Commission staff, September 21, 2010.

<sup>147</sup> Lewis, interview, September 21, 2010. Performing a displacement with the BOP closed can involve some minor encumbrances, including wear of the choke, kill, and boost lines, added time, and greater mixing of fluids in the wellbore. *Ibid.*

<sup>148</sup> *Ibid.*

<sup>149</sup> Joint Industry Task Force to Address Offshore Operating Procedures and Equipment, “Recommendations for Improving Offshore Safety,” 4.

<sup>150</sup> Testimony of Steve Lewis, 63; Lewis, interview, September 28, 2010. BP wells team leader John Guide stated that temporary abandonment procedures are historically written at the end of a well, not incorporated into the initial drilling program, because the final dimensions of the well are not yet clear. Guide, interview, January 19, 2011. This reasoning is unpersuasive. Many aspects of the well—such as the precise pore pressures of yet-undrilled formations—are not yet clear, but operators still create a casing and drilling fluids program to guide well operations. The engineers then revise those programs as additional information becomes available.

<sup>151</sup> Guide, interview, September 17, 2010. Indeed, because BP recognized Macondo’s production potential early on (from the seismic imaging), it involved completion engineers in the well design process from the very beginning. Sims, interview.

<sup>152</sup> Internal BP document (BP-HZN-MBI 180439); Internal BP document (BP-HZN-CEC 8712).

<sup>153</sup> Internal BP document (BP-HZN-CEC 8892).

<sup>154</sup> Internal BP document (BP-HZN-MBI 126338).

<sup>155</sup> Guide, interview, January 19, 2011.

<sup>156</sup> Internal BP document (BP-HZN-MBI 199123).

<sup>157</sup> Walz’s acknowledgment came in the context of the centralizer decision. Internal BP document (BP-HZN-CEC 22662). This was not a first for the Macondo team. In early March, onshore engineer Brett Cocales sent an email to the rig’s well site leader Earl Lee canceling the conversion of the float equipment on the 16-inch casing. The rig converted the float equipment anyway. This was because Lee did not see Cocales’ email until after the casing had been set and cemented. After learning of the mix-up, Cocales wrote, “I understand. We will work on getting you guys any changes in the future sooner so you will have time to review.” Internal BP document (BP-HZN-MBI 213550-51).

<sup>158</sup> Testimony of Steve Lewis, 63.

<sup>159</sup> A temporary abandonment procedure should be “designed with the same degree of rigor” as the initial well design. Changes in the procedure should be treated with similar rigor: “if you change one cog...you have to consider whether or not it meshes with the others.” Testimony of Steve Lewis, 63-64. The Macondo team

does not appear to have clearly understood whether they should have followed BP's management of change process when changing the temporary abandonment procedures. Macondo team managers David Sims and John Guide stated that changes in the lockdown sleeve setting procedures would not, as a general rule, have required a management of change process. Sims, interview; Guide, interview, September 17, 2010. But BP's own Macondo lockdown sleeve setting procedure appears to set down in writing just such a general rule: "Any deviation, exception or addition to this procedure must be approved by BP or designated representative. BP MOC procedures must be completed prior to implementing any procedural change." Internal BP document (BP-HZN-MBI 199226).

<sup>160</sup> Internal BP document (BP-HZN-MBI 127489).

<sup>161</sup> *Ibid.*

<sup>162</sup> Guide, interview, January 19, 2011.

<sup>163</sup> Internal BP document (BP-HZN-BLY 61203).

<sup>164</sup> Murry Sepulvado, interview.

<sup>165</sup> Internal BP document (BP-HZN-BLY 61361).

<sup>166</sup> Testimony of Steve Lewis, 59; Ronnie Sepulvado, interview.

<sup>167</sup> Confidential source, interview; Walz, interview; Kelley, interview; Internal BP document (BP-HZN-OSC 112884). Before planning the type of pipe, a BP engineer asks "How much pipe is already on the rig that can be used to weight the LIT/LDS?" Internal BP document (BP-HZN-OSC 112884).

<sup>168</sup> Guide, interview, January 19, 2010. Guide stated that the suggestion to use heavyweight drill pipe instead of drill collars came from Transocean senior toolpusher Randy Ezell. *Ibid.*

<sup>169</sup> Internal BP document (BP-HZN-MBI 199236).

<sup>170</sup> According to wells team leader John Guide, temporary abandonment procedures were very standard: displace the wellbore to seawater, negative pressure test, and set a plug. But Guide was speaking only about his own experience. Guide, interview, January 19, 2011. A review of past BP temporary abandonment procedures shows great variation. Internal BP document (BP-HZN-OSC 6083); Internal BP document (BP-HZN-OSC 6158).

<sup>171</sup> Internal BP document (BP-HZN-MBI 130875); Internal BP document (BP-HZN-OSC 7918).

<sup>172</sup> Internal BP document (BP-HZN-OSC 112993).

<sup>173</sup> Internal BP document (BP-HZN-BLY 47094) ("Anyone know if there is any requirements in the MMS regs for a negative test, can't find any specifics?"); Internal BP document (BP-HZN-OSC 112888) ("Regs for Temp Abandonment"); Internal BP document (BP-HZN-MBI 128655) ("If anyone else has any ideas of where something else might be let me know.").

## Chapter 4.6

<sup>1</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 82; John Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252* (July 1, 2010), 17, 25; John Smith (Expert witness), interview with Commission staff, September 7, 2010; Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 285; Testimony of Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 280; Testimony of Richard Vargo (Halliburton), Hearing before the National Commission, November 8, 2010, 285.

<sup>2</sup> Internal BP document (BP-HZN-MBI 136947).

<sup>3</sup> Internal BP document (BP-HZN-MBI 136948); BP, *Deepwater Horizon Accident Investigation Report*, 82.

<sup>4</sup> BP, *Deepwater Horizon Accident Investigation Report*, 82; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 17; Smith, interview, September 7, 2010; Testimony of Mark Bly, 285; Testimony of Bill Ambrose, 280; Testimony of Richard Vargo, 285. Even during the negative pressure test, a leak in the shoe track cement cannot be identified unless some other component of the casing system, such as the float valve equipment, also leaks.

<sup>5</sup> Testimony of John Smith (Expert witness), Hearing before the Deepwater Horizon Joint Investigation Team, July 23, 2010, 265-67.

<sup>6</sup> BP well site leader John Guide said the test was designed “to see if the float equipment and the cement – actually the cement...inside of the casing is holding, [a]nd also the casing itself” and agreed that the negative test is the last evaluative test performed on a well before the BOP is pulled and the rig is demobilized. Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 137-38. Daun Winslow, Transocean General Manager for the Gulf of Mexico region, said, “A negative test...is very important to understand that your barriers are in place and they...work and they hold prior to displacing the seawater and removing the blowout preventers from the wellhead. It’s very important.” Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 209.

<sup>7</sup> Testimony of Mark Bly, 204, 326; Testimony of Bill Ambrose, 204, 326; Testimony of Richard Vargo, 204, 326.

<sup>8</sup> Internal BP document (BP-HZN-OSC 1438).

<sup>9</sup> Internal BP document (BP-HZN-CEC 20190, 20204).

<sup>10</sup> Internal BP document (BP-HZN-CEC 20200-02).

<sup>11</sup> Testimony of Leo Lindner (M-I SWACO), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 273.

<sup>12</sup> Transocean contends that the choke and kill line were not fully displaced of mud. According to their calculations, which they have not shared with the Chief Counsel, the kill line had 22 barrels of mud remaining in it. Bill Ambrose (Transocean), interview with Commission staff, September 21, 2010. Dr. John Smith, an independent expert, has stated that both the volumes pumped and pressures after displacement indicate that the kill line was fully displaced with seawater. John Smith (Expert witness), email to Commission staff, October 3, 2010.

<sup>13</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 9; Internal Halliburton document (HAL\_48974).

<sup>14</sup> BP, *Deepwater Horizon Accident Investigation Report*, 83 and app. Q, 4; Internal BP document (BP-HZN-BLY 47100-02); Testimony of Greg Meche (M-I SWACO), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 215.

<sup>15</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 18; Testimony of Leo Lindner, 287. Dr. Smith writes that “[a] common industry practice to minimize this occurrence is to use an unweighted, viscous spacer to follow a dense fluid that is being displaced up the annulus.” Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 18. Leo Lindner, the M-I SWACO engineer, stated that despite having seawater and spacer mixing, you could still have a good negative pressure test. However, he went on to say that “ideally” you would have all the spacer above the annular preventer. Testimony of Leo Lindner, 288.

<sup>16</sup> Internal BP document (BP-HZN-MBI 129256). M-I SWACO wrote, “I do not know the exact [stinger] tool that will be used but if there are any small restrictions in the assembly [setting up] this would be a risk.” *Ibid.*

<sup>17</sup> Internal BP document (BP-HZN-BLY 47100-01). The BP well site leader, Murry Sepulvado, stated that the shoreside team had supposedly tested the spacer within hours after its use was suggested. Murry Sepulvado (BP), interview with Commission staff, December 10, 2010. However, BP’s own investigation could find no evidence of such a test. “This material is sold by M-I SWACO for lost circulation and has no history or testing for use as a spacer. No evidence of compatibility testing could be found for the Macondo well.” BP, *Deepwater Horizon Accident Investigation Report*, app. Q, 6. And although M-I SWACO recognized the possibility that the lost circulation materials presented certain risks, their communications suggested they had assumed rather than tested their compatibility as a spacer. “We do not feel there would be any restriction that would cause the FORM A SQUEEZE to set up and without [an additive in the FORM A SET] there is no cross linking agent to cause it to set up.” Internal BP document (BP-HZN-MBI 129256). Although BP’s subsequent investigation agreed that it was unlikely that cross-linking caused the blockage, it also found that cross-linking was not the only risk. Solids from the spacer could have plugged the kill line, or the viscosity or gel strength of the spacer could have been too high to allow pressure to be transmitted through the kill line. BP, *Deepwater Horizon Accident Investigation Report*, app. Q, 3, 9.

<sup>18</sup> Testimony of Ronnie Sepulvado (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 129.

<sup>19</sup> Testimony of Leo Lindner, 309-11, 320; Testimony of John Guide, July 22, 2010, 324; Internal BP document (BP-HZN-MBI 129043); Internal BP document (BP-HZN-MBI 129240); Internal BP document (BP-HZN-MBI 129256); Internal BP document (BP-HZN-MBI 129268). The Resource Conservation and Recovery Act (RCRA) identifies materials that are hazardous waste and regulates how hazardous waste is to be managed and disposed of. 42 U.S.C. §§ 6921-6939f. RCRA regulations, however, identify exceptions to material which might otherwise be treated as hazardous waste, including “[d]rilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy.” 40 C.F.R. § 261.4.

<sup>20</sup> Testimony of Leo Lindner, 308-11, 320; Internal BP document (BP-HZN-MBI 129256); Testimony of Greg Meche, 216-18.

<sup>21</sup> Internal BP document (BP-HZN-BLY 47100). It is unclear whether BP or M-I SWACO came up with the original idea to use the lost circulation material as spacer, but BP ultimately approved its use. Testimony of John Guide, July 22, 2010, 323. BP well site leader Ronnie Sepulvado stated that M-I SWACO mud engineer Leo Lindner had presented the idea to him on the rig, but that he assumed he had talked to either BP or M-I SWACO engineers onshore first. Testimony of Ronnie Sepulvado, 126-31. For his part, Lindner testified that he broached the subject with Murry Sepulvado (Lindner may have misidentified the well site leader), but that “it wasn’t an idea that I came up with.” Testimony of Leo Lindner, 297.

<sup>22</sup> Internal BP document (BP-HZN-MBI 129268); Murry Sepulvado, interview.

<sup>23</sup> Testimony of Leo Lindner, 275-76.

<sup>24</sup> Internal BP document (BP-HZN-MBI 133083); Testimony of Leo Lindner, 276. In contrast to other accounts, the BP *Deepwater Horizon Accident Investigation Report* indicates that 424 barrels of spacer and 30 barrels of freshwater were pumped. BP, *Deepwater Horizon Accident Investigation Report*, 83.

<sup>25</sup> Internal BP document (BP-HZN-MBI 133083); BP, *Deepwater Horizon Accident Investigation Report*, 83; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 9; Testimony of Jimmy Harrell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 33; Internal BP document (BP-HZN-CEC 20187, 20204).

<sup>26</sup> BP, *Deepwater Horizon Accident Investigation Report*, 84.

<sup>27</sup> Transocean has indicated that it believes that 100 barrels of spacer remained beneath the BOP, suggesting that two-thirds of the annular volume between the drill pipe and casing was filled with spacer rather than seawater. Ambrose, interview. Generally consistent with Transocean’s view, Dr. John Smith, an independent expert, has estimated that there was spacer at least 1,830 feet below the mudline. Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 9, 18.

<sup>28</sup> The drill pipe pressure that should have been expected here was 1,610 psi. Instead, the reading was 2,325 psi. Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 9; Internal Halliburton document (HAL\_48974).

<sup>29</sup> None of the temporary abandonment procedures that the BP shoreside team prepared included expected pressures for the beginning of the negative pressure test. BP depended on the well site leaders to prepare such calculations. Murry Sepulvado, interview. There is no evidence that anyone present at the start of the test had calculated what pressure ought to have been expected on the drill pipe. One rig crew member, Randy Ezell, reported that toolpusher Jason Anderson had a form with expected drill pipe pressures, but there is no evidence in any of the accounts of the negative pressure test that this form was consulted. Nor is there evidence that Anderson, who worked the evening shift, would have been in the drill shack at this point. Randy Ezell (Transocean), interview with Commission staff, September 16, 2010.

<sup>30</sup> Testimony of Ross Skidmore (Swift), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 386. The kill line pressure had leveled off at 1,250 psi after the rig crew had completed displacing it with seawater. *Ibid*; Internal Halliburton document (HAL\_48974). Skidmore said the drill pipe was bled to 1,200 psi, an insignificant difference.

<sup>31</sup> BP, *Deepwater Horizon Accident Investigation Report*, 24; Internal Halliburton document (HAL\_48974).

<sup>32</sup> Testimony of John Smith (Expert witness), Hearing before the National Commission, November 9, 2010, 139-40. Spacer in the annulus between the drill pipe and the casing would cause the drill pipe pressure to increase and the kill line pressure to drop due to a phenomenon called the u-tube effect. A u-shaped tube with two differently weighted fluids on each side will tend to show increased pressure on one end of the tube as the heavier fluid pushes against the lighter fluid. At Macondo, the heavy weight of the spacer that was only on the annular (or kill line) side would push against the lighter seawater below it and exert pressure on the drill pipe. At the same time, the heavy fluid would act as a barrier to pressure being felt on the kill line.

<sup>33</sup> Evidence suggests that the crew may have recognized the pressure readings were abnormal and ascribed it to u-tubing. Internal BP document (BP-HZN-CEC 20188); Testimony of Chris Pleasant (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 116. However, it appears that the u-tube effect was attributed to supposed residual mud in the kill line rather than spacer beneath the BOP. Testimony of Lee Lambert (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 387.

<sup>34</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 18-19; Testimony of John Smith, November 9, 2010, 140-41.

<sup>35</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 9; Internal Halliburton document (HAL\_48974); Testimony of John Smith, July 23, 2010, 283.

<sup>36</sup> Internal Halliburton document (HAL\_48974)(23 barrels); Internal BP document (BP-HZN-MBI 129629). Although this is the account of the witness at the cement unit, there are other estimates. Two other witnesses described a similar gain as the amount bled by bringing the drill pipe pressure down from 2,325 to 1,250 psi. Testimony of Ross Skidmore, 386 (25 barrels); Internal BP document (BP-HZN-CEC 20226)(25 bbl). Their testimony does not offer how much was bled to bring the drill pipe pressure from 1,250 down to 260 psi. BP has at times suggested that this approximate 23-barrel bleed included the later 15-barrel bleed. BP, *Deepwater Horizon Accident Investigation Report*, 25; Internal BP document (BP-HZN-MBI 129637). There is also general agreement that 60 to 65 barrels were bled "total" to bring the drill pipe pressure to 0 psi. Internal BP document (BP-HZN-CEC 20211); Internal BP document (BP-HZN-CEC 20338, 203347). However, it is unclear whether the "0" refers to the first or last time 0 psi was reached on the drill pipe.

<sup>37</sup> According to one well site leader, volumes expected to be bled should always be calculated ahead of time. Murry Sepulvado, interview. There is no evidence that any of the crew had prepared estimates of how many barrels of seawater would be bled, nor is there any reference in their accounts as to how the volumes bled compared to what they were expecting. Testimony of Darryl Bourgoyne (Expert witness), Hearing before the National Commission, November 9, 2010, 149-50.

<sup>38</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 10; Internal Halliburton document (HAL\_48974).

<sup>39</sup> By comparison, only approximately 6.5 barrels were needed during the positive pressure test to increase the pressure from 0 to 2,500 psi. Internal BP document (BP-HZN-MBI 136948). A return of four times as many barrels when reducing the pressure by half as much should have been seen as anomalous.

<sup>40</sup> Smith identified four negative pressure tests that took place, only two of which were recognized by the crew. Testimony of John Smith, July 23, 2010, 272; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 18.

<sup>41</sup> Testimony of Randy Ezell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 279-80. The leakage beneath the annular preventer after displacement is not unusual. Murry Sepulvado, interview.

<sup>42</sup> Some have theorized that the fluid level was falling at this time not because the annular was leaking, but because the well was losing returns. The drill pipe pressure was therefore rising because the well was flowing, not because spacer was leaking beneath the BOP. Phil Rae, "The Genesis of the Deepwater Horizon Blowout Full Report," *Energy Tribune*, December 8, 2010. The theory itself suffers from a number of shortcomings. It posits that the well was losing returns and flowing at the same time. And even if the well was losing returns, if the annular preventer was closed it would have had to have been leaking in order for the fluid in the riser to fall. Finally, rig crew accounts state that mud levels in the riser were falling. Kaluza said that "some of the mud had dropped." Internal BP document (BP-HZN-CEC 20187). And Harrell stated that "there was fluid coming out of the riser, dropping down in the riser u-tube." Testimony of Jimmy Harrell, 35.

<sup>43</sup> Internal BP document (BP-HZN-CEC 20187). This observation explains how the crew members could have identified that the fluid levels were falling, though it took place as the riser was being topped off.

<sup>44</sup> Testimony of Steve Bertone (Transocean), Hearing before the Deepwater Horizon Joint Investigation, July 19, 2010, 33.

<sup>45</sup> Testimony of Daun Winslow, 78; Testimony of Randy Ezell, 279-80.

<sup>46</sup> Internal BP document (BP-HZN-CEC 20201); Testimony of Randy Ezell, 279-80; Internal BP document (BP-HZN-CEC 20226)(20 bbl). Other accounts say the riser was filled with more mud. Internal Halliburton document (HAL\_48974)(50 bbl); Testimony of Chris Pleasant, 115 (60 bbl).



<sup>47</sup> On the other hand, the crew may not have realized that the dropping fluid levels in the riser meant that fluid was leaking beneath the BOP. Chris Pleasant, a subsea engineer, said that Anderson recognized that mud in the riser had been lost but was “convinced that we didn’t lose no mud through the annular” and that as a group, “[w]e never really had a clear understanding of where the fluid went to.” Testimony of Chris Pleasant, 115-16, 133. Some testimony suggests that the crew believed that mud, rather than spacer, was leaking beneath the BOP (though this still should have triggered concerns, as heavy mud could confound the test as well as spacer). Testimony of Lee Lambert, 288-89; Internal BP document (BP-HZN-CEC 20174-201).

<sup>48</sup> Internal BP document (BP-HZN-CEC 20187, 20201). Kaluza states that “nothing had been bled off that I know of” at the time he arrived. However, he also states that the drill pipe pressure was 1,260 psi when he arrived. Kaluza had surely missed the bleeding of the drill pipe from 2,325 to 1,250 psi to match the kill line. Given his description of what was occurring on the rig floor when he arrived, he likely also missed the bleed of the drill pipe from 1,250 to 260 psi. Internal Halliburton document (HAL\_48974).

<sup>49</sup> According to one BP well site leader, it is common to have such leaks at the annular preventer. The annular preventer is designed to hold pressure from the bottom, not the top. If large amounts of fluid had leaked through, as had happened here, it would be necessary to displace it back to above the BOP. Murry Sepulvado, interview. BP wells team leader also stated that he would have expected the rig crew to flush the spacer above the BOP after learning that it had leaked below the annular preventer. John Guide (BP), interview with Commission staff, January 19, 2011.

<sup>50</sup> Internal BP document (BP-HZN-CEC 20188); BP, *Deepwater Horizon Accident Investigation Report*, 85; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 11; Internal Halliburton document (HAL\_48974).

<sup>51</sup> BP, *Deepwater Horizon Accident Investigation Report*, 85; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 19; John Smith (Expert witness), interview with Commission staff, September, 14, 2010.

<sup>52</sup> When the crew on this occasion shut in the drill pipe, it closed the internal blowout preventer (IBOP). The IBOP is a valve in the top drive (a device suspended from the derrick which turns the drill string below it) on the rig. As the drill pipe pressure sensor was downstream of the IBOP, closing the IBOP prevented the drill pipe pressure from being monitored. When the IBOP was opened, the pressure at the cementing unit increased to 773 psi in less than a minute. However, it is likely that the pressure had been gradually building up at the IBOP while it had been closed. Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 11.

<sup>53</sup> *Ibid.*; Internal Halliburton document (HAL\_48974).

<sup>54</sup> Internal BP document (BP-HZN-CEC 20201); BP, *Deepwater Horizon Accident Investigation Report*, 85-86.

<sup>55</sup> Internal BP document (BP-HZN-CEC 20177, 20189, 20201-02, 20204). According to Kaluza, he wanted to discuss with Vidrine which line Vidrine wanted to monitor the negative pressure test on.

<sup>56</sup> Internal BP document (BP-HZN-CEC 20202-04); Internal BP document (BP-HZN-MBI 129623); Internal BP document (BP-HZN-MBI 129629); Testimony of Chris Haire (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 247. However, Halliburton cementer Chris Haire’s report of a 15-barrel return is confusing given that he places it after the drill pipe pressure reaches 1,400 psi. *Ibid.*

<sup>57</sup> If witness testimony is accurate, it would appear that at this point there was good communication between the kill line and the drill pipe.

<sup>58</sup> Internal BP document (BP-HZN-MBI 129629); BP, *Deepwater Horizon Accident Investigation Report*, 86; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 11.

<sup>59</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 11; Internal Halliburton document (HAL\_48974); BP, *Deepwater Horizon Accident Investigation Report*, 86.

<sup>60</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 19. The BP investigation also focused on this point in the negative pressure test as a moment of critical interpretation, stating that 1,400 psi on the drill pipe was “unexplained unless it was caused by pressure from the reservoir.” BP, *Deepwater Horizon Accident Investigation Report*, 89.

<sup>61</sup> The BP investigation found that “[t]he 1,400 psi drill pipe pressure observed during the negative pressure test best matched communication with the M56A sand through the annulus cement barrier and shoe track barriers.” BP, *Deepwater Horizon Accident Investigation Report*, 216.

- <sup>62</sup> Internal BP document (BP-HZN-CEC 20201-02, 20204); Internal BP document (BP-HZN-CEC 20346).
- <sup>63</sup> Witnesses consistently refer only to two negative pressure tests, one conducted on the drill pipe and one conducted on the kill line. Internal BP document (BP-HZN-CEC 20353-54); Internal BP document (BP-HZN-CEC 20190); Testimony of Jimmy Harrell, 88; Testimony of Randy Ezell, 68.
- <sup>64</sup> Internal BP document (BP-HZN-CEC 20342, 20348); Internal BP document (BP-HZN-CEC 20205); Internal BP document (BP-HZN-CEC 20339); Internal BP document (BP-HZN-CEC 20213); Internal BP document (BP-HZN-MBI 129621); Testimony of Lee Lambert, 334; Ezell, interview. Some of the above witness accounts include toolpusher Randy Ezell as part of the discussion. Ezell, however, testified that he left the drill shack before the drill pipe pressure reached 1,400 psi. Testimony of Randy Ezell, 38-39. Two M-I SWACO mud engineers, Gordon Jones and Blair Manuel, and a Dril-Quip service technician, Charles Credeur, may have been present on the rig floor but may not have taken part in the discussion. Harrell may have been present during an earlier discussion about the negative pressure test—likely regarding the leaking annular—but not concerning the pressure abnormalities. Testimony of Jimmy Harrell, 89-90.
- <sup>65</sup> Internal BP document (BP-HZN-CEC 20334, 20339, 20342, 20346, 20352); Internal BP document (BP-HZN-CEC 20177-78, 20190-20221, 20204-05); Testimony of Lee Lambert, 292.
- <sup>66</sup> Testimony of Lee Lambert, 292.
- <sup>67</sup> Smith, interview, September 7, 2010.
- <sup>68</sup> Internal BP document (BP-HZN-CEC 20204).
- <sup>69</sup> Internal BP document (BP-HZN-CEC 20178).
- <sup>70</sup> Testimony of Lee Lambert, 395-96.
- <sup>71</sup> Testimony of Jimmy Harrell, 117; Internal BP document (BP-HZN-CEC 20204); Internal BP document (BP-HZN-OSC 1438).
- <sup>72</sup> Internal BP document (BP-HZN-CEC 20200). *See also* [Chapter 4.5](#) on temporary abandonment procedures.
- <sup>73</sup> According to Ezell, Vidrine “wasn’t happy with the results from the first test.” Testimony of Randy Ezell, 300.
- <sup>74</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 12; Internal Halliburton document (HAL\_48974); Internal BP document (BP-HZN-CEC 20191, 20205). When the crew initially bled the kill line, 0.6 barrels were bled off to reach 0 psi. When the kill line was shut in, pressure rose to 30 psi. The crew then bled the pressure down to 0 psi again, bleeding off 0.2 more barrels. Internal BP document (BP-HZN-CEC 20205); Internal BP document (BP-HZN-CEC 20351-52).
- <sup>75</sup> Internal BP document (BP-HZN-CEC 20339, 20348, 20352).
- <sup>76</sup> Internal BP document (BP-HZN-CEC 20177-78, 20190, 20204-05). According to Kaluza, the bladder effect was first discussed at the end of the negative pressure test on the drill pipe, to explain the rise in drill pipe pressure to 1,400 psi. The bladder effect was also then discussed during the test on the kill line as an explanation for how there could be 1,400 psi on the drill pipe despite no flow on the kill line.
- <sup>77</sup> Internal BP document (BP-HZN-MBI 262896-97).
- <sup>78</sup> Internal BP document (BP-HZN-CEC 20342, 20359).
- <sup>79</sup> Testimony of Darryl Bourgoyne, 174-75; Testimony of John Smith, November 9, 2010, 175-76; Testimony of Steve Lewis (Expert witness), Hearing before the National Commission, November 9, 2010, 176-77; Murry Sepulvado, interview; Ronnie Sepulvado (BP), interview with Commission staff, October 26, 2010.
- <sup>80</sup> Testimony of Darryl Bourgoyne, 174-75; Murry Sepulvado, interview; Ronnie Sepulvado, interview; Testimony of Bill Ambrose, 208.
- <sup>81</sup> According to Transocean offshore installation manager Jimmy Harrell, both the well site leader and the toolpusher were interpreting the negative pressure test data. Testimony of Jimmy Harrell, 91. Although he was not on the rig floor during the interpretation of results, Harrell understood the negative pressure test to have been successful. *Ibid.*, 117. According to Pat O’Bryan, BP vice president for drilling and completions, Transocean’s toolpusher and driller would be able to interpret the results of a negative pressure test. Testimony of Pat O’Bryan (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 26, 2010, 449-50. And according to John Guide, BP wells team leader, the company man was “one of the people” who were supposed to determine if the negative pressure test was successful or not. Testimony of John Guide, July 22, 2010, 161-62.

<sup>82</sup> Testimony of Randy Ezell, 311-12; Testimony of Paul Johnson (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 356. Though Transocean has also stated it is unclear whether or not its rig personnel had the training and experience to interpret the negative pressure test. Testimony of Bill Ambrose, 207; Internal BP document (BP-HZN-CEC 20334, 20339, 20342, 20346, 20352); Internal BP document (BP-HZN-CEC 20177-78, 20190-20221, 20204-05); Testimony of Lee Lambert, 292.

<sup>83</sup> Vidrine may have made a call to Mark Hafle onshore during the negative pressure test but not talked about the results of the test. Internal BP document (BP-HZN-CEC 20339, 20352); Internal BP document (BP-HZN-CEC 20245). There is testimony from the rig crew that Kaluza called John Guide after the first negative pressure test. Testimony of Chris Pleasant, 117-18. Guide has denied this, and there is no evidence of this in BP's notes of its interviews with Kaluza. Testimony of John Guide, July 22, 2010, 175. Nor is there any conclusive evidence of this in logs of telephone calls made from the rig. While Guide made several brief calls to the rig during the negative pressure test (all under five minutes) in an attempt to determine how the executives' visit was going, he never spoke with the well site leaders. Guide, interview, January 19, 2011; Benjamin Powell (BP legal team), letter to Commission staff, December 22, 2010, telephone log attachment. Ezell states that the rig crew never asked him about the 1,400 psi during the test, though several witness accounts place him in the drill shack for at least some portion of the discussion. Ezell, interview; Internal BP document (BP-HZN-CEC 20342, 20348); Internal BP document (BP-HZN-CEC 20205); Internal BP document (BP-HZN-CEC 20339); Internal BP document (BP-HZN-CEC 20213).

<sup>84</sup> Testimony of Mark Bly, 286-90; Testimony of Bill Ambrose, 286-90; Murry Sepulvado, interview.

<sup>85</sup> Testimony of John Guide, July 22, 2010, 133-34; Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010 187-92; Testimony of Darryl Bourgoyne, 156-58.

<sup>86</sup> John Guide (BP), interview with Commission staff, September 17, 2010. Morel indicated in his internal BP interview that "if negative test unsuccessful the decision tree says contact John Guide." Internal BP document (BP-HZN-MBI 21306).

<sup>87</sup> Testimony of John Guide, July 22, 2010, 234-37. Transocean OIM Harrell had judged even the first test to be a successful one. Testimony of Jimmy Harrell, 26.

<sup>88</sup> Powell, letter, telephone log attachment. According to notes of BP's internal investigation interview of Vidrine, Vidrine may have described the test as "squirrely" but assured Hafle that the 1,400 psi did not indicate a problem because "if there had been a kick in the well we would have seen it." Internal BP document (BP-HZN-CEC 20343, 20348). Hafle's reaction to the 1,400 psi, if he was told about it, was apparently to tell Vidrine to "check the line up." Internal BP document (BP-HZN-CEC 20359); Internal BP document (BP-HZN-BLY 61374). Other accounts suggest Vidrine did not specifically tell Hafle about the drill pipe pressure. Internal BP document (BP-HZN-CEC 20234). But Hafle's account states that he had INSITE up on his computer screen during the call, a program that allowed him to access data transmitted from the rig. Internal BP document (BP-HZN-BLY 61374).

<sup>89</sup> Telephone logs show that wells team leader John Guide made several brief phone calls to the rig during the course of the test. (Powell, letter, telephone log attachment). Guide explained that he was calling to inquire about the progress of the VIP tour and did not discuss the course of the negative pressure test. Guide, interview, January 19, 2011.

<sup>90</sup> There are multiple ways that the spacer could have prevented flow from the kill line. Spacer could have clogged the kill line by either a phenomenon known as "bridging," by acting as a gelatin (the stiffening that occurs when the spacer is stationary), or by exerting a higher yield point and yield stress than the seawater above it. Regardless of how it acted, the important point may be that the clogging would not have needed to act as a complete barrier against the 1,400 psi in the drill pipe. Dr. John Smith has indicated that the spacer would only have needed to absorb 100 to 200 psi to prevent flow. Smith, interview, September, 14, 2010. Even if it did not clog the kill line, the heavy spacer beneath the BOP would have handicapped the test. Murry Sepulvado, interview. If the intent in displacing the well with seawater to 8,367 feet was to simulate conditions after abandonment, the presence of heavy spacer beneath the BOP defeated it. The cement shoe at the bottom of the well was expected to hold back formation pressures from below with only a column of water above 8,367 feet on top of it. Like a heavy weight compressing a spring below it, the heavier spacer would have exerted additional pressure from above that would have prevented the shoe cement from bearing the full formation pressure it would face in abandonment. Once displacement of the riser resumed after the negative pressure test, however, this heavy spacer would be removed.

<sup>91</sup> There are problems associated with each of these theories. BP has suggested that a valve connecting the kill line to the BOP may have been accidentally left closed during the negative pressure test. BP, *Deepwater Horizon Accident Investigation Report*, 87. However, that valve would have been opened minutes before during the negative pressure test on the drill pipe. The theory thus assumes that the valve was closed and

then almost immediately forgotten about. Transocean has suggested the kill line may have been clogged with mud, as it was never fully displaced during preparations for the negative pressure test. Ambrose, interview. However, Dr. John Smith has stated that both the volumes pumped and pressures after displacement indicate the kill line was fully displaced with seawater. Smith, email. While well site leader John Guide and drilling engineer Brian Morel have suggested that hydrates from migrating gas may have frozen in the kill line, no evidence has been produced suggesting that this actually took place or that gas had made it to the BOP as early as the time of the negative pressure test. Guide, interview, September 17, 2010; Internal BP document (BP-HZN-CEC 20247).

<sup>92</sup> Deepwater Horizon Study Group, *The Macondo Blowout: 3rd Progress Report* (December 5, 2010), app. B, 10; National Academy of Engineering, *Interim Report on Causes of Deepwater Horizon Oil Rig Blowout and Ways to Prevent Such Events* (November 16, 2010), 9-10.

<sup>93</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 19.

<sup>94</sup> For this reason, Transocean indicated “that spacer placement became ever so important but may have been overlooked. And that added confusion, and in that regards the test became more complicated.” Testimony of Bill Ambrose, 207.

<sup>95</sup> Internal BP document (BP-HZN-BLY 47100).

<sup>96</sup> Wells team leader John Guide agreed that personnel on the rig should have done so. Guide, interview, January 19, 2011.

<sup>97</sup> Testimony of John Guide, July 22, 2010, 333; Testimony of Daun Winslow, 194-95.

<sup>98</sup> Testimony of John Guide, July 22, 2010, 333. Well site leader Don Vidrine stated that there is “[n]o standard procedure on how to do these...leave to rig on how to do procedure.” Internal BP document (BP-HZN-CEC 20335).

<sup>99</sup> Testimony of Daun Winslow, 194-95. The previous negative pressure tests performed by the *Deepwater Horizon* crew at the Kodiak II and Tiber wells had been devised by the well site leader Murry Sepulvado and toolpusher Jason Anderson. Their method was to displace the choke, kill, and boost lines with seawater and to displace the drill pipe with spacer and seawater until the drilling mud was above the annular preventer. The method's use of the drill pipe to conduct the negative pressure test explains why the test was initially conducted on the drill pipe, despite the fact that the later APM stated that the negative pressure test would be done “with the kill line.” According to Ezell, this method was printed out and laminated by Murry Sepulvado and available in the drill shack. However, neither Murry nor Ronnie Sepulvado recalls such a procedure. Moreover, the procedure was “generic” in the sense that it did not include specific volumes or pressures to be expected on an individual well. Testimony of Leo Lindner, 347-48; Guide, interview, September 17, 2010; Ezell, interview; Murry Sepulvado, interview; Ronnie Sepulvado, interview.

<sup>100</sup> Before unlatching from the well in anticipation of Hurricane Ida, Transocean's *Marianas* conducted a negative pressure test. The negative pressure test was different in several ways. It used base oil rather than seawater. The kill line was displaced rather than the drill pipe. There was no displacement beneath the wellhead. The choke and boost lines were not displaced beforehand. Internal BP document (BP-HZN-MBI 172005).

<sup>101</sup> Testimony of Leo Lindner, 271-72.

<sup>102</sup> In September 2010, BOEMRE, the agency formerly known as MMS, proposed to update its regulations. The new regulations require that a negative pressure test be performed on intermediate and production casing strings, that test procedures and criteria be provided on the permit application, and that the results of the test be available for inspection. 30 C.F.R. § 250.423(c); Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf, 75 Fed. Reg. 63346, 63373 (October 14, 2010).

<sup>103</sup> Negative pressure tests are done only if the well will experience a similar underbalanced pressure condition during temporary abandonment. In many wells (especially land wells) the well is abandoned in an overbalanced state, so a negative pressure test is not necessary. Testimony of John Smith, November 9, 2010, 153; Darryl Bourgoyne (Expert witness), email to Commission staff, December 24, 2010.

<sup>104</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 17.

<sup>105</sup> *Ibid.*

<sup>106</sup> Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf, 75 Fed. Reg. 63346, 63373 (October 14, 2010); John Smith (Expert witness), interview with Commission staff, October 26.

<sup>107</sup> Murry Sepulvado, interview.

<sup>108</sup> Internal BP document (BP-HZN-CEC 20352); Internal BP document (BP-HZN-CEC 20191-92); Internal BP document (BP-HZN-CEC 20264).

<sup>109</sup> Internal BP document (BP-HZN-MBI 262896-97); Internal BP document (BP-HZN CEC 20196).

<sup>110</sup> Testimony of Bill Ambrose, 291; Internal Transocean document (TRN-HCEC 5402).

<sup>111</sup> Testimony of Bill Ambrose, 205-07.

<sup>112</sup> Smith, interview, October 26, 2010; Darryl Bourgoyne (Expert witness), interview with Commission staff, October 26, 2010.

<sup>113</sup> Guide, interview, January 19, 2010; Pat O'Bryan (BP), interview with Commission staff, December 17, 2010.

<sup>114</sup> Murry Sepulvado, interview.

<sup>115</sup> Internal BP document (BP-HZN-MBI 126180, 126189-90). Morel was certainly unfamiliar with whether there were any regulatory requirements for the negative pressure test. He asked in one email, apparently sent after the APM had been submitted, "Anyone know if there is any requirements in the MMS regs for a negative test, can't find any specifics?" and later said "If anyone else has any ideas of where something else might be let me know." Internal BP document (BP-HZN-BLY 47094); Internal BP document (BP-HZN-MBI 128655).

<sup>116</sup> Internal BP document (BP-HZN-MBI 126585-86).

<sup>117</sup> Testimony of Jimmy Harrell, 26-28; Ezell, interview. Harrell's testimony indicates that the omission of the negative pressure test may have occurred during briefing on April 19 or April 20. Testimony of Jimmy Harrell, 76-77, 115-16. It seems difficult to understand that Kaluza would have omitted the test from a briefing on the morning of April 20, as he (1) had discussed the test during the rig call earlier that morning, (2) had asked Lindner how they conducted the negative pressure test on earlier wells after the rig call, and (3) had just received Morel's Ops Note, which included the negative pressure test. Gregory Walz (BP), interview with Commission staff, October 6, 2010; Testimony of Leo Lindner, 271-72; Internal BP document (BP-HZN-MBI 195580).

<sup>118</sup> Independent experts have stated that these calculations should have been part of the temporary abandonment procedure. Testimony of John Smith, November 9, 2010, 147; Testimony of Darryl Bourgoyne, 148.

<sup>119</sup> Internal BP document (BP-HZN-CEC 20206).

<sup>120</sup> Internal BP document (BP-HZN-BLY 61380).

<sup>121</sup> Internal BP document (BP-HZN-MBI 133083).

<sup>122</sup> According to Kaluza's account in his interview with BP investigators, he left the rig floor after Leo Lindner's 3 p.m. safety meeting and did not arrive until Wyman Wheeler was filling the riser with mud after the fluid level had fallen. Internal BP document (BP-HZN-CEC 20200-01). According to BP's own investigators' notes, Kaluza "was in office and did not know volume." Internal BP document (BP-HZN-CEC 20207). However, Randy Ezell's testimony suggests that Kaluza may have been present at the time that he and the executive tour arrived at the drill shack. Testimony of Randy Ezell, 279-80.

<sup>123</sup> If Kaluza was not on the rig floor as the annular leaked, it may explain his statement to investigators that "spacer was above the top annular" even though it had by this point migrated beneath it. Internal BP document (BP-HZN-CEC 20201); Internal BP document (BP-HZN-CEC 20174).

<sup>124</sup> Murry Sepulvado, interview.

<sup>125</sup> Darryl Bourgoyne (Expert witness), email to the Commission staff, December 18, 2010; Steve Lewis (Expert witness), email to Commission staff, December 29, 2010. BP wells team leader John Guide also stated that he would expect well site leaders to be in the drill shack when the negative pressure test is run. Guide, interview, January 19, 2011. BP management appears to encourage well site leader presence on the rig floor. Kaluza's most recent performance evaluation before the blowout criticized him for not spending enough time there, warning that safety could not be assured from sitting in the well site leader's office. It is not clear, however, what occasions the evaluation was referring to, as the Chief Counsel's team was unable to interview Kaluza or his evaluator. Kaluza was criticized for "giving priority to WSL office preparation for meetings;" "can't assure HSE [Health, Safety, and Environment] and rig operation performance or be aware of the details of how the crews are executing their jobs from WSL office;" "he should spend more time on the

rig floor;" and "should spend more time out on deck and other parts of the rig to work with the crews towards safety performance improvement." Internal BP document (BP-HZN-MBI 193097).

<sup>126</sup> Internal BP document (BP-HZN-CEC 20207).

<sup>127</sup> Internal BP document (BP- HZN-CEC 20174, 20185-87, 20201, 20204).

<sup>128</sup> Lewis, email. A former well site leader has stated that while he would not have felt that examining it personally would have been required, he would have examined the spacer if his time allowed. Bourgoyne, email, December 28, 2010.

<sup>129</sup> Testimony of Mark Bly, 286-90; Testimony of Bill Ambrose, 286-90. Morel stated that his Ops Note directed that results of the positive pressure test on the surface cement plug were to be sent to Houston, but there was "no similar requirement for negative test." Internal BP document (BP-HZN-CEC 20235).

<sup>130</sup> Guide, interview, September 17, 2010; Internal BP document (BP-HZN-MBI 21306).

<sup>131</sup> Internal BP document (BP-HZN-MBI 21330); Internal BP document (BP-HZN-MBI 129616); Testimony of John Guide, July 22, 2010, 197.

## Chapter 4.7

<sup>1</sup> Transocean asserts that a reduced pump efficiency during the final displacement potentially "skew[ed] the measurement of returns and potentially mask[ed] the entry of hydrocarbons into the well." Transocean legal team, letter to Commission staff, November 5, 2010. Even if true, this assertion does not alter the Chief Counsel's team's findings. The analysis in this section is based on data anomalies that *are* apparent (despite any error in pump efficiency). A correct pump efficiency would only have made *more* anomalies apparent. Furthermore, if the pump efficiency did indeed decrease, rig personnel properly monitoring the data by performing volumetric calculations should have detected the change during the displacement itself and taken actions to resolve the discrepancy. Darryl Bourgoyne (Expert witness), interview with Commission staff, November 23, 2010.

<sup>2</sup> Rig personnel can augment an existing barrier, such as by increasing the weight of the mud in the well, or put in place a separate barrier, such as by closing in the well with the BOP.

<sup>3</sup> Hearing to Review Recent Issues in Offshore Oil and Gas Development, Before the S. Comm. on Energy and Natural Resources, 111th Cong. (May 11, 2010)(statement of F.E. Beck, Texas A&M University).

<sup>4</sup> There are several more parameters that rig personnel use to detect whether a kick is developing, including rate of penetration and changes in the salinity and electrical resistivity of mud. American Petroleum Institute, *Recommended Practice for Well Control Operations* 59, 2nd ed. (May 2006), 33 ("API RP 59").

<sup>5</sup> Internal BP document (BP-HZN-BLY 61693).

<sup>6</sup> API RP 59, 33; Doug Slitor (MMS), "Drilling Operations and Equipment" (presentation to Commission staff, August 3, 2010), 33.

<sup>7</sup> A displacement will also not appear to be closed-loop, even if all fluids come into and out of the pits, if the pits involved in the fluid transfer are not all selected as part of the active pit system. For example, when fluid going into the well is taken from an active pit, but fluid coming out of the well is returned to a reserve pit.

<sup>8</sup> Transocean personnel typically performed this calculation by hand, periodically throughout a displacement. Allen Seraile (Transocean), interview with Commission staff, January 7, 2011. The Sperry-Sun system may calculate volume-in automatically. Testimony of Joseph Keith (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, December 7, 2010, part 1, 193. But it does not compare volume-in and volume-out to compute pit gain automatically. Testimony of John Gisclair (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, December 7, 2010, part 2, 137.

<sup>9</sup> Testimony of John Gisclair (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, October 8, 2010, 100.

<sup>10</sup> API RP 59, 33. Because the two numbers are derived in different ways (one a measurement, the other a calculation), the difference between them need not be zero so much as constant. Testimony of John Gisclair, October 8, 2010, 101.

<sup>11</sup> API RP 59, 33.

- <sup>12</sup> *Ibid.*, 34. Rig personnel should carefully investigate each of these other phenomena as well. Rig heave can be accounted for by monitoring for several heave cycles. Thermal expansion would be exceedingly slow and should be watched. And ballooning would have to be fingerprinted and applies only if open hole sections are exposed, which was not the case at the time of the Macondo explosion. Darryl Bourgoyne (Expert witness), email to Commission staff, December 16, 2010.
- <sup>13</sup> The amount of residual flow is rig-specific and can be as high as 120 barrels. Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.
- <sup>14</sup> Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, part 2, 199.
- <sup>15</sup> Testimony of John Guide, October 7, 2010, 199; Testimony of John Gisclair (Halliburton), Hearing before the National Commission, November 8, 2010, 230. “When you’re staring at these traces, you’re going to have to wait a significant number of minutes in some cases to notice a certain trend.” Testimony of John Gisclair, November 8, 2010, 230.
- <sup>16</sup> Drill pipe pressure is actually represented by stand pipe pressure. The stand pipe is a line connecting the pumps to the drill pipe (via the kelly hose and top drive). The pressure sensor is located on that line. Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.
- <sup>17</sup> Testimony of John Gisclair, October 8, 2010, 135.
- <sup>18</sup> Bourgoyne, email, December 16, 2010.
- <sup>19</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, October 26, 2010; John Smith (Expert witness), interview with Commission staff, October 26, 2010.
- <sup>20</sup> Bourgoyne, interview, October 26, 2010; Smith, interview, October 26, 2010.
- <sup>21</sup> John Smith (Expert witness), interview with Commission staff, September 7, 2010.
- <sup>22</sup> API RP 59, 34.
- <sup>23</sup> Darryl Bourgoyne (Expert witness), email to Commission staff, November 23, 2010.
- <sup>24</sup> API RP 59, 34; Testimony of John Gisclair, October 8, 2010, 227-29; Bourgoyne, interview, October 26, 2010; Smith, interview, October 26, 2010.
- <sup>25</sup> API RP 59, 34. But “Until a confirmation can be made as to whether the cause is a hole or a well kick, a kick should be assumed.” *Ibid.*
- <sup>26</sup> Bourgoyne, interview, October 26, 2010; Smith, interview, October 26, 2010.
- <sup>27</sup> BP’s decision tree on monitoring wellbore pressure, included in its Macondo well drilling program, identifies an increase in gas as an indication of increasing pore pressure and a reason to stop drilling and check for flow. Internal BP document (BP-HZN-BLY 39344).
- <sup>28</sup> Steve Lewis (Expert witness), interview with Commission staff, September 2, 2010.
- <sup>29</sup> Bourgoyne, email, December 16, 2010.
- <sup>30</sup> Internal Transocean document (TRN-HCEC 90727); Bill Ambrose (Transocean), interview with Commission staff, September 30, 2010.
- <sup>31</sup> Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR).
- <sup>32</sup> *Ibid.*
- <sup>33</sup> Testimony of John Gisclair, November 8, 2010, 233. “Most of the data that is in that Sperry database was transmitted to us realtime from Transocean.” *Ibid.*
- <sup>34</sup> Internal BP document (BP-HZN-BLY 38391); Testimony of John Gisclair, November 8, 2010, 234.
- <sup>35</sup> Testimony of John Gisclair, November 8, 2010, 233; Testimony of Joseph Keith, 113.
- <sup>36</sup> Testimony of John Gisclair, October 8, 2010, 96; Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR).
- <sup>37</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.

<sup>38</sup> *Ibid.*; Bill Ambrose (Transocean), interview with Commission staff, September 21, 2010; Testimony of John Gisclair, October 8, 2010, 109-10. Indeed, setting an alarm for pit volume change is typically standard operating procedure. *Ibid.*, 109-10.

<sup>39</sup> Ronnie Sepulvado (BP), interview with Commission staff, October 26, 2010.

<sup>40</sup> Joseph Keith (Halliburton), interview with Commission staff, October 6, 2010; Darryl Bourgoyne (Expert witness), interview with Commission staff, September 10, 2010; Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.

<sup>41</sup> Testimony of John Gisclair, October 8, 2010, 99; Internal BP document (BP-HZN-MBI 21292).

<sup>42</sup> Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR).

<sup>43</sup> Testimony of John Gisclair, October 8, 2010, 97.

<sup>44</sup> Internal BP document (BP-HZN-MBI 21292).

<sup>45</sup> Testimony of John Gisclair, October 8, 2010, 109; Testimony of Joseph Keith, 113.

<sup>46</sup> Another difference between the sensors was their mode of measurement. The Hitec flow-out sensor measured flow-out in terms of a percentage of total flow; the Sperry-Sun sensor measured it in terms of gallons per minute. Randy Ezell (Transocean), interview with Commission staff, September 16, 2010. In terms of crew reliance, Transocean and BP rig personnel looked at the Hitec flow-out meter. Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 302. The Sperry Drilling mudlogger did not understand the readings from the Hitec flow-out sensor and did not rely on it. Keith, interview; Testimony of Joseph Keith, 172-73.

<sup>47</sup> Testimony of Joseph Keith, 152-53.

<sup>48</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; Murry Sepulvado (BP), interview with Commission staff, December 10, 2010. Returns first go to the gumbo box, then split off to either the shakers or overboard. Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.

<sup>49</sup> Internal Transocean document (TRN-HCEC 90727). “There were no reported discrepancies for pit volumes, [flow-out] indicators, mud pump strokes or weight,” and the inspectors’ “scan of the pages did not show any anomalies.” *Ibid.* All of the gauges were in good condition and had proper calibration labels; and the driller and electronics technician confirmed “the condition of the drilling instruments and that the system operated without any problems.” *Ibid.*

<sup>50</sup> Testimony of Stephen Bertone (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 30; Testimony of Michael Williams, Hearing before the Deepwater Horizon Joint Investigation Team, July 23, 2010, 42; Seraile, interview.

<sup>51</sup> Testimony of Stephen Bertone, 195-96; Testimony of John Guide, July 22, 2010, 63; Testimony of Michael Williams, July 23, 2010, 104.

<sup>52</sup> Testimony of Stephen Bertone, 197-200; Testimony of Michael Williams, 42, 99-101. On a prior well, a crash of the *Horizon A*-chair coincided with a well control incident. *Ibid.*

<sup>53</sup> Testimony of John Guide, July 22, 2010, 63; Testimony of Stephen Bertone, 199; Testimony of Michael Williams, 102-03. They may have also replaced some of the chairs’ software. Testimony of Paul Johnson (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, part 2, 164. Transocean planned to entirely upgrade the hardware and software at a later date, after the *Horizon* left the Macondo well. Internal Transocean document (TRN-HCEC 90727); Testimony of Paul Johnson, 164. According to one witness, Transocean was waiting to see how the upgraded package worked on a sister rig before installing it on the *Horizon*. Testimony of Michael Williams, 99.

<sup>54</sup> Testimony of John Guide, July 22, 2010, 63; Testimony of Stephen Bertone, 200; Testimony of Paul Johnson, 164-65; Seraile, interview.

<sup>55</sup> Internal Transocean document (TRN-HCEC 90727).

<sup>56</sup> Testimony of Stephen Bertone, 199. Even if the chairs had crashed on April 20, the Sperry-Sun system would have remained operational. Seraile, interview.

<sup>57</sup> Testimony of Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 239; Testimony of John Gisclair, November 8, 2010, 240-41.

<sup>58</sup> Internal BP document (BP-HZN-MBI 21442).



- <sup>59</sup> Testimony of Micah Burgess (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 94-95.
- <sup>60</sup> Internal BP document (BP-HZN-BLY 38370, 38378).
- <sup>61</sup> Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 247-48; Testimony of Micah Burgess, 84.
- <sup>62</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.
- <sup>63</sup> Testimony of Darryl Bourgoyne, 179.
- <sup>64</sup> *Ibid.*; Testimony of Micah Burgess, 84. “Roles as the driller would be just to – I mean, to maintain, watching the well, know drilling, and make sure, you know, I had the authority to shut the well in at any time I had any doubt about anything.” Testimony of Micah Burgess, 84.
- <sup>65</sup> Internal BP document (BP-HZN-MBI 21434).
- <sup>66</sup> *Ibid.*; Testimony of Micah Burgess, 97.
- <sup>67</sup> Testimony of Allen Seraile (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 129-30.
- <sup>68</sup> Internal BP document (BP-HZN-MBI 139541).
- <sup>69</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.
- <sup>70</sup> Seraile, interview.
- <sup>71</sup> Testimony of Mark Bly, November 8, 2010, 249.
- <sup>72</sup> Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR); Testimony of Mark Bly, November 8, 2010, 249; Testimony of Joseph Keith, 18. “Sperry Drilling Services (Unit # 82418) was contracted to perform surface data logging and pore pressure prediction services by BP Exploration and Production for the Macondo Prospect 001 ST00BP00 in Mississippi Canyon Block 252.” Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR).
- <sup>73</sup> Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR); Testimony of John Gisclair, October 8, 2010, 140; Testimony of Joseph Keith, 27.
- <sup>74</sup> Testimony of Micah Burgess, 100.
- <sup>75</sup> Cathleenia Willis (Halliburton), interview with Commission staff, October 21, 2010.
- <sup>76</sup> Testimony of Joseph Keith, 22-23.
- <sup>77</sup> Internal BP document (BP-HZN-BLY 38334).
- <sup>78</sup> Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR); Willis, interview.
- <sup>79</sup> Testimony of Mark Bly, November 8, 2010, 247; Testimony of Ronnie Sepulvado (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 78.
- <sup>80</sup> Bourgoyne, interview, September 10, 2010; Steve Lewis (Expert witness), interview with Commission staff, September 21, 2010; Ezell, interview. Transocean argues that the BP company man should monitor all critical operations and that the final displacement was a critical operation. Transocean legal team, interview with Commission staff, August 17, 2010. BP disagrees. Mark Bly (BP), interview with Commission staff, September 8, 2010.
- <sup>81</sup> Lee Lambert (BP), interview with Commission staff, September 17, 2010; Ezell, interview; Testimony of Joseph Keith, 110-11; Ronnie Sepulvado (BP), interview with Commission staff, August 20, 2010.
- <sup>82</sup> Internal BP document (BP-HZN-MBI 21458).
- <sup>83</sup> *Ibid.*
- <sup>84</sup> Ezell, interview.
- <sup>85</sup> Internal BP document (BP-HZN-MBI 21456).
- <sup>86</sup> Ezell, interview.
- <sup>87</sup> Internal BP document (BP-HZN-MBI 21448).

- <sup>88</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; Ezell, interview.
- <sup>89</sup> This feature was called *INSITE Anywhere*. Testimony of Michael Beirne (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 6, 2010, part 2, 18-19, 34.
- <sup>90</sup> Testimony of Bill Ambrose, 240; Testimony of John Guide, July 22, 2010, 418-419.
- <sup>91</sup> Testimony of Brett Cocola, Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 233-35.
- <sup>92</sup> Testimony of John Guide, October 7, 2010, 152; Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR); Internal Halliburton document (HAL\_50546)(log showing BP, Anadarko, MOEX, and Halliburton personnel accessing INSITE).
- <sup>93</sup> Testimony of Michael Beirne, 18-19. Co-owners Anadarko and MOEX had a contractual right to the data, and their personnel accessed it. *Ibid.*, 18-19, 96-97; Internal BP document (BP-HZN-MBI 173481-83, 174919, 175868).
- <sup>94</sup> Testimony of Mark Bly, November 8, 2010, 234; Testimony of Mark Bly (BP), Hearing before the National Academy of Engineering, September 26, 2010; Mike Zanghi (BP), interview with Commission staff, December 15, 2010; Internal BP document (BP-HZN-MBI 175868).
- <sup>95</sup> Testimony of John Gisclair, October 8, 2010, 103; Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR).
- <sup>96</sup> Testimony of John Gisclair, October 8, 2010, 107-08; Testimony of John Gisclair, December 7, 2010, 25-26.
- <sup>97</sup> Testimony of Brett Cocola, 234; Testimony of Joseph Keith, 242.
- <sup>98</sup> Testimony of Paul Johnson, 332; Testimony of Bill Ambrose, 240.
- <sup>99</sup> Testimony of Bill Ambrose, 238.
- <sup>100</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; Testimony of Bill Ambrose, 223. Some data display systems record metadata of user settings including what screen the user has up at any given time, what alarm thresholds the user has set, when an alarm activates, and when the user acknowledges an alarm. Dan Jenkins (Oilfield Instrumentation), interview with Commission staff, November 12, 2010. This does not appear to have been the case with the Sperry-Sun and Hitec systems on the *Deepwater Horizon*.
- <sup>101</sup> Testimony of Bill Ambrose, 223.
- <sup>102</sup> Testimony of John Gisclair, November 8, 2010, 228.
- <sup>103</sup> Keith, interview; Seraile, interview; Ronnie Sepulvado, interview, October 26, 2010.
- <sup>104</sup> Ronnie Sepulvado, interview, October 26, 2010.
- <sup>105</sup> Testimony of Bill Ambrose, 224; Testimony of John Gisclair, October 8, 2010, 107, 122; Testimony of John Gisclair, December 7, 2010, 70; Willis, interview. The driller would have had standpipe or drill pipe pressure on his screen. Testimony of Bill Ambrose, 224.
- <sup>106</sup> Testimony of John Gisclair, November 8, 2010, 230.
- <sup>107</sup> Internal BP document (BP-HZN-MBI 133083).
- <sup>108</sup> Internal BP document (BP-HZN-MBI 139541).
- <sup>109</sup> Internal BP document (BP-HZN-MBI 21387).
- <sup>110</sup> Testimony of Charles Credeur (Dril-Quip), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 62-63; Testimony of Heber Morales (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 143-44; Internal BP document (BP-HZN-MBI 129622); Brandon Bouillion (Weatherford), interview with Commission staff, October 22, 2010. One of an assistant driller's responsibilities is to make up connections and equipment. Internal BP document (BP-HZN-MBI 21434).
- <sup>111</sup> Internal BP document (BP-HZN-MBI 139543); Testimony of John Gisclair, November 8, 2010, 249.
- <sup>112</sup> Internal BP document (BP-HZN-MBI 21406); Sperry-Sun data, April 20, 2010, 20:02. "Sperry-Sun data" references an internal Halliburton document (HAL\_48973-74).

It appears that the crew had a short meeting in the drill shack prior to displacing the riser. The details of the meeting are unclear. The drill crew typically uses such meetings to review the remaining steps in the operation and discuss expected volumes and pump strokes, but not pressures. Caleb Holloway (Transocean), interview with Commission staff, December 20, 2010; Seraile, interview.

<sup>113</sup> Testimony of John Gisclair, October 8, 2010, 129.

<sup>114</sup> Testimony of Joseph Keith, 98, 190.

<sup>115</sup> Testimony of Joseph Keith, 99; Testimony of Ronnie Sepulvado, July 20, 2010, 137.

<sup>116</sup> Testimony of Joseph Keith, 146; Sperry-Sun data, April 20, 2010.

<sup>117</sup> John Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252* (July 1, 2010), 13.

<sup>118</sup> Testimony of Leo Lindner (M-I SWACO), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 275.

<sup>119</sup> John Gisclair (Halliburton), interview with Commission staff, September 20, 2010; Seraile, interview.

<sup>120</sup> This behavior was expected. Testimony of Joseph Keith, 134.

<sup>121</sup> Transocean legal team, "April 20 End of Well Activities" (presentation to Commission staff, November 5, 2010); Sperry-Sun data, April 20, 2010.

<sup>122</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 13.

<sup>123</sup> Gisclair, interview.

<sup>124</sup> Testimony of Joseph Keith, 178-81.

<sup>125</sup> Testimony of Bill Ambrose, 220.

<sup>126</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 25.

<sup>127</sup> Internal BP document (BP-HZN-BLY 61369-74); Internal BP document (BP-HZN-MBI 21406).

<sup>128</sup> Testimony of Joseph Keith, 50.

<sup>129</sup> *Ibid.*, 51, 102, 114-15.

<sup>130</sup> *Ibid.*, 102, 183-84.

<sup>131</sup> *Ibid.*, 102 ("Five minutes, eight minutes. No longer than that."), 184 ("About 10 minutes. That's what it seemed like.").

<sup>132</sup> Nonpublic Transocean document (presentation to Commission staff, August 5, 2010), 14; BP, *Deepwater Horizon Accident Investigation Report*, 25-26.

<sup>133</sup> BP, *Deepwater Horizon Accident Investigation Report*, 92. "At that point in time it masked what was the biggest inflow at that point." Testimony of Bill Ambrose, 221. "It would have been impossible to tell in realtime what increase might have been due to the trip tank drain or what increases might have been due to a well influx." Testimony of John Gisclair, December 7, 2010, 12-14, 55.

<sup>134</sup> Testimony of John Gisclair, November 8, 2010, 229. Emptying the trip tanks does not affect drill pipe pressure, so that action does not explain the increase. Bill Ambrose (Transocean), interview with Commission staff, August 17, 2010.

<sup>135</sup> Testimony of John Gisclair, November 8, 2010, 228; Bly, interview; Willis, interview.

<sup>136</sup> Testimony of John Gisclair, November 8, 2010, 228; BP, *Deepwater Horizon Accident Investigation Report*, 92; Seraile, interview; Willis, interview.

<sup>137</sup> Testimony of Joseph Keith, 238.

<sup>138</sup> Internal BP document (BP-HZN-MBI 170828).

<sup>139</sup> Testimony of Joseph Keith, 120-21, 196.

<sup>140</sup> Internal BP document (BP-HZN-MBI 139549).

<sup>141</sup> *Ibid.*

- <sup>142</sup> The *Deepwater Horizon*'s residual flow signature was a straight line evenly going down. Seraile, interview.
- <sup>143</sup> Ambrose, interview, September 21, 2010.
- <sup>144</sup> Sperry-Sun data, April 20, 2010; Internal BP document (BP-HZN-MBI 139549).
- <sup>145</sup> Steve Lewis (Expert witness), interview with Commission staff, September 7, 2010; Darryl Bourgoyne (Expert witness), interview with Commission staff, November 23, 2010; Keith, interview (watched flow line for 30 to 45 seconds); Seraile, interview (*Horizon* residual flow was typically three to five minutes). According to assistant driller Seraile, a credible visual confirmation of no flow required five to seven minutes after the pumps stopped. Here, the crew diverted returns within two minutes. Seraile, interview.
- <sup>146</sup> Gisclair, interview; Bourgoyne, interview, November 23, 2010.
- <sup>147</sup> Internal BP document (BP-HZN-MBI 13950); Gisclair, interview.
- <sup>148</sup> Seraile, interview; Murry Sepulvado, interview; Ronnie Sepulvado, interview, August 20, 2010.
- <sup>149</sup> Bourgoyne, email, December 16, 2010.
- <sup>150</sup> The non-zero reading on the Sperry-Sun flow-out sensor, from 9:09 to 9:21 p.m., likely reflects fluid left over in the flow line after the gate to route returns overboard closed. Gisclair, interview; Bly, interview; Smith, interview, October 26, 2010.
- <sup>151</sup> Testimony of Jimmy Harrell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 28; Internal BP document (BP-HZN-MBI 21305).
- <sup>152</sup> Transocean legal team, interview, August 17, 2010 (sustained drill pipe pressure increase was anomalous); Testimony of John Gisclair, October 8, 2010, 135 (“a curiosity”); BP, *Deepwater Horizon Accident Investigation Report*, 93 (anomalous); Smith, interview, September 7, 2010 (fishy).
- <sup>153</sup> Ambrose, interview, September 21, 2010; Testimony of John Gisclair, October 8, 2010, 228-29 (“So it’s not your typical indicator of a kick but it, again, is something to give pause”).
- <sup>154</sup> Testimony of Bill Ambrose, 225-26. This underscores the notion that current kick detection methodology depends on the right person being in the right place at the right time. *Ibid.*, 246.
- <sup>155</sup> Keith testified that, if he had seen the increase, he would have notified the drill crew. Testimony of Joseph Keith, 215.
- <sup>156</sup> *Ibid.*, 216, 230-31.
- <sup>157</sup> The PRV exists “for the purpose of protecting the pump from excessive high-pressure overloads.” Internal BP document (BP-HZN-BLY 49091). The PRV is generally “piped directly into the mud tanks” so that, when it blows, fluid goes to the pits. *Ibid.* On the *Horizon*, the PRVs were probably routed to the slugging pit. Internal Transocean document (TRN-HCEC 68478). When the PRV blew, the data showed a gain in the slugging pit (pit 11).
- <sup>158</sup> Seraile, interview; BP, *Deepwater Horizon Accident Investigation Report*, 97; Keith, interview. It is unlikely that the PRV blew because of pressure from the well. John Smith (Expert witness), interview with Commission staff, October 14, 2010.
- <sup>159</sup> Holloway, interview. That group also included Adam Weise, Shane Roshto, and Roy Wyatt Kemp.
- <sup>160</sup> Testimony of Bill Ambrose, 380-82. That valve is on the choke manifold, on the rig floor. Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; Holloway, interview; Seraile, interview.
- <sup>161</sup> Testimony of Randy Ezell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 282.
- <sup>162</sup> Testimony of Bill Ambrose, 384; Testimony of John Gisclair, October 8, 2010, 138.
- <sup>163</sup> Testimony of Bill Ambrose, 80-82. “When that happened, it had a very strange trend, and over a period of about seven minutes it started to build pressure.” *Ibid.*
- <sup>164</sup> Experts have suggested at least two explanations for this anomaly. One explanation is that the kill line pressure was anomalous because it did not sufficiently match the drill pipe pressure. Testimony of Bill Ambrose, 381. Another explanation is that the kill line pressure was anomalous because it was higher than it should have been, at a time when the crew was not pumping fluid down the kill line. In this latter scenario,

the crew closed the kill line valve once they saw the pressure rising. Bourgoyne, interview, November 23, 2010.

<sup>165</sup> Testimony of Bill Ambrose, 384. “The anomaly was that now that the kill line had been opened, the differential was causing some concern.” *Ibid.*

<sup>166</sup> *Ibid.*

<sup>167</sup> Testimony of David Young (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 258-59. Tabler entered shortly afterward. *Ibid.*, 276.

<sup>168</sup> David Young (Transocean), interview with Commission staff, November 19, 2010.

<sup>169</sup> Testimony of David Young, 276.

<sup>170</sup> Young, interview.

<sup>171</sup> Testimony of David Young, 276.

<sup>172</sup> Seraile, interview; Smith, interview, September 7, 2010.

<sup>173</sup> “With months of work we’ve determined that it appears as the kick was coming in, the influx was coming in, it was changing heights of fluid columns in the well. And the geometry of the well was such that as the 14-pound mud that was – When this all started, there was about 500 barrels of 14-pound mud below the drill pipe, and that had been pushed up into the BOP, and as it hit the BOP it was – it kept a constant pressure, a sign that fluids are moving.” Testimony of Bill Ambrose, 380-82. “The drill pipe pressure increased until 21:35 hours as 14.17 ppg mud rose above the stinger and then declined after that as hydrocarbons rose above the stinger. Modeling indicated that this fluctuation was consistent with the change in fluid densities (spacer, seawater, mud and hydrocarbons) moving through the various cross-sectional areas in the well.” BP, Deepwater Horizon *Accident Investigation Report*, 101. Fluid flow is complex. The two-phase flow pattern, in which gas migrates up through the mud instead of completely displacing the mud, can effect unexpected pressure fluctuations. Adam T. Bourgoyne, Jr., “University uses on-campus abandoned well to simulate deepwater well-control operations,” *Oil and Gas Journal* (May 31, 1982), 141; Peter G. McFadden, “The Pressure Behavior of a Shut-In Well Due to the Upward Migration of a Gas Kick” (thesis, December 1984), 8-9.

<sup>174</sup> Holloway, interview.

<sup>175</sup> *Ibid.*; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 14; BP, Deepwater Horizon *Accident Investigation Report*, 100.

<sup>176</sup> Holloway, interview.

<sup>177</sup> *Ibid.*

<sup>178</sup> Testimony of Bill Ambrose, 381.

<sup>179</sup> Testimony of John Gisclair, November 8, 2010, 30.

<sup>180</sup> Seraile, interview; Internal Transocean document (TRN-HCEC 5415). It is the responsibility of the drill crew “to shut-in the well as quickly as possible if a kick is indicated or suspected.” *Ibid.* Shutting in the well also would have involved notifying senior Transocean and BP personnel. *Ibid.*

<sup>181</sup> Testimony of David Young, 259-60.

<sup>182</sup> *Ibid.*, 297.

<sup>183</sup> Young, interview.

<sup>184</sup> *Ibid.*

<sup>185</sup> *Ibid.*

<sup>186</sup> *Ibid.*

<sup>187</sup> Holloway, interview.

<sup>188</sup> Testimony of Joseph Keith, 20-21.

<sup>189</sup> Testimony of Charles Credeur, 62-63; Bouillion, interview. BP estimates mud overflow at 9:40 p.m. BP, Deepwater Horizon *Accident Investigation Report*, 103; Transocean estimates it at 9:43 p.m. Testimony of Bill Ambrose, 383.

- <sup>190</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 14. It appears that it was the *Horizon's* practice to “monitor the flow from the riser via the flowline to the trip tank.” Internal Transocean document (TRN-HCEC 25883); Seraile, interview; Ezell, interview.
- <sup>191</sup> Testimony of Chris Pleasant, 166 (BOP panel showed lower annular closed); Testimony of Bill Ambrose, 252; BP, *Deepwater Horizon Accident Investigation Report*, 104. Though testimony indicates that Anderson activated the lower annular, Transocean has contended that the rig crew in fact activated the upper annular, not the lower annular.
- <sup>192</sup> Internal BP document (BP-HZN-MBI 139551); Internal BP document (BP-HZN-MBI 21421); Internal BP document (BP-HZN-MBI 142485); Internal BP document (BP-HZN-CEC 20334); Internal BP document (BP-HZN-CEC 20357); BP, *Deepwater Horizon Accident Investigation Report*, 103.
- <sup>193</sup> Testimony of Randy Ezell, 283.
- <sup>194</sup> Testimony of Yancy Keplinger (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, October 5, 2010, part 1, 150, 219, 254-55; Testimony of Andrea Fleytas (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, October 5, 2010, part 2, 13, 39. Floorhand Caleb Holloway called Revette via radio during this time but received no response. David Barstow, David Rohde, and Stephanie Saul, “Deepwater Horizon’s Final Hours,” *New York Times*, December 25, 2010.
- <sup>195</sup> Internal BP document (BP-HZN-MBI 139551).
- <sup>196</sup> Testimony of Randy Ezell, 283.
- <sup>197</sup> Testimony of Yancy Keplinger, 149, 219.
- <sup>198</sup> *Ibid.*, 252.
- <sup>199</sup> Testimony of Paul Meinhart (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 29. Meanwhile, Young had gone by the subsea office and mentioned to Chris Pleasant and Allen Seraile that the cement job was delayed because they were “having some sort of differential pressure problem” up on the rig floor. Pleasant and Seraile (who was getting ready to come on tour) turned to live video feed of the rig floor and saw the mud. Pleasant instantly picked up the phone and called the rig floor—all three lines—but got no answer. Young, interview; Testimony of Chris Pleasant, 103-04, 121.
- <sup>200</sup> Bly, interview.
- <sup>201</sup> BP, *Deepwater Horizon Accident Investigation Report*, 103-04; Testimony of Bill Ambrose, 252-53. It is worth noting that Pleasant and Vidrine, once on the bridge, looked at the BOP panel and saw only an indication that an annular had been activated, not the variable bore ram. Internal BP document (BP-HZN-MBI 21420); Internal BP document (BP-HZN-MBI 142485).
- <sup>202</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 23-24; BP, *Deepwater Horizon Accident Investigation Report*, 146.
- <sup>203</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 15; Bourgoyne, email, November 23, 2010; Testimony of Joseph Keith, 124.
- <sup>204</sup> Internal BP document (BP-HZN-MBI 21424); Internal BP document (BP-HZN-MBI 21427).
- <sup>205</sup> Internal BP document (BP-HZN-MBI 21424); Internal BP document (BP-HZN-MBI 139551).
- <sup>206</sup> Testimony of Chad Murray (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 335-36.
- <sup>207</sup> Internal BP document (BP-HZN-MBI 21267). Keith did not notice any anomalies in the data during the displacement, with the exception of one instance of pit gain that he learned reflected emptying of the sand traps. Testimony of Joseph Keith, 178-81, 193. The first time Keith became aware that the well was flowing was, “When it sounded like it was raining outside my unit and I started smelling gas coming through my purge system.” *Ibid.*, 32.
- <sup>208</sup> Testimony of Jimmy Harrell, 64, 128-129, 118.
- <sup>209</sup> BP, Transocean, and Halliburton representatives all agree that if skilled personnel had observed the Sperry-Sun data, they would have noticed indicators sufficiently clear to cause alarm. Testimony of Mark Bly, November 8, 2010, 241-42; Testimony of Bill Ambrose, 241-42; Testimony of John Gisclair, November 8, 2010, 241-42.
- <sup>210</sup> Some have suggested that the rig pumping mud to the *Damon Bankston* interfered with well monitoring during the final displacement. Donald Winter et al., *Interim Report on Causes of the Deepwater Horizon Oil*

*Rig Blowout and Ways to Prevent Such Events* (November 17, 2010), 10-11. This is incorrect. Pumping to the Bankston had ceased by 5:17 p.m., well before the start of the displacement of the riser. Internal BP document (BP-HZN-MBI 139482).

<sup>211</sup> Murry Sepulvado, interview.

<sup>212</sup> Internal BP document (BP-HZN-BLY 61692); Ronnie Sepulvado, interview, October 26, 2010; Seraile, interview.

<sup>213</sup> Bourgoyne, email, November 23, 2010. “The rig crew could decide to fill pits in the active system from the sea chest system, then line up the pump to those pits.” *Ibid.*

<sup>214</sup> It is worth noting that, even if the gas meter were used for monitoring, it is likely that rig personnel would not have seen gas until after most of the mud was ejected from the well. Bourgoyne, email, December 16, 2010.

<sup>215</sup> Earlier in the evening, the crew had been using the cranes to off-load equipment onto a supply ship. The starboard crane had been down for repair. Testimony of Heber Morales, 143. By the time of the displacement, it was apparently working and in use. Young, interview. The crew may have been testing it. Internal BP document (BP-HZN-MBI 139588); Testimony of Joseph Keith, 35. Or they may have resumed off-loading equipment. There was also a crane operator in the gantry crane on the port aft deck helping the rig personnel at the bucking unit put together the tools necessary for running the lockdown sleeve. Testimony of Micah Sandell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 7-8; Testimony of Heber Morales, 143-44; Testimony of Ross Skidmore (Swift), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 217-19; Testimony of Joseph Keith, 35; Internal BP document (BP-HZN-MBI 129622); Internal BP document (BP-HZN-MBI 139583); Internal BP document (BP-HZN-MBI 139588); Internal BP document (BP-HZN-MBI 21277).

<sup>216</sup> Internal BP document (BP-HZN-MBI 21441).

<sup>217</sup> Testimony of John Gisclair, October 8, 2010, 102; Testimony of Joseph Keith, 35, 198; Willis, interview.

<sup>218</sup> API RP 59, 46. Persistent rig movement can also make it difficult to calibrate the flow-out sensor. Testimony of Joseph Keith, 24-25.

<sup>219</sup> Bourgoyne, email, December 16, 2010; Testimony of Joseph Keith, 25.

<sup>220</sup> Testimony of Jimmy Harrell, 28; Testimony of Leo Lindner, 279; BP, *Deepwater Horizon Accident Investigation Report*, 91; Internal BP document (BP-HZN-MBI 21305).

<sup>221</sup> Testimony of Leo Lindner, 272; Testimony of Joseph Keith, 191; Internal BP document (BP-HZN-MBI 21250).

<sup>222</sup> Testimony of Bill Ambrose, 221; Ambrose, interview, August 17, 2010.

<sup>223</sup> Ambrose, interview, August 17, 2010; Testimony of John Smith (Expert witness), Hearing before the Deepwater Horizon Joint Investigation Team, July 23, 2010, 297.

<sup>224</sup> Gisclair, interview; Ronnie Sepulvado, interview, August 20, 2010. Another example is the rig’s flow-out meters. According to BP well site leader Ronnie Sepulvado, the rig’s flow-out meters “had inherent variability and were not completely accurate.” Internal BP document (BP-HZN-BLY 61694). Measuring flow-out can be challenging because there are few flow-out meters able to handle such a wide variety of fluids and pump rates. Bourgoyne, interview, September 10, 2010; Testimony of John Smith, 295.

<sup>225</sup> Testimony of John Gisclair, October 8, 2010, 102.

<sup>226</sup> Testimony of Mark Bly, November 8, 2010, 246-47; Testimony of Bill Ambrose, 246-47.

<sup>227</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; Ambrose, interview, September 21, 2010; Testimony of John Gisclair, October 8, 2010, 109-10.

<sup>228</sup> Testimony of John Gisclair, October 8, 2010, 109-10.

<sup>229</sup> BP, *Deepwater Horizon Accident Investigation Report*, app. W.

<sup>230</sup> Testimony of Darryl Bourgoyne, 170-72.

<sup>231</sup> Testimony of John Gisclair, November 8, 2010, 228. “The standpipe pressure, especially that first increase, it basically draws a straight line, and it’s very difficult to spot that 100-pound increase over that extended period using that particular presentation.” *Ibid.*

- <sup>232</sup> Representatives from BP, Transocean, and Sperry-Sun all agree that kick indications were clear enough that, if observed by skilled personnel, they would have allowed the rig crew to have responded earlier. Testimony of Bill Ambrose; Testimony of John Gisclair, November 8, 2010, 242; Testimony of Mark Bly, November 8, 2010, 242.
- <sup>233</sup> Of the kicks that occurred during drilling operations, a “majority of them were observed when drilling new hole.” Per Holand and Pal Skalle, *Deepwater Kicks and BOP Performance* (SINTEF, July 2001), 11, 45. It is worth noting that Transocean specifically drilled its crew for this situation. Internal Transocean document (TRN-USCG\_MMS 30540).
- <sup>234</sup> Per Holand and Pal Skalle, *Deepwater Kicks and BOP Performance*, 11, 45-46.
- <sup>235</sup> John Guide (BP), interview with Commission staff, January 19, 2011 (if they had already passed the negative test, it maybe would not be surprising if he did not check for flow all the time); Testimony of John Smith, 301 (“They think they’ve already proven that the well is safe...if it’s sealed up and you’ve proved it’s sealed up and it’s not going to leak, well, that’s a reason to [reduce] your rigor.”); Bourgoyne, interview, September 10, 2010; Lewis, interview, September 21, 2010.
- <sup>236</sup> Internal Transocean document (TRN-PC 3227); David Borthwick, *Report of the Montara Commission of Inquiry* (The Montara Commission of Inquiry, Australia, June 2010), 116.
- <sup>237</sup> Internal Transocean document (TRN-PC 3227); David Borthwick, *Report of the Montara Commission of Inquiry* (The Montara Commission of Inquiry, Australia, June 2010), 116.
- <sup>238</sup> Anadarko legal team, interview with Commission staff, September 29, 2010; Testimony of Steve Lewis (Expert witness), Hearing before the National Commission, November 9, 2010, 65, 79-80.
- <sup>239</sup> Local Impact of the Deepwater Horizon Oil Spill, Before Subcomm. on Oversight and Investigations of the H. Comm. on Energy and Commerce, 111th Cong. (2010)(statement of Courtney Kemp), 62 (deceased husband characterized well as having “so many problems and so many things were happening...it was just kind of out of hand”); Testimony of Micah Burgess, 117 (“It was a difficult well.”); Internal BP document (MC 252-1\_DDR)(the Macondo well sustained numerous lost circulation events, two previous kicks, a ballooning event, and trouble with LOTs); E.C. Thomas (Expert witness), interview with Commission staff, October 27, 2010 (the Horizon crew encountered more problems than usual).
- <sup>240</sup> Internal BP document (BP-HZN-CEC 20200); Ross Skidmore (Swift), interview with Commission staff, December 21, 2010 (after the last casing string is run, floorhands are often doing preventative maintenance duties and thinking about the next job); Testimony of Greg Meche (M-I SWACO), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 216-217.
- <sup>241</sup> Testimony of Ross Skidmore, 263-64.
- <sup>242</sup> Murry Sepulvado, interview (always monitors final displacements from the rig floor); Guide, interview, January 19, 2011 (would have expected the well site leader to be watching the data during the displacement and performing flow checks himself); Bourgoyne, email, November 23, 2010. After the explosion, well site leader Don Vidrine apparently felt “like he should have been on the [rig] floor when this happened.” Internal BP document (BP-HZN-BLY 72265).
- <sup>243</sup> This critique would apply equally to the Sperry Drilling mudlogger, if he had noticed the pressure anomalies. There is no evidence that he did.
- <sup>244</sup> In addition to the anomalies discussed in this chapter, the negative pressure test repeatedly showed that the bottomhole cement job did not isolate hydrocarbons ([Chapter 4.6](#)). Testimony of Mark Bly, November 8, 2010, 203-04.
- <sup>245</sup> Testimony of Bill Ambrose, 381; Seraile, interview.
- <sup>246</sup> Testimony of John Gisclair, November 8, 2010, 30.
- <sup>247</sup> Testimony of Bill Ambrose, 380-86.
- <sup>248</sup> *Ibid.*
- <sup>249</sup> *Ibid.*, 205, 207, 277; Transocean legal team, interview with Commission staff, December 10, 2010.
- <sup>250</sup> Testimony of Bill Ambrose, 205 (“when the approval came back [from BP] that it was a good negative test, our people proceeded ahead on good faith that it was a good test”); Transocean legal team, interview, December 10, 2010.
- <sup>251</sup> Transocean legal team, interview, December 10, 2010.



<sup>252</sup> BP's Engineering Technical Practice on Simultaneous Operations (GP 10-75) directs its personnel to conduct a risk assessment of simultaneous operations "in order to identify the risks across the complete range of well activities" and to "ensure all well activities...are carried out in a safe and controlled manner, when these activities are performed in the same space and time as another operation." Internal BP document (BP-HZN-OSC 8019). It is not clear whether BP personnel associated with the *Deepwater Horizon* conducted any such risk assessment with respect to rig activities going on during the final displacement operation. At least one witness has suggested that other well site leaders would not have allowed so many rig operations. Keith, interview.

<sup>253</sup> Testimony of John Gisclair, November 8, 2010, 218; Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 22.

<sup>254</sup> For example, Transocean suggests that the driller may have watched the screens for 60 seconds and then turned his back to line up pump 2. Testimony of Bill Ambrose, 225-26.

<sup>255</sup> Ezell, interview; Testimony of Paul Johnson, 329-30.

<sup>256</sup> Transocean legal team, interview with Commission staff, September 21, 2010; Testimony of Paul Johnson, 389 (design decisions affect the crew's ability to control the well).

<sup>257</sup> "Prior to commencing operations, it is advisable that all involved parties understand the objectives, procedures, and hazards. All personnel should be encouraged to report abnormal conditions. Alertness and speed of communication are critical factors in well control." API RP 59, 40.

<sup>258</sup> The pre-tour meetings that day did not involve any special instructions about the negative pressure test or kick detection. Seraile, interview. "I guess they figured it was going to go the same way as having all these other barriers in place." *Ibid.*

<sup>259</sup> Guide, interview, January 19, 2011 (would expect rig crew and well site leader to perform direct visual flow checks—not just rely on telemetry—whenever they shut down the pumps).

<sup>260</sup> Industry experts recommend a well control plan be "worked out beforehand.... To be successful, subsurface conditions must be predicted, detected, and controlled." API RP 59, 35. It is unlikely that the *Horizon's* driller knew what drill pipe pressures to expect during the displacement. Ambrose, interview, September 21, 2010.

<sup>261</sup> Rig personnel could communicate with each other through radio, telephone, overhead pages, and messenger. Willis, interview; Seraile, interview.

<sup>262</sup> Both Ronnie and Murry Sepulvado, alternative BP well site leaders for the *Horizon*, took active role in ensuring proper communication between the drill crew and mudlogger. They did so by periodically speaking with the drill crew and mudlogger when there was a change in rig operations and confirming that the two entities had kept each other informed of the change. Murry Sepulvado, interview; Willis, interview.

<sup>263</sup> Willis, interview.

<sup>264</sup> *Ibid.*

<sup>265</sup> Testimony of Joseph Keith 31-32.

<sup>266</sup> This included that the drill crew was switching returns from the active pits to the reserve pits, dumping the sand traps into the active pits, emptying the trip tanks, transferring fluid from the active pits (pits 9 and 10) to reserve pit 6 during the sheen test, and fixing a blown PRV. *Ibid.*, 40, 178, 193; Keith, interview.

<sup>267</sup> Testimony of Joseph Keith, 177-78; Transocean legal team, interview, December 10, 2010.

<sup>268</sup> Testimony of John Gisclair (Halliburton), Hearing before the National Academy of Engineering, September 26, 2010, 18, 63.

<sup>269</sup> *Ibid.*; Willis, interview.

<sup>270</sup> Internal BP document (BP-HZN-MBI 193469).

<sup>271</sup> Internal BP document (BP-HZN-CEC 20094).

<sup>272</sup> Internal BP document (BP-HZN-OSC 5641-44).

<sup>273</sup> Internal BP document (BP-HZN-MBI 193469); Internal BP document (BP-HZN-CEC 20094).

<sup>274</sup> Internal BP document (BP-HZN-CEC 20094).

<sup>275</sup> Internal BP document (BP-HZN-MBI 128017).

- <sup>276</sup> Internal BP document (BP-HZN-MBI 128018).
- <sup>277</sup> David Sims (BP), interview with Commission staff, December 14, 2010.
- <sup>278</sup> Internal BP document (BP-HZN-OSC 5522).
- <sup>279</sup> Internal BP document (BP-HZN-MBI 127999, 128002, 128018-20); Zanghi, interview.
- <sup>280</sup> Internal BP document (BP-HZN-MBI 128002, 128018).
- <sup>281</sup> Zanghi, interview; Internal BP document (128017)(ERA would focus “primarily on the execute stage of well construction”); Internal BP document (128017, 128002, 128018)(preset configurations for drilling, tripping, running casing, and cementing; no mention of abandonment or completion).
- <sup>282</sup> Internal BP document (BP-HZN-MBI 127996, 128009).
- <sup>283</sup> Testimony of Pat O’Bryan (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 26, 2010, 412; Testimony of Brett Cocola, 233.
- <sup>284</sup> Testimony of Brett Cocola, 233-35; Testimony of Gregory Walz (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, part 2, 21. It is worth noting that, after the blowout, BP has been re-evaluating its planned ERA program and is in the process of reshaping it to include more attention to well control issues. Zanghi, interview.
- <sup>285</sup> Internal BP document (BP-HZN-OSC 4095).
- <sup>286</sup> *Ibid.*
- <sup>287</sup> Internal BP document (BP-HZN-MBI 213677).
- <sup>288</sup> Internal BP document (BP-HZN-OSC 4095); Internal Halliburton documents (MC252\_001\_ST00BP00 Sperry Rpt 037); Internal Halliburton document (MC252\_001\_ST00BP01\_EOWR); Internal BP document (BP-HZN-MBI 213677)(there was a 35- to 40-barrel influx).
- <sup>289</sup> Internal BP document (BP-HZN-OSC 4095); Serrano, interview.
- <sup>290</sup> Internal BP document (BP-HZN-MBI 197360).
- <sup>291</sup> Guide, interview, January 19, 2011.
- <sup>292</sup> Internal BP document (BP-HZN-OSC 1490); Internal BP document (BP-HZN-OSC 1493).
- <sup>293</sup> BP, *Deepwater Horizon Accident Investigation Report*, 107; Internal BP document (BP-HZN-MBI 113015); Internal BP document (BP-HZN-MBI 198127). One TIGER team member went to the *Deepwater Horizon* for several days to implement the suggested improvements.
- <sup>294</sup> Internal BP document (BP-HZN-MBI 198126, 113018-19)(emphasis added)(“The entire breadth of pore-pressure indicators need to be evaluated under higher scrutiny.... Thus far on this well, it has been shown that one or more pore-pressure indicators have provided ambiguous or even contradictory data. A more robust analysis of all indicators would allow us to better discern systemic pore-pressure changes from localized anomalies.”).
- <sup>295</sup> Internal BP document (BP-HZN-MBI 113018).
- <sup>296</sup> BP, *Deepwater Horizon Accident Investigation Report*, 107; Internal BP document (BP-HZN-BLY 61465). Although BP personnel deemed the drill crew’s response inadequate, Transocean personnel did not. Transocean legal team, interview, September 21, 2010.
- <sup>297</sup> John Guide (BP), interview with Commission staff, September 17, 2010.
- <sup>298</sup> Internal BP document (BP-HZN-MBI 113018).
- <sup>299</sup> Internal BP document (BP-HZN-BLY 61465-66).
- <sup>300</sup> Guide, interview, January 19, 2011.
- <sup>301</sup> Internal BP document (BP-HZN-MBI 113018-19)(“drilling practices,” “drilling techniques,” “drilling parameters”).
- <sup>302</sup> Internal Transocean document (TRN-HCEC 16041).
- <sup>303</sup> Internal Transocean document (TRN-HCEC 15880).

<sup>304</sup> Internal Transocean document (TRN-HCEC 16041).

<sup>305</sup> *Ibid.*

<sup>306</sup> Internal BP document (BP-HZN-BLY 38354-55, 38357-58). The desired completion fluid was base oil, so the plan was to clean up the well by swapping out mud first to seawater and then to base oil. Internal BP document (BP-HZN-BLY 38357-58).

<sup>307</sup> “The seawater was pumped via one pit with a constant top up (no volume control).” Internal BP document (BP-HZN-BLY 38358).

<sup>308</sup> Internal BP document (BP-HZN-BLY 38354-55, 38357-58).

<sup>309</sup> Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 139.

<sup>310</sup> Rig personnel noticed an increase in flow show, increase in pits, and problems at the shakers, but made different interpretations due to “changes in clean up parameters on the one pit fill, perceived rig trimming issues; and potential blockage in lines from shakers to pits.” Internal BP document (BP-HZN-BLY 38358, 38361).

## Chapter 4.8

<sup>1</sup> Also known as a “degasser” or “po’ boy degasser.”

<sup>2</sup> Internal BP document (BP-HZN-BLY 56833).

<sup>3</sup> Internal Transocean document (TRN-HCEC 5708)(Transocean Well Control Handbook). The crew conducted an EDS drill on January 31, 2010. Internal BP document (BP-HZN-BLY 55870). The *Horizon’s* EDS also successfully activated and sheared drill pipe on June 30, 2003. Internal BP document (BP-HZN-MBI 136652).

<sup>4</sup> Internal BP document (BP-HZN-BLY 56833).

<sup>5</sup> *Ibid.*

<sup>6</sup> Testimony of Christopher Pleasant (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 165.

<sup>7</sup> Internal BP Document (BP-HZN-CEC 45983).

<sup>8</sup> There is an inversely proportional relationship between pressure and volume for an ideal gas. Though actual conditions in the wellbore might lead to different behavior than what is predicated for an ideal gas, the gas almost certainly expanded exponentially—or very near to exponentially.

<sup>9</sup> BP’s analysis indicates that gas traveled up the 5,000-foot riser in about two minutes. BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 27.

<sup>10</sup> Testimony of Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 386; Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 245.

<sup>11</sup> Internal Transocean document (TRN-HCEC 5607).

<sup>12</sup> Internal BP document (BP-HZN-MBI 213402).

<sup>13</sup> Internal Transocean document (TRN-HCEC 5607).

<sup>14</sup> Testimony of Bill Ambrose, 257.

<sup>15</sup> Detailed information on diverters is available in API, *Recommended Practice for Diverter Systems Equipment and Operations*, 2nd ed. (November 2001, reaffirmed March 1, 2007)(“API RP 64”).

<sup>16</sup> Internal Transocean document (TRN-HCEC 5608).

<sup>17</sup> Internal BP document (BP-HZN-BLY 49092).

<sup>18</sup> Confidential industry expert, interview with Commission staff.

<sup>19</sup> Internal BP document (BP-HZN-BLY 49092); Internal BP document (BP-HZN-BLY 49094).

- <sup>20</sup> Internal BP document (BP-HZN-BLY 49094).
- <sup>21</sup> Confidential industry expert, interview.
- <sup>22</sup> Confidential industry expert, letter to Commission staff.
- <sup>23</sup> *Ibid.*
- <sup>24</sup> *Ibid.*
- <sup>25</sup> Internal Transocean document (TRN-HCEC 5606); Confidential industry expert, letter.
- <sup>26</sup> Confidential industry expert, letter.
- <sup>27</sup> Gas rises very quickly in deepwater. Internal Transocean document (TRN-HCEC 5607).
- <sup>28</sup> BP's analysis estimates the time at 9:40 p.m. BP, *Deepwater Horizon Accident Investigation Report*, 28. Transocean contends that the time was 9:43 p.m. Testimony of Bill Ambrose, 383. These estimates are generally consistent with the testimony of witnesses.
- <sup>29</sup> Internal Transocean document (TRN-HCJ 120914).
- <sup>30</sup> Testimony of Micah Sandell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 10.
- <sup>31</sup> Testimony of David Young (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 264.
- <sup>32</sup> Testimony of Bill Ambrose, 244.
- <sup>33</sup> *Ibid.*
- <sup>34</sup> Testimony of Micah Sandell, 9-10.
- <sup>35</sup> Internal BP document (BP-HZN-CEC 20357).
- <sup>36</sup> Testimony of Micah Sandell, 9-10.
- <sup>37</sup> *Ibid.*
- <sup>38</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, September 9, 2010.
- <sup>39</sup> Confidential industry expert, interview; Internal Transocean Document (TRN-HCEC 5606).
- <sup>40</sup> Deepwater Horizon Study Group, *The Macondo Blowout: 3rd Progress Report* (December 5, 2010), app. B, 12.
- <sup>41</sup> Testimony of Micah Sandell, 10.
- <sup>42</sup> Internal BP document (BP-HZN-BLY 61525).
- <sup>43</sup> Testimony of Jimmy Harrell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 98-99.
- <sup>44</sup> BP's modeling of the flow of mud and gas onto the rig indicates that the mud gas separator equipment may have failed. BP, *Deepwater Horizon Accident Investigation Report*, 115. The Chief Counsel's team is not aware of a sophisticated model that has been completed by an independent party at this time.
- <sup>45</sup> Internal BP document (BP-HZN-MBI 129187).
- <sup>46</sup> Confidential industry expert, interview.
- <sup>47</sup> John Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252* (July 1, 2010), 14; Testimony of Bill Ambrose, 252-53; BP, *Deepwater Horizon Accident Investigation Report*, 28. According to subsea supervisor Chris Pleasant, he reset the lower annular regulator pressure to 1,500 psi from 1,900 psi soon after 9 p.m. Testimony of Christopher Pleasant, 120. According to BP, 1,500 psi was the normal regulator pressure setting for both annular preventers. BP, *Deepwater Horizon Accident Investigation Report*, 145. According to an independent expert, this would not have affected the ability to close the annular but it may have affected the equipment's ability to seal fully. Confidential industry expert, interview with Commission staff; Internal BP document (BP-HZN-BLY 61257).
- <sup>48</sup> Testimony of Christopher Pleasant, 123. BP post-explosion models also suggest an annular was activated at 9:41 p.m. BP, *Deepwater Horizon Accident Investigation Report*, 104.

- <sup>49</sup> Internal Transocean document (TRN-HCJ 121107); Internal BP document (BP-HZN-BLY 61563).
- <sup>50</sup> Data on well pressures are consistent with the closing of the annular or the variable bore ram. BP, *Deepwater Horizon Accident Investigation Report*, 103-04. Transocean has suggested the rig crew closed both variable bore rams. Transocean legal team, interview with Commission staff, December 10, 2010. Post-explosion information indicates that the rig crew may have activated the upper variable bore ram and perhaps the middle pipe ram. Response teams closed the upper variable bore ram but pumped only 1.5 gallons of hydraulic fluid, instead of the 28 gallons typically required to close the ram. This indicates the rig crew had likely already closed the upper variable bore ram. BP, *Deepwater Horizon Accident Investigation Report*, 162. Post-explosion pressure measurements also suggest the rig crew may have activated the middle pipe ram. *Ibid.*
- <sup>51</sup> Testimony of Bill Ambrose, 256; Internal Transocean document (TRN-HCEC 5487). Because of Macondo, some industry experts now question the appropriateness of typical kick response procedures.
- <sup>52</sup> BP, *Deepwater Horizon Accident Investigation Report*, 44.
- <sup>53</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, September 10, 2010; Testimony of Bill Ambrose, 256.
- <sup>54</sup> MMS regulation 30 CFR § 250.416(e) requires that the BOP description include information that shows the blind shear rams installed as capable of shearing the drill pipe in the hole under maximum anticipated surface pressures.
- <sup>55</sup> BP, *Deepwater Horizon Accident Investigation Report*, 175.
- <sup>56</sup> *Ibid.*
- <sup>57</sup> *Ibid.*, 103-04; Internal Transocean document (TRN-HCEC 5487).
- <sup>58</sup> Internal Transocean document (TRN-HCEC 5487).
- <sup>59</sup> Internal Transocean document (TRN-HCEC 5543).
- <sup>60</sup> BP, *Deepwater Horizon Accident Investigation Report*, 29.
- <sup>61</sup> Internal Transocean document (TRN-HCJ 121107).
- <sup>62</sup> *Ibid.*
- <sup>63</sup> Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 447-448.
- <sup>64</sup> Internal Transocean document (TRN-HCJ 121107).
- <sup>65</sup> Confidential industry expert, interview.
- <sup>66</sup> Testimony of William Stoner (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 380. The engines are equipped with shutdown devices. During an audit of the rig in April, Engine 3 was out of service and its shutdown function was likely not tested. Internal Transocean document (TRN-USCG\_MMS 38670).
- <sup>67</sup> Testimony of Michael Williams (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, July 23, 2010, 11-17.
- <sup>68</sup> Testimony of Paul Meinhart (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 29, 2010, 30; Testimony of Douglas Brown (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 26, 2010, 100-01.
- <sup>69</sup> Testimony of Douglas Brown, 130.
- <sup>70</sup> Testimony of Michael Williams, 16.
- <sup>71</sup> Testimony of Paul Meinhart, 30; Testimony of Jimmy Harrell, 65; Testimony of Stephen Bertone (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 116.
- <sup>72</sup> Internal BP document (BP-HZN-CEC 20285).
- <sup>73</sup> Testimony of Chris Pleasant, 123.
- <sup>74</sup> BP, *Deepwater Horizon Accident Investigation Report*, 150; Internal BP document (BP-HZN-MBI 143364).

<sup>75</sup> Internal Transocean document (TRN-HCJ 121114); Testimony of Jimmy Harrell, 21, 66-67, 70-71; Internal BP document (BP-HZN-CEC 20285).

<sup>76</sup> BP, *Deepwater Horizon Accident Investigation Report*, 152.

<sup>77</sup> The MUX cable reels were located in the moon pool, in the center of the rig underneath the rig floor. BP, *Deepwater Horizon Accident Investigation Report*, 151.

<sup>78</sup> Testimony of Curt Kuchta (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 190.

<sup>79</sup> Internal BP document (BP-HZN-BLY 39346); Testimony of Joseph Keith (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, December 7, 2010, 237; Allen Seraile (Transocean), interview with Commission staff, January 7, 2011; Testimony of Darryl Bourgoyne (Expert witness), Hearing before the National Commission, November 9, 2010, 179-80.

<sup>80</sup> BP's modeling indicates that "the flowing conditions could have prevented an annular preventer from fully closing and sealing around the drill pipe." BP, *Deepwater Horizon Accident Investigation Report*, 146.

<sup>81</sup> Internal Halliburton document (HAL\_48973); BP representatives, interview with Commission staff, September 8, 2010.

<sup>82</sup> Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 24.

<sup>83</sup> Internal Halliburton document (HAL\_48973); Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 23.

<sup>84</sup> Transocean asserts that the variable bore ram was closed. Testimony of Bill Ambrose, 252. Witnesses only saw the annular activated. Internal BP document (BP-HZN-MBI 21420).

<sup>85</sup> Internal Halliburton document (HAL\_48973); Smith, *Review of Operational Data Preceding Explosion on Deepwater Horizon in MC252*, 24.

<sup>86</sup> BP, *Deepwater Horizon Accident Investigation Report*, 172. According to Transocean, the proposal to convert the lower annular to a stripping annular was approved on July 29, 2006. Internal BP document (BP-HZN-MBI 136646).

<sup>87</sup> Internal BP document (BP-HZN-MBI 136646).

<sup>88</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, December 18, 2010.

<sup>89</sup> Some industry experts—including Darryl Bourgoyne at Louisiana State University—suggest that the diverter should be set automatically to go overboard. If the event is not an emergency, then the rig crew will have time to send the influx to the mud gas separator.

<sup>90</sup> Internal Transocean document (TRN-HCEC 5607).

<sup>91</sup> *Ibid.*

<sup>92</sup> Confidential industry expert, interview.

<sup>93</sup> BP, *Deepwater Horizon Accident Investigation Report*, 117.

<sup>94</sup> *Ibid.*, app. V, 52.

<sup>95</sup> *Ibid.*

<sup>96</sup> Steve Lewis (Expert witness), email to Commission staff, January 11, 2011.

<sup>97</sup> The Chief Counsel's team thus disagrees with Transocean's assertion that flow rate and volume would have been so extreme that it necessarily would have overwhelmed the diverter system had the crew sent flow overboard.

<sup>98</sup> BP, *Deepwater Horizon Accident Investigation Report*, 117. The Chief Counsel's team also requested information on the slip joint from Transocean, but it was unavailable at the publication of this report.

<sup>99</sup> *Ibid.*, 114.

<sup>100</sup> *Ibid.*, 117.

<sup>101</sup> NOAA, “Meteorological data from NOAA’s Station PSTL1,” [http://www.ndbc.noaa.gov/view\\_text\\_file.php?filename=pstl142010.txt.gz&dir=data/stdmet/Apr/](http://www.ndbc.noaa.gov/view_text_file.php?filename=pstl142010.txt.gz&dir=data/stdmet/Apr/); Internal BP document (BP-HZN-MBI 129187).

<sup>102</sup> NOAA, “Meteorological data from NOAA’s Station PSTL1,” [http://www.ndbc.noaa.gov/view\\_text\\_file.php?filename=pstl142010.txt.gz&dir=data/stdmet/Apr/](http://www.ndbc.noaa.gov/view_text_file.php?filename=pstl142010.txt.gz&dir=data/stdmet/Apr/); Internal BP document (BP-HZN-MBI 129187).

<sup>103</sup> Wind often changes, and BP’s report has the wind earlier in the day blowing the opposite direction. BP, *Deepwater Horizon Accident Investigation Report*, app. V, 22.

<sup>104</sup> The port overboard line was unavailable because the *Damon Bankston* was on that side of the rig.

<sup>105</sup> Deepwater Horizon Study Group, *The Macondo Blowout: 3rd Progress Report*, app. B, 13.

<sup>106</sup> David Izon, E.P. Danenberger and Melinda Mayes, “Absence of fatalities in blowouts encouraging in MMS study of OCS incidents,” *Drilling Contractor 90* (July/August 2007). The study’s authors also noted that a previous study found that “22 of the 41 diverter uses were considered successful.” *Ibid.*

<sup>107</sup> Confidential industry expert, interview; Deepwater Horizon Study Group, *The Macondo Blowout: 3rd Progress Report*, app. B, 13; BP, *Deepwater Horizon Accident Investigation Report*, 44.

<sup>108</sup> BP, *Deepwater Horizon Accident Investigation Report*, 44.

<sup>109</sup> Rachel Clingman (Transocean legal team), letter to Commission staff, November 16, 2010.

<sup>110</sup> BP agrees: “Transocean’s shut-in protocols did not fully address how to respond in high flow emergency situations after well control has been lost. Well control actions taken prior to the explosion suggest the rig crew was not sufficiently prepared to manage an escalating well control situation.” BP, *Deepwater Horizon Accident Investigation Report*, 44.

<sup>111</sup> Rachel Clingman (Transocean legal team), letter to Commission staff, November 1, 2010, att. *The Deepwater Horizon—Crew and Safety*, 7-8.

<sup>112</sup> Testimony of Bill Ambrose, 252.

<sup>113</sup> Clingman, letter.

<sup>114</sup> Internal Transocean document (TRN-HCEC 5609-5610).

<sup>115</sup> Even at the ninth step, the procedures are ambiguous. They say merely to “be prepared...to send the mud overboard,” not directly to send the mud overboard. Moreover, the 10th step prescribes continued circulation through the mud gas separator. Internal Transocean document. *Ibid.*

<sup>116</sup> In an interview after the explosion with BP investigators, Mark Hafle, the senior drilling engineer for Macondo, agreed. He observed that rig crews conduct frequent drills but not for worst-case scenarios. Internal BP document (BP-HZN-BLY 61371).

## Chapter 4.9

<sup>1</sup> 30 C.F.R. § 250.442; 30 C.F.R. § 250.515(b); 30 C.F.R. § 250.1624(b)(1).

<sup>2</sup> Internal BP document (BP-HZN-CEC 46007).

<sup>3</sup> Internal Cameron document (CAM-GR 101); Internal Transocean document (TRN-HCEC 5543); Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 137.

<sup>4</sup> To avoid having a tool joint lay across the blind shear rams, rig crews engage in a procedure whereby they close an annular preventer, strip the pipe upward (through the closed annular) until it hits a tool joint, and then lower the pipe a predetermined amount so that the tool joint is out of the way and there is only straight pipe across the rams. This procedure requires time and a sequence of steps, which an emergency situation may not permit. Commission staff site visit to the *Deepwater Nautilus*, September 9, 2010.

<sup>5</sup> Internal BP document (BP-HZN-BLY 59392-93).

<sup>6</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, January 22, 2011; BP legal team, interview with Commission staff, January 25, 2011. Most rigs use range 2 drill pipe, which averages 31 feet in

length per interval. However, deepwater rigs may use range 3 drill pipe, which comes in 38- to 45-foot lengths. Bourgoyne, interview, January 22, 2011.

<sup>7</sup> Adding an additional ram may require a reconfiguration of drilling rigs in order to accommodate a taller BOP stack.

<sup>8</sup> West Engineering Services, *Mini Shear Study for U.S. Minerals Management Service* (December 2002), 3.

<sup>9</sup> *Ibid.*

<sup>10</sup> Michael Montgomery (West Engineering Services), letter to Commission staff, November 12, 2010, 4.

<sup>11</sup> West Engineering Services, *Mini Shear Study for U.S. Minerals Management Service*, 3.

<sup>12</sup> *Ibid.*, 12.

<sup>13</sup> *Ibid.*

<sup>14</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), app. H, 234; Internal BP document (BP-HZN-BLY 52594). The test took five seconds to shear the pipe and 12 seconds to completely close the shear rams.

<sup>15</sup> BP, *Deepwater Horizon Accident Investigation Report*, 156.

<sup>16</sup> Internal BP document (BP-HZN-MBI 136652).

<sup>17</sup> 30 C.F.R. § 250.449(b), (d).

<sup>18</sup> 30 C.F.R. § 250.516; Internal BP document (BP-HZN-MBI 133302).

<sup>19</sup> 30 C.F.R. § 250.446(b) requires visual inspection of subsea BOPs at least once every three days. According to witness testimony, ROVs inspected the Deepwater Horizon BOP daily to monitor for equipment irregularities including leaks. Testimony of Tyrone Benton (Oceaneering), Hearing before the Deepwater Horizon Joint Investigation Team, July 23, 2010, 244. However, according to daily operations reports there were some days, including February 18, when ROVs did not dive to the BOP. Internal BP document (BP-HZN-MBI 135192).

<sup>20</sup> The blind shear ram was tested to 914 psi. Internal Transocean document (TRN-USCG\_MMS 26242). According to daily drilling reports, the rig crew pressure tested the blind shear ram on February 6, 2010; February 9, 2010; March 21, 2010; March 26, 2010; and April 1, 2010. Internal BP document (BP-HZN-OSC 4074); Internal BP document (BP-HZN-OSC 4099); Internal BP document (BP-HZN-OSC 4191); Internal BP document (BP-HZN-OSC 4222); Internal Transocean document (TRN-USCG\_MMS 26242).

<sup>21</sup> Internal BP document (BP-HZN-OSC 4116)(February 11, 2010); Internal BP document (BP-HZN-OSC 4139)(February 14, 2010); Internal BP document (BP-HZN-OSC 4207)(February 24, 2010); Internal BP document (BP-HZN-OSC 4037)(March 1, 2010); Internal BP document (BP-HZN-OSC 4070)(March 5, 2010); Internal BP document (BP-HZN-OSC 4158)(March 16, 2010); Internal BP document (BP-HZN-OSC 4222)(March 26, 2010); Internal Transocean document (TRN-USCG\_MMS 26242)(April 1, 2010); Internal Transocean document (TRN-USCG\_MMS 26266)(April 8, 2010); Testimony of Mark Hay (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 25, 2010, 249.

<sup>22</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, January 24, 2011.

<sup>23</sup> 30 C.F.R. § 250.448(b).

<sup>24</sup> Internal BP document (BP-HZN-OSC 619).

<sup>25</sup> BP, *Deepwater Horizon Accident Investigation Report*, app. H, 230. According to daily drilling reports, the blind shear ram was tested at various pressures during drilling, including 15,000 psi on the surface (February 6, 2010), 6,500 psi (February 9, 2010), 2,400 psi (March 21, 2010), 1,800 psi (March 26, 2010), and 914 psi (April 1, 2010). Internal BP document (BP-HZN-OSC 4074); Internal BP document (BP-HZN-OSC 4099); Internal BP document (BP-HZN-OSC 4191); Internal BP document (BP-HZN-OSC 4222); Internal Transocean document (TRN-USCG\_MMS 26242).

<sup>26</sup> 30 C.F.R. § 250.448(c). The upper annular was rated to withstand 10,000 psi closed on pipe or 5,000 psi closed on an open hole. BP, *Deepwater Horizon Accident Investigation Report*, app. H, 227. After conversion to a stripping annular, the lower annular was rated to withstand 5,000 psi. BP, *Deepwater Horizon Accident Investigation Report*, 172. Post-explosion examination of the blue pod found regulated pressure on the lower annular preventer was set to approximately 1,700 psi. *Ibid.*, 145. Transocean has recently contended the rig crew activated the upper annular, not the lower annular.



- <sup>27</sup> Internal BP document (BP-HZN-MBI 130883).
- <sup>28</sup> Internal BP document (BP-HZN-OSC 619).
- <sup>29</sup> Internal BP document (BP-HZN-OSC 925, 931-32).
- <sup>30</sup> Steve Lewis (Expert witness), interview with Commission staff, September 28, 2010.
- <sup>31</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, December 18, 2010.
- <sup>32</sup> *Ibid.*
- <sup>33</sup> Internal Transocean document (TRN-USCG\_MMS 11646).
- <sup>34</sup> BP, *Deepwater Horizon Accident Investigation Report*, 175-76. ROVs can also activate the rams electronically through subsea controls.
- <sup>35</sup> Nonpublic BP document (presentation to Commission staff, September 8, 2010), 13.
- <sup>36</sup> Internal BP document (BP-HZN-CEC 46012-13).
- <sup>37</sup> Internal BP document (BP-HZN-CEC 46012).
- <sup>38</sup> Internal Transocean document (TRN-USCG\_MMS 38822).
- <sup>39</sup> BP, *Deepwater Horizon Accident Investigation Report*, 29.
- <sup>40</sup> Internal BP document (BP-HZN-CEC 18896); BP, *Deepwater Horizon Accident Investigation Report*, 162.
- <sup>41</sup> BP, *Deepwater Horizon Accident Investigation Report*, 29.
- <sup>42</sup> Internal BP document (BP-HZN-CEC 18896).
- <sup>43</sup> Internal Department of the Interior document (OSC-DWH BOEM-WDC-Bo6-00001-0005), 374-79.
- <sup>44</sup> Internal BP document (BP-HZN-MBI 136647).
- <sup>45</sup> BP, *Deepwater Horizon Accident Investigation Report*, 172.
- <sup>46</sup> Internal BP document (BP-HZN-MBI 136648).
- <sup>47</sup> Internal BP document (BP-HZN-CEC 18896).
- <sup>48</sup> *Ibid.*
- <sup>49</sup> Testimony of Harry Thierens (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 25, 2010, 104-05.
- <sup>50</sup> The modification was made in 2004, and according to BP notes, it was “overlooked at the time” to change the ROV hot stab connections. Internal BP document (BP-HZN-MBI 136648); Internal BP document (BP-HZN-CEC 18896).
- <sup>51</sup> Internal BP document (BP-HZN-CEC 18896).
- <sup>52</sup> Internal Transocean document (TRN-HCEC 5708); Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 515.
- <sup>53</sup> BP, *Deepwater Horizon Accident Investigation Report*, 155.
- <sup>54</sup> *Ibid.*; Darryl Bourgoyne (Expert witness), interview with Commission staff, January 21, 2011.
- <sup>55</sup> Transocean legal team, interview with Commission staff, December 10, 2010.
- <sup>56</sup> BP, *Deepwater Horizon Accident Investigation Report*, 156.
- <sup>57</sup> Internal Cameron document (CAM-GR 209). Each SEM has an AMF card that recognizes when power, communication, and hydraulics are lost. BP, *Deepwater Horizon Accident Investigation Report*, 154 and app. X, 2.
- <sup>58</sup> Internal Cameron document (CAM-GR 209). According to manufacturer specifications, communication between the control pods must also be lost in order for the AMF/deadman to activate. It is not certain whether the control pods communicate locally or through the MUX cables running to the rig.

- <sup>59</sup> *Ibid.* The rigid conduit line running from the rig continually charged BOP stack accumulators. BP, Deepwater Horizon *Accident Investigation Report*, 160. Pressure sensors compare ambient pressure at the seabed with pressure in the conduit line. If conduit pressure is equal or less than ambient hydrostatic pressure, the AMF sequence continues. Internal Cameron document (CAM-GR 8041).
- <sup>60</sup> BP, Deepwater Horizon *Accident Investigation Report*, 175-76.
- <sup>61</sup> Internal Cameron document (CAM-GR 209); Internal BP document (BP-HZN-BLY 56840).
- <sup>62</sup> Internal Transocean document (TRN-USCG\_MMS 38826); BP, Deepwater Horizon *Accident Investigation Report*, 150.
- <sup>63</sup> BP, Deepwater Horizon *Accident Investigation Report*, 151.
- <sup>64</sup> Transocean legal team, interview with Commission staff, September 30, 2010.
- <sup>65</sup> BP, Deepwater Horizon *Accident Investigation Report*, 151. Transocean questions whether hydraulic power was severed between the rig and BOP during the explosion. Transocean legal team, interview, September 30, 2010.
- <sup>66</sup> Transocean legal team, interview, September 30, 2010.
- <sup>67</sup> Internal BP document (BP-HZN-CEC 18896); BP, Deepwater Horizon *Accident Investigation Report*, 29.
- <sup>68</sup> Transocean legal team, interview, December 10, 2010.
- <sup>69</sup> Internal BP document (BP-HZN-BLY 56143).
- <sup>70</sup> Transocean legal team, interview, September 30, 2010.
- <sup>71</sup> Internal Transocean document (TRN-HCEC 5708).
- <sup>72</sup> Rather, Transocean representatives indicated that neither the AMF system nor batteries necessary to power the system are regularly tested. Transocean legal team, interview, September 30, 2010. A deadman system surface test typically cuts the power and hydraulics to the BOP stack and confirms the rams are closed. Internal BP document (BP-HZN-CEC 18893). Testing the deadman subsea is a risk because cutting power and hydraulics to the BOP stack could drain the system batteries. The system could also fail to restart as designed. However, according to an internal BP memo, these are “manageable risks.” Internal BP document (BP-HZN-CEC 18894).
- <sup>73</sup> Records indicate “working on yellow pod” on February 1 and 2, 2010. Internal BP document (BP-HZN-BLY 55870). Both pods were function tested and powered on February 5, 2010. BP Internal document (BP-HZN-OSC 4065).
- <sup>74</sup> BP, Deepwater Horizon *Accident Investigation Report*, 153. The 27-volt battery was comprised of three connected 9-volt battery packs. *Ibid.*, app. X, 2.
- <sup>75</sup> *Ibid.*, app. X, 2. The sequence may have stopped prior to energizing the conduit and ambient pressure sensors, which according to BP testing requires at least 14.4 volts. *Ibid.*, app. X, 4.
- <sup>76</sup> *Ibid.*, app. X, 4.
- <sup>77</sup> Testimony of William Stringfellow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 25, 2010, 421.
- <sup>78</sup> BP, Deepwater Horizon *Accident Investigation Report*, app. X, 3. The Chief Counsel's team received protocols used during this initial blue pod testing but awaits more comprehensive results from the ongoing government forensic testing of the blowout preventer.
- <sup>79</sup> *Ibid.*
- <sup>80</sup> After the AMF sequence, the SEM, AMF card, and AMF controller are powered down to preserve battery life. *Ibid.*, app. X, 2.
- <sup>81</sup> Transocean legal team, interview, September 30, 2010.
- <sup>82</sup> Important records relating to the blowout preventer were lost with the sinking of the rig. This includes the event logger, which continuously records data from both pods and records all BOP functions activated from the control panels. BP, Deepwater Horizon *Accident Investigation Report*, app. H, 232. This lost information may have helped to determine what the battery charges were at the time of the incident.

- <sup>83</sup> Internal Cameron document (CAM-GR 252). Cameron recommends replacing pod batteries at the following times, whichever is earliest: after one year of on-time operation, when a battery is actuated 33 times, or five years after date of purchase.
- <sup>84</sup> Testimony of William Stringfellow, 348-49.
- <sup>85</sup> Internal Transocean document (TRN-USCG\_MMS 38660).
- <sup>86</sup> Transocean subsea supervisor Chris Pleasant testified that pod batteries were not replaced immediately before the crew lowered the BOP in February 2010. Testimony of Chris Pleasant (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 199. Senior subsea engineer Mark Hay testified that the blue pod batteries are “replaced within a year.” Testimony of Mark Hay, 262-63.
- <sup>87</sup> BP, *Deepwater Horizon Accident Investigation Report*, 167.
- <sup>88</sup> Internal Transocean document (TRN-HCJ 98117)(Pod #2 December 29, 2005 replacement, Cost: \$17,786.13); Internal Transocean document (TRN-PC 3787).
- <sup>89</sup> BP, *Deepwater Horizon Accident Investigation Report*, app. H, 233.
- <sup>90</sup> *Ibid.*; Earl Shanks et al., “Deepwater BOP Control Systems—A Look at Reliability Issues” (paper, Offshore Technology Conference, Houston, TX, May 2003), 1.
- <sup>91</sup> BP, *Deepwater Horizon Accident Investigation Report*, app. H, 233; Cameron representative, interview with Commission staff, August 10, 2010.
- <sup>92</sup> Internal BP document (BP-HZN-BLY 55870).
- <sup>93</sup> BP, *Deepwater Horizon Accident Investigation Report*, 154. These results were witnessed and accepted on May 8, 2010. Internal Cameron document (CAMCG 3011).
- <sup>94</sup> Internal Cameron document (CAMCG 2999).
- <sup>95</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010; BP, *Deepwater Horizon Accident Investigation Report*, 173.
- <sup>96</sup> Testimony of Mark Hay, 262. An April 2010 Transocean rig condition assessment identified an error message on the yellow pod indicating a valve was mismatched. Internal Transocean document (TRN-USCG\_MMS 38657). However, the audit did not clarify which solenoid valve and left the issue unresolved. It is not certain whether this message could be an indication of a faulty solenoid. Internal Transocean document (TRN-USCG\_MMS 38658).
- <sup>97</sup> Darryl Bourgoyne (Expert witness), interview with Commission staff, December 14, 2010.
- <sup>98</sup> Internal BP document (BP-HZN-BLY 56842).
- <sup>99</sup> BP, *Deepwater Horizon Accident Investigation Report*, 156.
- <sup>100</sup> Internal BP document (BP-HZN-BLY 55870); Internal Transocean document (TRN-HCEC 5708). The autoshear is tested by sending a signal that simulates LMRP disconnection, then verifying the shuttle valves for the selected rams worked as intended. This can be done through “dry firing,” meaning with no hydraulic pressure. Internal BP document (BP-HZN-CEC 18894).
- <sup>101</sup> Internal BP document (BP-HZN-CEC 18896); BP, *Deepwater Horizon Accident Investigation Report*, 48.
- <sup>102</sup> Internal BP document (BP-HZN-CEC 18896); BP, *Deepwater Horizon Accident Investigation Report*, 156.
- <sup>103</sup> Nonpublic BP document (presentation to Commission staff on BOP), 15.
- <sup>104</sup> Preliminary evidence shows the upper annular preventer closed around the drill pipe. Therefore, even if pipe severed above the annular preventer, the annular would have prevented that pipe from falling below the annular and interfering with the closure of the blind shear ram.
- <sup>105</sup> BP, *Deepwater Horizon Accident Investigation Report*, app. H, 228.
- <sup>106</sup> *Ibid.*, app. H, 231. The BOP stack accumulators also provided hydraulic fluid should the rig crew directly activated the blind shear ram from one of the rig’s control panels. *Ibid.*
- <sup>107</sup> *Ibid.*, 160.

<sup>108</sup> Internal BP document (BP-HZN-BLY 55870); Internal BP document (BP-HZN-OSC 4049). Accumulator levels are generally checked prior to or during an accumulator drill. Bourgoyne, interview, January 22, 2011.

<sup>109</sup> According to BP's internal investigation, if only three accumulators were charged there would not be sufficient pressure to shear the pipe and seal the well. BP, *Deepwater Horizon Accident Investigation Report*, 160.

<sup>110</sup> *Ibid.*, 170-71.

<sup>111</sup> *Ibid.*, 170.

<sup>112</sup> *Ibid.*, 171.

<sup>113</sup> Internal BP document (BP-HZN-MBI 135553).

<sup>114</sup> Darryl Bourgoyne (Expert witness), email to Commission staff, December 15, 2010.

<sup>115</sup> *Ibid.*

<sup>116</sup> Bourgoyne, interview, January 22, 2011. According to a 2010 West Engineering study on blowout prevention equipment reliability, "a very large percentage" of control system failures can be identified by function tests. Internal Cameron document (CAM-GR 15911). According to this study, lower pressures may not allow leaks to be indentified. Internal Cameron document (CAM-GR 15918).

<sup>117</sup> Bourgoyne, interview, January 22, 2011.

<sup>118</sup> *Ibid.*

<sup>119</sup> Testimony of Mark Hay, 242.

<sup>120</sup> The rig crew identified leaks 1, 2, and 5 before the incident. Rachel Clingman (Transocean legal team), letter to Commission staff, November 1, 2010.

<sup>121</sup> Bourgoyne, interview, December 18, 2010. Post-explosion log books identified more leaks, some of which may have developed during the response effort and some of which were identified prior to the incident. Internal BP document (BP-HZN-MBI 135553).

<sup>122</sup> BP, *Deepwater Horizon Accident Investigation Report*, 170.

<sup>123</sup> *Ibid.*, 156; Clingman, letter.

<sup>124</sup> Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 193-95; BP, *Deepwater Horizon Accident Investigation Report*, 169.

<sup>125</sup> Internal BP document (BP-HZN-MBI 135226); Internal BP document (BP-HZN-MBI 192017). The leak may have been recognized even earlier than February 23. While inspecting leak 2 on February 19, the rig crew isolated the pressure supply to the yellow pod and, using the ROV, observed a pilot system leak on the yellow pod. This may have been referring to leak 1. Clingman, letter.

<sup>126</sup> Clingman, letter; BP, *Deepwater Horizon Accident Investigation Report*, 169.

<sup>127</sup> Clingman, letter. According to witness testimony, this leak was discovered approximately two weeks after landing the BOP on the wellhead. Testimony of Mark Hay, 244. According to BP's internal investigation, this leak was not identified until post-explosion ROV intervention. BP, *Deepwater Horizon Accident Investigation Report*, 169.

<sup>128</sup> BP, *Deepwater Horizon Accident Investigation Report*, 170.

<sup>129</sup> Internal Transocean document (TRN-USCG\_MMS 38843).

<sup>130</sup> BP, *Deepwater Horizon Accident Investigation Report*, 170.

<sup>131</sup> Internal Transocean document (TRN-USCG\_MMS 38843).

<sup>132</sup> BP, *Deepwater Horizon Accident Investigation Report*, 171.

<sup>133</sup> Clingman, letter.

<sup>134</sup> *Ibid.*

<sup>135</sup> 30 C.F.R. § 250.466(f).

<sup>136</sup> Elmer Danenberger (Expert witness), email to Commission staff, January 5, 2011.

- <sup>137</sup> Internal BP document (BP-HZN-OSC 4199-4202).
- <sup>138</sup> Internal BP document (BP-HZN-MBI 135226); Internal BP document (BP-HZN-MBI 135558).
- <sup>139</sup> John Guide, interview with Commission staff, September 17, 2010.
- <sup>140</sup> Ronnie Sepulvado, interview with Commission staff, August 20, 2010.
- <sup>141</sup> Clingman, letter.
- <sup>142</sup> Internal BP document (BP-HZN-OSC 4175-77).
- <sup>143</sup> Clingman, letter.
- <sup>144</sup> Danenberger, email, January 5, 2011.
- <sup>145</sup> Bourgoyne, interview, January 22, 2011.
- <sup>146</sup> According to senior subsea supervisor Owen McWhorter, this leak was brought to everyone's attention. Clingman, letter. BP's John Guide called Transocean's Paul Johnson and confirmed the leak did not affect the ram's functionality. Guide, interview.
- <sup>147</sup> Internal BP document (BP-HZN-MBI 225124).
- <sup>148</sup> Clingman, letter.
- <sup>149</sup> *Ibid.*
- <sup>150</sup> *Ibid.*
- <sup>151</sup> *Ibid.*; Internal BP document (BP-HZN-MBI 135553).
- <sup>152</sup> Testimony of Mark Hay, 195.
- <sup>153</sup> American Petroleum Institute, *Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells*, 3rd ed. (March 1997, reaffirmed September 2004), 56 ("API RP 53 § 18.10.3").
- <sup>154</sup> *Ibid.*
- <sup>155</sup> Testimony of William Stringfellow, 359.
- <sup>156</sup> Internal Cameron document (CAM-GR 261); Bourgoyne, interview, January 22, 2011.
- <sup>157</sup> Earl Shanks et al., *Deepwater BOP Control Systems—A Look at Reliability Issues* (May 2003), 2.
- <sup>158</sup> Internal Transocean document (TRN-HCEC 90585).
- <sup>159</sup> 30 C.F.R. § 250.446(a).
- <sup>160</sup> API RP 53 § 18.10.3.
- <sup>161</sup> Internal Cameron document (CAM-GR 261-62).
- <sup>162</sup> Testimony of Mark Hay, 205; Testimony of John Sprague (BP), Hearing before the Deepwater Horizon Joint Investigation Team, December 8, 2010, part 2, 79-80.
- <sup>163</sup> Internal BP document (BP-HZN-MBI 136213); Internal BP document (BP-HZN-MBI 136230).
- <sup>164</sup> Internal Transocean document (TRN-USCG\_MMS 38652).
- <sup>165</sup> Internal BP document (BP-HZN-MBI 136230); Testimony of John Sprague, 79-80.
- <sup>166</sup> Internal Transocean document (TRN-USCG\_MMS 38652).
- <sup>167</sup> Internal Transocean document (TRN-USCG\_MMS 38662). The BOP's fail-safe valves, designed to shut off choke and kill lines remotely and automatically, had also not been certified since December 13, 2000. Internal Transocean document (TRN-USCG\_MMS 38656).
- <sup>168</sup> 30 C.F.R. § 250.446(a); Danenberger, email, January 5, 2011. To use a stack that was out of compliance, BP may have needed to request a regulatory departure under 30 C.F.R. § 250.142. Elmer Danenberger (Expert witness), email to Commission staff, January 16, 2011.
- <sup>169</sup> Internal Transocean document (TRN-HCEC 66722); Testimony of Eric Neal (MMS), Hearing before the Deepwater Horizon Joint Investigation Team, May 11, 2010, 318-21.

- <sup>170</sup> Internal MMS document.
- <sup>171</sup> Testimony of Mark Hay, 255-56.
- <sup>172</sup> Internal Transocean document (TRN-HCEC 11560).
- <sup>173</sup> Testimony of William Stringfellow, 414-15.
- <sup>174</sup> *Ibid.*, 415.
- <sup>175</sup> *Ibid.*, 413-14 (emphasis added)(condition of BOPs is tracked in the RMS).
- <sup>176</sup> *Ibid.*
- <sup>177</sup> *Ibid.*, 426-27, 439.
- <sup>178</sup> BP, Deepwater Horizon *Accident Investigation Report*, app. AA, 2.
- <sup>179</sup> Internal BP document (BP-HZN-MBI 136649).
- <sup>180</sup> Internal BP document (BP-HZN-MBI 136646).
- <sup>181</sup> Internal Transocean document (TRN-USCG\_MMS 38855).
- <sup>182</sup> *Ibid.*
- <sup>183</sup> BP, Deepwater Horizon *Accident Investigation Report*, app. AA, 1. According to Transocean, conditions after the explosion permitted the control pods to be retrieved despite this modification. Transocean legal team, interview with Commission staff, November 2, 2010.
- <sup>184</sup> BP, Deepwater Horizon *Accident Investigation Report*, app. AA, 1.
- <sup>185</sup> *Ibid.*, app. AA, 2.
- <sup>186</sup> *Ibid.*
- <sup>187</sup> Internal Transocean document (TRN-USCG\_MMS 38855).
- <sup>188</sup> Cameron representative, interview.
- <sup>189</sup> BP, Deepwater Horizon *Accident Investigation Report*, 172.
- <sup>190</sup> *Ibid.*, app. AA, 1.
- <sup>191</sup> *Ibid.*, 172.
- <sup>192</sup> Internal BP document (BP-HZN-MBI 136649).
- <sup>193</sup> Internal BP document (BP-HZN-MBI 136648).
- <sup>194</sup> *Ibid.*
- <sup>195</sup> BP, Deepwater Horizon *Accident Investigation Report*, app. AA, 2.
- <sup>196</sup> Internal BP document (BP-HZN-MBI 136647).
- <sup>197</sup> Internal BP document (BP-HZN-MBI 136648).
- <sup>198</sup> Internal BP document (BP-HZN-MBI 136649).
- <sup>199</sup> *Ibid.*
- <sup>200</sup> *Ibid.*
- <sup>201</sup> Internal Transocean document (TRN-HCJ 96972).
- <sup>202</sup> BP, Deepwater Horizon *Accident Investigation Report*, 172; Internal BP document (BP-HZN-MBI 136646).
- <sup>203</sup> Internal BP document (BP-HZN-BLY 56004).
- <sup>204</sup> Internal Transocean document (TRN-USCG\_MMS 38855).
- <sup>205</sup> *Ibid.*

<sup>206</sup> *Ibid.*

<sup>207</sup> Internal BP document (BP-HZN-MBI 136648).

## Chapter 4.10

<sup>1</sup> Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 87.

<sup>2</sup> Internal Transocean document (Transocean, “Deepwater Horizon Safety and Maintenance Overview,” presentation to U.S. House of Representatives Committee on Energy and Commerce, August 2010), 13.

<sup>3</sup> *Ibid.*, 8, 10.

<sup>4</sup> Testimony of Pat O’Bryan (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 26, 2010, 411.

<sup>5</sup> John Guide (BP), interview with Commission staff, September 17, 2010.

<sup>6</sup> Testimony of Pat O’Bryan, 365.

<sup>7</sup> Internal BP document (BP-HZN-MBI 198309).

<sup>8</sup> Internal Transocean document (TRN-HCEC 5322). Transocean also used a system called “FOCUS” for tracking audit items and rig crew training. David Young (Transocean), interview with Commission staff, November 19, 2010.

<sup>9</sup> Testimony of Paul Johnson (Transocean), Hearing before Deepwater Horizon Joint Investigation Team, August 23, 2010, 325. Previously, Transocean used an Empac system. Internal BP document (BP-HZN-MBI 136212).

<sup>10</sup> Internal Transocean document (TRN-HCEC 5340); Testimony of Stephen Bertone (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, July 19, 2010, 231. The Rig Management System was the approved Computerized Maintenance Management System (CMMS) for all Transocean installations. Witness testimony commonly refers to the RMS as the rig maintenance system. Testimony of Stephen Bertone (Transocean), July 19, 2010, 70.

<sup>11</sup> Internal Transocean document (TRN-HCEC 5340).

<sup>12</sup> Internal Transocean document (TRN-HCEC 5343).

<sup>13</sup> Preventative maintenance refers generally to normally scheduled maintenance, including planned maintenance, scheduled overhauls, condition monitoring, and daily and weekly equipment checks and measurements. Internal Transocean document (TRN-HCEC 5358).

<sup>14</sup> Testimony of Stephen Bertone, 109.

<sup>15</sup> *Ibid.*

<sup>16</sup> Internal Transocean document (TRN-HCEC 5340).

<sup>17</sup> Young, interview. Young suggested that a lack of knowledge among the crew may not have been problematic because supervisors were familiar with the system. Young handled entries into the system for his team such that, according to Young, a lack of system familiarity did not inhibit operations. David Young, interview.

<sup>18</sup> Internal Transocean document (Transocean, “Deepwater Horizon Safety and Maintenance Overview,” presentation to U.S. House of Representatives Committee on Energy and Commerce, August 2010), 16.

<sup>19</sup> Testimony of Stephen Bertone, 233.

<sup>20</sup> *Ibid.*

<sup>21</sup> *Ibid.* According to chief engineer technician Mike Williams, there would be up to four listings for the same job. Testimony of Mike Williams (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, July 23, 2010, 76.

<sup>22</sup> Allen Seraile (Transocean), interview with Commission staff, January 7, 2011.

- <sup>23</sup> Testimony of Stephen Bertone, 232-33.
- <sup>24</sup> Seraile, interview.
- <sup>25</sup> Testimony of Mike Williams, 75. Transocean has suggested that the rig crew described the implementation of the RMS as a “speed bump.” Internal Transocean document (Transocean, “Deepwater Horizon Safety and Maintenance Overview,” presentation to U.S. House of Representatives Committee on Energy and Commerce, August 2010), 24.
- <sup>26</sup> Internal Transocean document (TRN-HCEC90590).
- <sup>27</sup> *Ibid.*
- <sup>28</sup> *Ibid.*
- <sup>29</sup> Internal Transocean document (TRN-HCEC 90910-11).
- <sup>30</sup> Testimony of Paul Johnson, 352; Internal BP document (BP-HZN-OSC 4254). However, some forms of maintenance, including BOP maintenance, were exempt from this provision. *Ibid.*
- <sup>31</sup> Internal Transocean document (TRN-HCEC 90584).
- <sup>32</sup> Internal Transocean document (TRN-HCEC 90585).
- <sup>33</sup> Guide, interview.
- <sup>34</sup> Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 508. Winslow’s full title is Operations Manager, Performance, North American Division. *Ibid.*, 437.
- <sup>35</sup> Testimony of Mike Williams, 161.
- <sup>36</sup> Internal Transocean document (Transocean, “Deepwater Horizon Safety and Maintenance Overview,” presentation to U.S. House of Representatives Committee on Energy and Commerce, August 2010, slide 14). Internal Transocean document (TRN-HCEC 90585).
- <sup>37</sup> Internal Transocean document (TRN-HCEC 90585).
- <sup>38</sup> Internal Transocean document (TRN-HCEC 90603).
- <sup>39</sup> Transocean legal team, interview with Commission staff, August 6, 2010.
- <sup>40</sup> Internal Transocean document (TRN-HCEC 5384).
- <sup>41</sup> Testimony of Paul Johnson, 290-91.
- <sup>42</sup> For example, the September 2009 audit and April 2010 rig condition assessment both identified excessive silicon on mud pump covers that could cause pump failure. Internal BP document (BP-HZN-MBI 136221); Internal Transocean document (TRN-USCG\_MMS 38637). The September 2009 audit identified the pipe racking system (PRS) as requiring maintenance before drilling operations resumed; the April 2010 rig condition assessment found the PRS in only “fair” condition. Internal BP document (BP-HZN-MBI 136240); Internal Transocean document (TRN-USCG\_MMS 38666). According to assistant driller Allen Seraile, the rig crew was aware of major problems with the PRS. Seraile, interview.
- <sup>43</sup> Internal Transocean document (TRN-HCEC 90955).
- <sup>44</sup> Internal Transocean document (TRN-HCEC 90968-69).
- <sup>45</sup> Testimony of Mike Williams, 115.
- <sup>46</sup> Guide, interview.
- <sup>47</sup> Internal Transocean document (TRN-HCEC 90901).
- <sup>48</sup> Testimony of Michael Saucier (MMS), Hearing before the Deepwater Horizon Joint Investigation Team, May 12, 2010, 12-15.
- <sup>49</sup> Testimony of Paul Johnson, 120.
- <sup>50</sup> *Ibid.*
- <sup>51</sup> *Ibid.*



<sup>52</sup> The rig audit surveys the condition of the drilling machinery while the marine audit surveys the ability of the vessel itself. Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 96. BP conducts assessments on all vessels owned by third parties that BP employs in the Gulf of Mexico. Testimony of Neil Cramond (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 23, 2010, 21-30. The September 2009 audit followed up a previous BP rig audit and included a standard marine assessment as prescribed by the International Maritime Contractors Association (IMCA). The audit also reviewed the condition of the dynamic positioning system. *Ibid*, 94-95.

<sup>53</sup> Internal BP document (BP-HZN-MBI 136222).

<sup>54</sup> *Ibid.*; Testimony of Neil Cramond, 94.

<sup>55</sup> The new system showed duplicates and listed jobs with no work history as immediately due because there was no history in the new system. Internal Transocean document. (Transocean, “Deepwater Horizon Safety and Maintenance Overview,” presentation to U.S. House of Representatives Committee on Energy and Commerce, August 2010, slides 16, 24.) Duplicate maintenance orders and orders from other rigs may have also inflated the number of overdue items. *Ibid*, 233.

<sup>56</sup> Internal BP document (BP-HZN-MBI 136222); Testimony of Paul Johnson, 314-15, 321-22; Testimony of Neil Cramond, 35-36. The *Horizon* was already in an out-of-service period at the time of the audit so rather than stopping ongoing operations, BP requested the rig remain shut down until some repairs were made. Testimony of Paul Johnson, 248. This included repairs to the rig’s pipe racking system, as one of the racking arms was bent. *Ibid*, 315.

<sup>57</sup> Testimony of Daun Winslow, August 24, 2010, 187.

<sup>58</sup> BP, Deepwater Horizon *Accident Investigation Report*, app. Y, 1 (September 8, 2010), 1.

<sup>59</sup> Angel Rodriguez of BP verified a Transocean spreadsheet of maintenance items. Testimony of Neil Cramond, 100-01. Tracking of other audits may not have been as focused. An April 2010 email from John Guide to Paul Johnson indicated 36 of 37 action items from an August 2009 environmental audit may have remained outstanding as of April 2010. Internal BP document (BP-HZN-MBI 251718).

<sup>60</sup> Testimony of Neil Cramond, 74. Four days after the audit ended on September 17, Transocean’s Paul Johnson emailed BP’s John Guide to inform him Transocean was satisfied the rig could resume operations because audit items were either closed out or had “robust mitigation measures in place.” Internal BP document (BP-HZN-BLY 55679). The rig audit took place September 13-17. Internal BP document (BP-HZN-MBI 136212).

<sup>61</sup> Brett Coteles, Angel Rodriguez, and sometimes John Guide would attend these meetings. Testimony of Paul Johnson, 325, 354-55. While meetings were initially weekly, the companies later began meeting biweekly or monthly to discuss audit progress. *Ibid*, 325.

<sup>62</sup> *Ibid*, 355. BP well site leaders stayed informed by attending 8:30 a.m. rig meetings or had rig crew members email them regarding broken parts. Ronnie Sepulvado (BP), interview with Commission staff, August 20, 2010.

<sup>63</sup> Internal Transocean document (TRN-HCEC 115553).

<sup>64</sup> Testimony of Paul Johnson, 247.

<sup>65</sup> *Ibid*, 316; Testimony of Neil Cramond, 115.

<sup>66</sup> Sepulvado, interview.

<sup>67</sup> Testimony of Neil Cramond, 116-18.

<sup>68</sup> Testimony of John Guide, 201.

<sup>69</sup> Internal Transocean document (TRN-HCEC 66722); Testimony of Eric Neal (MMS), Hearing before the Deepwater Horizon Joint Investigation Team, May 11, 2010, 318.

<sup>70</sup> Internal MMS document.

## Chapter 5

<sup>1</sup> BP, *Deepwater Horizon Accident Investigation Report* (September 8, 2010), 32 (identifying eight “physical or operational barriers” that failed and concluding that “[i]f any of these critical factors had been eliminated, the outcome of *Deepwater Horizon* events on April 20, 2010, could have been either prevented or reduced in severity”).

<sup>2</sup> BP’s operating management system (OMS) sets out minimum expectations for “leadership,” “people and competence,” “procedures,” “working with contractors,” “technology,” and “risk” (among others). Internal BP document (BP-HZN-MBI 208576-77). Transocean’s management system has principles on “leadership,” “policies and procedures,” “organization,” “risk management,” “training and competence,” and “communications.” Internal Transocean document (TRN-USCG\_MMS 32700). Exxon’s operations integrity management system (OIMS) is also quite similar. ExxonMobil, *Operations Integrity Management System*.

<sup>3</sup> Internal BP document (BP-HZN-MBI 208603).

<sup>4</sup> Internal BP document (BP-HZN-MBI 208611).

<sup>5</sup> Internal BP document (BP-HZN-MBI 222521).

<sup>6</sup> *Ibid.*

<sup>7</sup> David Sims (BP), interview with Commission staff, February 1, 2011. At about the same time, Sims had drafted a longer version of the email to Guide that he never sent. Internal BP document (BP-HZN-MBI 222540). He wrote, “Everything else is someone else’s fault. You criticize nearly everything we do on the rig but don’t seem to realize that you are responsible for everything we do on the rig.” *Ibid.* He also wrote, “You seem to not want to make a decision so that you can criticize it later.” *Ibid.* Sims also pointed out a number of times when episodes on the rig—including a kick, a crane incident, and an injury—were not reported in a timely manner to onshore members of the Macondo team. *Ibid.* Sims later explained that he was frustrated with Guide but later realized he probably should have cut Guide a bit more slack because a member of Guide’s family had recently passed away. Sims, interview, February 1, 2011.

<sup>8</sup> Internal BP document (BP-HZN-MBI 212781). The next day, BP senior drilling engineer Mark Hafle asked a colleague, “Have you been within earshot of any of the Sims / Guide conversations lately?” Internal BP document (BP-HZN-MBI 212781).

<sup>9</sup> David Sims (BP), interview with Commission staff, December 14, 2010; Testimony of John Sprague (BP), Hearing before the Deepwater Horizon Joint Investigation Team, December 8, 2010, part 2, 10-11.

<sup>10</sup> Sims, interview, December 14, 2010; Testimony of Gregory Walz (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, part 2, 119.

<sup>11</sup> Internal BP document (BP-HZN-CEC 21533).

<sup>12</sup> Internal BP document (BP-HZN-BLY 125441).

<sup>13</sup> Sims, interview, February 1, 2011.

<sup>14</sup> Internal BP document (BP-HZN-BLY 61356).

<sup>15</sup> Internal BP document (BP-HZN-BLY 61470).

<sup>16</sup> Internal BP document (BP-HZN-MBI 255906).

<sup>17</sup> John Guide (BP), interview with Commission staff, January 19, 2011.

<sup>18</sup> Internal BP document (BP-HZN-BLY 61372).

<sup>19</sup> Sims, interview, February 1, 2011; Internal BP document (BP-HZN-BLY 125441).

<sup>20</sup> BP, *Deepwater Horizon Accident Investigation Report*, 36.

<sup>21</sup> Internal BP document (BP-HZN-BLY 125439).

<sup>22</sup> Internal BP document (BP-HZN-BLY 125436).

<sup>23</sup> Testimony of Brett Cocalles (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 113; Randy Ezell (Transocean), interview with Commission staff, September 16, 2010; Testimony of Paul Johnson (Transocean), August 23, 2010, 136-38. Halliburton’s Vincent Tabler admitted that he read the OptiCem report but did not review the portion indicating “SEVERE gas flow” potential. Testimony of

Vincent Tabler (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, August 25, 2010, 17.

<sup>24</sup> Internal BP document (BP-HZN-BLY 61350).

<sup>25</sup> Internal BP document (BP-HZN-MBI 254886).

<sup>26</sup> Internal BP document (BP-HZN-MBI 193521).

<sup>27</sup> The plan required personnel to call shore for “Any HSSE incident” or “Anytime operations deviate from agreed plan.” Internal BP document (BP-HZN-MBI 193528).

<sup>28</sup> Internal BP document (BP-HZN-BLY 61374).

<sup>29</sup> Internal BP document (BP-HZN-MBI 308059).

<sup>30</sup> Internal BP documents (BP-HZN-MBI 262896-7).

<sup>31</sup> Gregory Walz (BP), interview with Commission staff, October 6, 2010; Brett Cocales (BP), interview with Commission staff, September 16, 2010; John Guide (BP), interview with Commission staff, September 17, 2010; Sims, interview, December 14, 2010; Pat O’Bryan (BP), interview with Commission staff, December 17, 2010.

<sup>32</sup> It is perhaps not surprising that neither Kaluza nor Vidrine called back to shore. Kaluza was new to the *Deepwater Horizon*, whereas Vidrine had been there for months and Revette and Anderson were experienced veterans on the rig. In Kaluza’s 2009 performance review, BP management observed, “It sometimes appears that Bob is trying too much to impress the Houston office by attempting to have all the answers to any questions that may arise.” Internal BP document (BP-HZN-MBI 193095-98). As for Vidrine, BP management praised him in his 2009 performance review because he only called to shore when needed. Internal BP document (BP-HZN-OSC 9089).

<sup>33</sup> Guide, interview, September 17, 2010; Murry Sepulvado (BP), interview with Commission staff, December 10, 2010.

<sup>34</sup> Testimony of Mark Bly (BP), Hearing before the National Commission, November 8, 2010, 286. Even that “expectation” would have been insufficient, as it would have required the well site leaders to be confused. Thus, Kaluza and others twice called back to shore for guidance when they encountered difficulties attempting to convert the float equipment. See [Chapter 4.3](#). Whether well site leaders are confused or not, they should be required to call back to shore for a second opinion whenever there is anything unusual or unexpected with critical tests, such as the negative pressure test.

<sup>35</sup> Testimony of John Sprague, 177 (agreeing that it does not take long to call back to shore).

<sup>36</sup> Internal BP document (BP-HZN-BLY 38354).

<sup>37</sup> Internal BP document (BP-HZN-BLY 38355).

<sup>38</sup> *Ibid.*

<sup>39</sup> Internal BP document (BP-HZN-BLY 38361).

<sup>40</sup> *Ibid.*

<sup>41</sup> Internal BP document (BP-HZN-BLY 38362).

<sup>42</sup> Internal Transocean document (HQS-OPS-ADV-09).

<sup>43</sup> *Ibid.*

<sup>44</sup> *Ibid.*

<sup>45</sup> *Ibid.*

<sup>46</sup> *Ibid.*

<sup>47</sup> Ezell, interview; Testimony of Paul Johnson, 340-342, 344-347; Testimony of Daun Winslow (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 132-36; Testimony of Jerry Canducci, Hearing before the Deepwater Horizon Joint Investigation Team, December 9, 2010, part 1, 171-172.

<sup>48</sup> Transocean representatives, interview with Commission staff, December 10, 2010.

- <sup>49</sup> Internal Transocean document (TRN-PC 3227-30).
- <sup>50</sup> Internal Transocean document (TRN-PC 3227).
- <sup>51</sup> Internal Transocean document (TRN-PC 3229).
- <sup>52</sup> Testimony of Daun Winslow, 122-23.
- <sup>53</sup> Internal Transocean document (TRN-PC 3229); Transocean legal team, interview, December 10, 2010. As an aside, it appears that BP sometimes shared lessons from well control events on certain wells with rig crews operating other wells. Internal BP document (BP-HZN-MBI 221988). It is unclear whether the company did this on a systematic basis. In general, it appears that the industry as a whole does not systematically share incident reports and “lessons learned” broadly across companies.
- <sup>54</sup> Internal Transocean document (TRN-PC 3227). Even after the blowout, Transocean continues to insist that drilling and completions are so different—like “apples and oranges”—as to render the North Sea incident irrelevant. Transocean representatives, interview, December 10, 2010.
- <sup>55</sup> Testimony of Daun Winslow, 129.
- <sup>56</sup> Transocean legal team, interview with Commission staff, December 10, 2010.
- <sup>57</sup> Testimony of Paul Johnson, 385. Transocean sent out another, more detailed advisory on April 14, 2010. Internal Transocean document (TRN-PC 3227-230). However, it sent the advisory only to its North Sea fleet; it did not send it to the Gulf of Mexico. And again, it unduly limited it to completion operations—the title of the advisory was “Loss of Well Control During Completions Operations.” Internal Transocean document (TRN-PC 3227-30).
- <sup>58</sup> Transocean legal team, interview, December 14, 2010.
- <sup>59</sup> Internal BP document (BP-HZN-MBI 199122).
- <sup>60</sup> Morel was relatively new to drilling engineering and BP. He was assigned to the exploration team in 2008, where he helped to plan two wells before being transferred to Macondo to help Hafle. Hafle, by contrast, was the senior drilling engineer of the two and has been involved with deepwater drilling since 1993 and has personally been involved in between 20 and 50 wells. Testimony of Mark Hafle (BP), Hearing before the Deepwater Horizon Joint Investigation Team, May 28, 2010, 8-9. Hafle was on vacation during much of the week leading up to the blowout.
- <sup>61</sup> Internal BP document (BP-HZN-MBI 195579).
- <sup>62</sup> Testimony of John Sprague, 175-76.
- <sup>63</sup> *Ibid.*, 193-94. Sprague further acknowledged that drill plans should be provided to the rig as soon as possible, admitting that “You can plan and understand things a lot better the sooner they get there, isn’t that true?” *Ibid.*, 192.
- <sup>64</sup> Internal BP document (BP-HZN-MBI 199122).
- <sup>65</sup> Internal BP document (BP-HZN-MBI 126145).
- <sup>66</sup> Internal BP document (BP-HZN-MBI 126333).
- <sup>67</sup> Internal BP document (BP-HZN-MBI 126585-586).
- <sup>68</sup> Internal BP document (BP-HZN-CEC 21260-279).
- <sup>69</sup> Internal BP document (BP-HZN-MBI 126585-86).
- <sup>70</sup> *Ibid.*
- <sup>71</sup> *Ibid.*
- <sup>72</sup> Internal BP document (BP-HZN-MBI 126982).
- <sup>73</sup> Internal BP document (BP-HZN-MBI 127489).
- <sup>74</sup> *Ibid.*
- <sup>75</sup> Internal BP document (BP-HZN-CEC 21281-301).

<sup>76</sup> Internal BP document (BP-HZN-CEC 21288-91).

<sup>77</sup> *Ibid.*

<sup>78</sup> Internal BP document (BP-HZN-MBI 127909). The April 16 APM provides so little detail on the negative pressure test that members of BP's Macondo team after the fact disagree as to what it means. Testimony of Gregg Walz, Hearing before the Deepwater Horizon Joint Investigation Team, October 8, 2010, 147-48, 150-51 (Acknowledging it could be subject to different interpretations but that he interpreted it to mean that the negative pressure test should be performed after displacing mud from 8,367 feet to above the BOP); Guide, interview, September 16, 2010 (Interpreting steps 2 and 3 to be subparts of step 1); Ronnie Sepulvado (BP), interview with Commission staff, August 20, 2010 (interpreting step 1 to require performing the test at the mudline with base oil and step 3 as a separate flow check after fully displacing the riser).

<sup>79</sup> Internal BP document (BP-HZN-MBI 127906).

<sup>80</sup> Internal BP document (BP-HZN-BLY 47094).

<sup>81</sup> Internal BP document (BP-HZN-CEC 8574).

<sup>82</sup> Internal BP document (BP-HZN-CEC 22433-34). Other examples include the last-minute decisions regarding the combined spacer and long string versus a liner, the latter prompting Transocean's rig manager for the *Deepwater Horizon*, Paul Johnson, to complain to Guide that the crew needed the procedures to plan accordingly. Testimony of Paul Johnson, 360-61.

<sup>83</sup> Internal BP document (BP-HZN-MBI 213550).

<sup>84</sup> Internal BP document (BP-HZN-CEC 21533).

<sup>85</sup> Internal BP document (BP-HZN-MBI 255906).

<sup>86</sup> *Ibid.*

<sup>87</sup> Testimony of Mark Hafle, 8-9.

<sup>88</sup> Both Guide and Morel also may have been overworked, as suggested by some of the hasty, last-minute decisions. In his 2009 performance evaluation of Morel, David Sims wrote that Morel "[w]ants and needs a high work load" and went on to describe all of the different projects he was involved with. Internal BP document (BP-HZN-OSC 9029). As for Guide, when asked by the MBI panel for any recommendations going forward, BP operations engineer Brett Coteles testified, "I would say with the kind of load that a wells team leader is undertaking, that additional resources would be of benefit to that person," including "[a]dditional people to handle the multitasking areas that that person has to undertake." Testimony of Brett Coteles, 268-69.

<sup>89</sup> Testimony of John Sprague, 33-34.

<sup>90</sup> *Ibid.*, 34-37; Internal BP document (BP-HZN-MBI 208674). Section 3.1.13 of BP's Drilling and Well Operations Practice (DWOP) manual provides: "Temporary or permanent changes to personnel, systems, procedures, programmes, safety and critical data, equipment, facilities, materials or substances should be made using the management of change process." Internal BP document (BP-HZN-OSC 7222).

<sup>91</sup> Testimony of John Guide, Hearing before the Deepwater Horizon Joint Investigation Team, July 22, 2010, 110-11.

<sup>92</sup> Testimony of John Sprague, 33-34.

<sup>93</sup> Internal Transocean document (TRN-HCEC 5402-797). Although the near miss in the North Sea on December 23, 2009 did not occur during end-of-well activities, it took place during similar circumstances—the single barrier to flow had been tested. The incident prompted Transocean to remind its North Sea fleet that "tested barriers can fail" and that "high vigilance" is necessary "when reduced to one barrier underbalanced." Internal BP document (BP-HZN-BLY 38362).

<sup>94</sup> David Borthwick, *Report of the Montara Commission of Inquiry* (The Montara Commission of Inquiry, Australia, June 2010), 5, 26. According to the *Report of the Montara Commission of Inquiry*, released on November 24, 2010, many of the technical and managerial causes of the Montara blowout track those at Macondo. For instance, the Commission of Inquiry concluded that the cement job in the 9<sup>5</sup>/<sub>8</sub>-inch casing shoe failed, that there were numerous risk factors surrounding the cement job that went unheeded, and that the cement job was not properly pressure tested. *Ibid.*, 7. According to the Commission of Inquiry:

The multiple problems in undertaking the cement job—such as the failure of the top and bottom plugs to create a seal after “bumping,” the failure of the float valves and an unexpected rush of fluid—should have raised alarm bells. Those problems necessitated a careful evaluation of what happened, the instigation of pressure testing and, most likely, remedial action. No such careful evaluation was undertaken. The problems were not complicated or unsolvable, and the potential remedies were well known and not costly. This was a failure of “sensible oilfield practice 101.”

*Ibid.* The Commission of Inquiry went on to conclude that while the “absence of tested barriers was a proximate cause of the Blowout,” the deeper failure was a systemic failure of management on the part of the operator, PTTEP Australasia. *Ibid.*, 9.

<sup>95</sup> *Ibid.*

<sup>96</sup> Testimony of Steve Lewis (Expert witness), Hearing before the National Commission, November 9, 2010, 64-65.

<sup>97</sup> Testimony of Ross Skidmore (BP), Hearing before the Deepwater Horizon Joint Investigation Team, July 20, 2010, 264.

<sup>98</sup> Ezell, interview.

<sup>99</sup> Internal Transocean document (TRN-HCEC 5609-10).

<sup>100</sup> There were a number of different alarm systems on the *Deepwater Horizon*, including a general alarm audible to the entire rig and localized combustible gas, fire, and toxic gas alarms that were positioned throughout the rig. When triggered, the localized alarms would sound automatically in the affected area and send a signal back to the DPO's panel on the bridge. According to most witness accounts, the general alarm was set to “manual mode,” meaning that a person on the bridge had to activate the general alarm in order for it to sound to the entire rig. See, e.g., Testimony of Yancy Keplinger (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, October 5, 2010, part 1, 188, 222 (standard practice to have general alarm in manual mode in order “to permit some human judgment to make a determination as to whether or not a general alarm should be sounded as opposed to having it on some automated system”); Testimony of Jerry Canducci, 124 (purpose of manual mode is to “alert somebody so that they can pass judgment on the efficacy of the system, and when it is deemed to be a proper alarm, then the alarm is sounded to all”). The Chief Counsel's team does not express a view on the wisdom of having the general alarms in manual rather than automatic mode except to note that if the alarm is in manual mode, Transocean must ensure that its DPOs are trained to deal with emergency situations. See, e.g., U.S. Coast Guard, Navigation and Vessel Inspection Circular No. 2089 (August 4, 1999) § 5.2 (stating that a member of the crew should decide whether to sound the general alarm, that the alarm must be initiated manually and is intended to be sounded by a person on watch or other responsible member of the crew, and that the general alarm may be sounded automatically by a safety monitoring system if a fire alarm is not acknowledged within a reasonable amount of time).

<sup>101</sup> Testimony of Andrea Fleytas, Hearing before the Deepwater Horizon Joint Investigation Team, October 5, 2010, part 2, 13-14.

<sup>102</sup> *Ibid.* Fleytas did tell the engine control room that the rig was experiencing a well control situation, as she had just received a phone call from the drill floor indicating as much. *Ibid.*

<sup>103</sup> *Ibid.*, 65.

<sup>104</sup> *Ibid.*, 53-55.

<sup>105</sup> *Ibid.*, 40. Asked whether any of the alarms on the panel were from the engine control room, she responded, “There were so many alarms. There were hundreds of them on that page, so I don't remember if those were some of them.” *Ibid.*

<sup>106</sup> Section 15.2.7 of BP's Drilling and Well Operations Practice (DWOP) manual provides: “Kick detection, diverter, circulating, stripping, and shut-in drills shall be held regularly until the designated company representative is satisfied that each crew demonstrates suitable BP standards.” Internal BP document (BP HZN-OSC 7267). It is not clear what, if any drills, BP required on emergency kick detection or diverter situations.

<sup>107</sup> Ezell, interview.

<sup>108</sup> Nonpublic BP document (presentation to Commission staff, August 9, 2010), 6.

<sup>109</sup> Testimony of Mark Bly, 335.

- <sup>110</sup> For example, see Rick Godfrey's questioning of Gagliano. Testimony of Jesse Gagliano, Hearing before the Joint Investigation Team, August 24, 2010, 291.
- <sup>111</sup> Internal BP document (BP-HZN-OSC 9338).
- <sup>112</sup> Internal BP document (BP-HZN-MBI 255509).
- <sup>113</sup> *Ibid.*
- <sup>114</sup> Internal BP document (BP-HZN-MBI 128542); Internal BP document (BP-HZN-MBI 110151).
- <sup>115</sup> Internal BP document (BP-HZN-MBI 128542).
- <sup>116</sup> *Ibid.*
- <sup>117</sup> Sims, interview, February 1, 2011.
- <sup>118</sup> Internal BP document (BP-HZN-BLY 125446).
- <sup>119</sup> Internal BP document (BP-HZN-MBI 212826).
- <sup>120</sup> Internal BP document (BP-HZN-MBI 61225).
- <sup>121</sup> Testimony of Daniel Oldfather (Weatherford), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, 14.
- <sup>122</sup> Jesse Gagliano (Halliburton), interview with the U.S. House of Representatives Committee on Energy and Commerce, June 11, 2010; Testimony of Gregg Walz, 53-54.
- <sup>123</sup> Testimony of Nathaniel Chaisson (Halliburton), Hearing before the Deepwater Horizon Joint Investigation Team, August 24, 2010, 437-38.
- <sup>124</sup> Gagliano, interview.
- <sup>125</sup> Testimony of Jesse Gagliano, August 24, 2010, 335, 360.
- <sup>126</sup> Internal BP document (BP-HZN-MBI 137370).
- <sup>127</sup> Guide, interview, January 19, 2011.
- <sup>128</sup> BP and Transocean agree on this. Testimony of Mark Bly, 246-47; Bill Ambrose (Transocean), Hearing before the National Commission, November 8, 2010, 246-247.
- <sup>129</sup> See [Chapter 4.7](#).
- <sup>130</sup> Joseph Keith (Halliburton), interview with Commission staff, October 6, 2010; Cathleenia Willis (Halliburton), interview with Commission staff, October 21, 2010.
- <sup>131</sup> See [Chapter 4.7](#).
- <sup>132</sup> See [Chapter 4.7](#).
- <sup>133</sup> Allen Seraile (Transocean), interview with Commission staff, January 7, 2010.
- <sup>134</sup> See [Chapter 4.7](#).
- <sup>135</sup> Commission staff site visit to *Deepwater Nautilus*, September 9, 2010.
- <sup>136</sup> Internal BP document (BP-HZN-MBI 127997-128022).
- <sup>137</sup> *Ibid.*
- <sup>138</sup> Internal BP document (BP-HZN-MBI 128018).
- <sup>139</sup> *Ibid.*
- <sup>140</sup> Internal BP document (BP-HZN-MBI 128002).
- <sup>141</sup> Internal BP document (BP-HZN-MBI 128009).
- <sup>142</sup> During a visit to BP's Houston headquarters to see the Macondo room, BP personnel told the Chief Counsel's team that BP did not constantly monitor data and other information from onshore because doing so tended to disempower personnel on the rig. The Chief Counsel's team does not fully understand that

explanation. In any event, it is inconsistent with BP's pre-blowout plan to implement the ERA advisory system.

<sup>143</sup> It should be noted that Transocean does not send its data in real time back to shore.

<sup>144</sup> The notable exception is the decision to use a long string production casing, which had been the plan all along. However, it was not until the lost circulation event and declaration of early total depth that BP's Macondo team identified many of the risks associated with using a long string at Macondo.

<sup>145</sup> Internal BP document (BP-HZN-OSC 5420). According to the manual, "Beyond the Best' is the strategic brand for Drilling & Completions focused on improving performance in drilling and completions efficiency. It targets a prize characteri[z]ed by improved safety performance, improved capital efficiency and a bigger contribution to production from new wells." Internal BP document (BP-HZN-OSC 5426).

<sup>146</sup> Internal BP document (BP-HZN-OSC5428); Internal BP document (BP-HZN-OSC 5434).

<sup>147</sup> Internal BP document (BP-HZN-OSC 5463).

<sup>148</sup> Guide, interview, September 17, 2010.

<sup>149</sup> Sims interview, December 14, 2010. Sims told the Chief Counsel's team that except for changes to the well plan, the wells team leader had discretion whether to subject a particular decision to the MOC process. *Ibid.*

<sup>150</sup> The drilling and completions group's Beyond the Best manual requires that "[a] clear process must be in place for management of change throughout any project. This management of change process must be auditable and in place during planning as well as operations." Internal BP document (BP-HZN-OSC 5458). Among its requirements for a management of change process are: "A clear project statement saying when the Management of Change process will be utilized," "[i]ncorporate a risk assessment," and "[h]ave a clear approval structure linked to this change process." *Ibid.*

<sup>151</sup> BP's exploration and production unit's DWOP provides: "Any significant changes to a well programme shall be documented and approved via a formal management of change (MOC) process which includes those on the original approval list." Internal BP document (BP-HZN-OSC 7243).

<sup>152</sup> See Internal BP document (BP-HZN-MBI 143120-22); Internal BP document (BP-HZN-MBI 143242-44); Internal BP document (BP-HZN-MBI00143247-49)(January 27, 2010 MOC for change from *Marianas* to *Deepwater Horizon*); Internal BP document (BP-HZN-MBI 143251-53); Internal BP document (BP-HZN-MBI 143255-57); Internal BP document (BP-HZN-MBI 143259-61); Internal BP document (BP-HZN-MBI 143292-94).

<sup>153</sup> Internal BP document (BP-HZN-MBI 143251-53); Internal BP document (BP-HZN-MBI 143255-57); Internal BP document (BP-HZN-MBI 143259-61); Internal BP document (BP-HZN-MBI 143292-94). The Macondo team twice submitted the long string decision to the MOC process because of an error in the first MOC.

<sup>154</sup> Guide, interview, September 17, 2010.

<sup>155</sup> Internal BP document (BP-HZN-BLY 61195).

<sup>156</sup> Internal BP document (BP-HZN-BLY 61205).

<sup>157</sup> Internal BP document (BP-HZN-OSC 7105).

<sup>158</sup> Internal BP document (BP-HZN-OSC 7128).

<sup>159</sup> O'Bryan, interview.

<sup>160</sup> Internal BP document (BP-HZN-BLY 61475).

<sup>161</sup> See [Chapter 4.7](#). BP's Engineering Technical Practice on Simultaneous Operations (GP 10-75) also directs its personnel to conduct a risk assessment of simultaneous operations "in order to identify the risks across the complete range of well activities" and to "ensure all well activities...are carried out in a safe and controlled manner, when these activities are performed in the same space and time as another operation." Internal BP document. Internal BP document (BP-HZN-OSC 8019). It is not clear whether BP personnel associated the ETP with activities on the *Deepwater Horizon* generally, let alone conducted any such risk assessment with respect to rig activities going on during the final displacement operation. At least one witness has suggested that other well site leaders would not have allowed so many rig operations. Joseph Keith, interview.

<sup>162</sup> See [Chapter 4.7](#).



- <sup>163</sup> Internal Transocean document (TRN-HCEC 90501).
- <sup>164</sup> Internal BP document (BP-HZN-MBI 225048).
- <sup>165</sup> Discussing the shut-down of a drilling rig in March, BP executive Harry Thierens wrote Gregg Walz and several other managers: “time is money after all.” Internal BP document (BP-HZN-MBI 225981).
- <sup>166</sup> Transocean-BP Drilling Contract No. 980249; Amendment 41 to Drilling Contract No. 980249.
- <sup>167</sup> Internal BP document (BP-HZN-MBI 126763).
- <sup>168</sup> Internal BP document (BP-HZN-MBI 269181); see also Internal BP document (BP-HZN-BLY 125444).
- <sup>169</sup> Sims, interview, February 1, 2011.
- <sup>170</sup> Internal Halliburton document (HAL\_10648).
- <sup>171</sup> Guide, interview, January 19, 2011; Internal BP document (BP-HZN-CEC 22433).
- <sup>172</sup> Internal BP document (BP-HZN-OSC 5561).
- <sup>173</sup> Internal BP document (BP-HZN-OSC 5558).
- <sup>174</sup> Internal BP document (BP-HZN-OSC 5573).
- <sup>175</sup> *Ibid.*
- <sup>176</sup> Internal BP document (BP-HZN-MBI 117622).
- <sup>177</sup> *Ibid.*
- <sup>178</sup> *Ibid.*
- <sup>179</sup> *Ibid.*
- <sup>180</sup> Internal BP document (BP-HZN-MBI 126763).
- <sup>181</sup> *Ibid.*
- <sup>182</sup> Internal BP document (BP-HZN-OSC 5558).
- <sup>183</sup> As of April 13, BP had paid Transocean about \$68 million for the rig’s day rate. The total cost of the well up to that point was \$137 million. Internal BP document (BP-HZN-MBI 126763).
- <sup>184</sup> *Ibid.*
- <sup>185</sup> *Ibid.*
- <sup>186</sup> *Ibid.*
- <sup>187</sup> Internal BP document (BP-HZN-MBI 258390).
- <sup>188</sup> Internal BP document (BP-HZN-MBI 192546).
- <sup>189</sup> Internal BP document (BP-HZN-MBI 19552); Internal BP document (BP-HZN-MBI 192558); Internal BP document (BP-HZN-MBI 192559).
- <sup>190</sup> The first AFE was \$96.1 million. Internal BP document (BP-HZN-MBI 19552). The total authorizations added up to \$154.5 million. Internal BP document (BP-HZN-MBI 192559).
- <sup>191</sup> Internal BP document (BP-HZN-MBI 125958).
- <sup>192</sup> Testimony of David Sims (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 25, 2010, 200.
- <sup>193</sup> Internal BP document (BP-HZN-MBI 128953).
- <sup>194</sup> BP estimated bottom 10% performance at 58.7 days per 10,000 feet. Internal BP document (BP-HZN-BLY 47298).
- <sup>195</sup> BP estimated bottom 10% performance at \$142.16 million. *Ibid.*
- <sup>196</sup> Hafle estimated nonproductive time at 48.3%. Internal BP document (BP-HZN-MBI 128953). BP estimated bottom 10% performance at 39.8%. Internal BP document (BP-HZN-BLY 47298).

<sup>197</sup> Ronnie Sepulvado, interview.

<sup>198</sup> *Ibid.*; Guide, interview, January 26, 2011; Sims, interview; O'Bryan interview.

<sup>199</sup> Testimony of Steve Lewis (Expert Witness), hearing before the National Commission, November 9, 2010, 79.

<sup>200</sup> Internal BP document (BP-HZN-OSC 5420).

<sup>201</sup> Internal BP document (BP-HZN-OSC 5437).

<sup>202</sup> Internal BP document (BP-HZN-OSC 5557).

<sup>203</sup> *Ibid.*

<sup>204</sup> Internal BP document (BP-HZN-OSC 5558).

<sup>205</sup> Internal BP document (BP-HZN-OSC 5437).

<sup>206</sup> Internal BP document (BP-HZN-OSC 5557).

<sup>207</sup> Internal BP document (BP-HZN-OSC 5561).

<sup>208</sup> Sims, interview, December 14, 2010.

<sup>209</sup> *Ibid.*

<sup>210</sup> Internal BP document (BP-HZN-OSC 8982).

<sup>211</sup> For instance, Ross Skidmore, a BP contractor tasked with setting the lockdown sleeve at Macondo, and Merrick Kelley, BP subsea wells team leader and the person at BP responsible for lockdown sleeves in the Gulf of Mexico, had planned per their normal practice to perform a separate “wash trip” to clean out any debris before running the lead impression tool and lockdown sleeve. Guide rejected their plan, telling Skidmore: “We will never know if your million dollar flush run was needed. How does this get us to sector leadership.” Internal BP document (BP-HZN-MBI 258507). Guide has subsequently explained that he did not believe a separate wash run was necessary because the crew would already have washed out any debris when tripping out of the hole with the drill pipe. Guide, interview, January 19, 2011; Internal BP document (BP-HZN-MBI 258233). This explanation may be credible, and the Chief Counsel's team cannot say that Guide's decision increased risk at Macondo. Nevertheless, BP experts still questioned Guide's views after the incident.

<sup>212</sup> Confidential Commission staff review of personnel information, December 8, 2010.

<sup>213</sup> Internal BP document (BP-HZN-OSC 7163).

<sup>214</sup> Internal BP document (BP-HZN-MBI 98517).

<sup>215</sup> Internal BP document (BP-HZN-MBI 261533).

<sup>216</sup> Internal BP document (BP-HZN-OSC8980).

<sup>217</sup> *Ibid.*

<sup>218</sup> Internal BP document (BP-HZN-OSC 8982).

<sup>219</sup> Internal BP document (BP-HZN-OSC 8980).

<sup>220</sup> *Ibid.*

<sup>221</sup> Graham Ruddick, “BP says ‘every dollar counts’ as profits tumble,” *The Telegraph*, February 3, 2009.

<sup>222</sup> Internal BP document (BP-HZN-OSC 8981).

<sup>223</sup> Internal BP document (BP-HZN-OSC 9060).

<sup>224</sup> Internal BP document (BP-HZN-OSC 9067).

<sup>225</sup> Internal BP document (BP-HZN-OSC 9068).

<sup>226</sup> Internal BP document (BP-HZN-OSC 9074-75).

<sup>227</sup> BP, Letter to the National Commission, November 22, 2010.

<sup>228</sup> *Ibid.*

<sup>229</sup> BP, “Golden Rules of Safety,” [http://www.bp.com/liveassets/bp\\_internet/globalbp/STAGING/global\\_assets/downloads/B/BPs\\_Golden\\_rules\\_of\\_safety.pdf](http://www.bp.com/liveassets/bp_internet/globalbp/STAGING/global_assets/downloads/B/BPs_Golden_rules_of_safety.pdf).

<sup>230</sup> Internal BP document (BP-HZN-OSC 9025).

<sup>231</sup> *Ibid.*

<sup>232</sup> Internal BP document (BP-HZN-OSC 9054).

<sup>233</sup> Internal BP document (BP-HZN-OSC 9025).

<sup>234</sup> Sims, interview, December 14, 2010.

## Chapter 6

<sup>1</sup> Troy Trosclair (MMS), interview with Commission staff, October 1, 2010.

<sup>2</sup> Testimony of Walter Cruickshank (MMS), Hearing before the National Commission, November 9, 2010, 186-87.

<sup>3</sup> U.S. Department of the Interior, Outer Continental Shelf Safety Oversight Board, *Report to the Secretary of the Interior* (September 1, 2010), 6. “APMs have increased by 71% from 1,246 in 2005 to 2,136 in 2009 in the New Orleans District.” *Ibid.*

<sup>4</sup> Frank Patton (MMS), interview with Commission staff, October 1, 2010; David Trocquet (MMS), interview with Commission staff, October 1, 2010.

<sup>5</sup> Patton, interview.

<sup>6</sup> 30 C.F.R. § 250.413.

<sup>7</sup> Patton, interview.

<sup>8</sup> 30 C.F.R. § 250.428.

<sup>9</sup> Internal BP document (BP-HZN-MBI 133874).

<sup>10</sup> Internal BP document (BP-HZN-MBI 23715).

<sup>11</sup> 30 C.F.R. § 250. 415, 420. Test pressures are determined based on operator calculation of maximum anticipated surface pressure, or the amount of pressure an operator expects to be exerted on casing and subsea equipment. Steve Lewis (Expert witness), email to Commission staff, October 27, 2010. Regulations expressly leave this calculation to operators. 30 C.F.R. § 250.413(f). In calculating this figure, some operators, including BP at the Macondo well, currently assume a well column is 50% gas and 50% drilling fluid. Steve Lewis (Expert witness), interview with Commission staff, September 28, 2010. However, during a blowout the well column can be entirely empty of mud and instead contain 100% gas. *Ibid.* The current industry norm assuming 50% mud in the well column thus underestimates MASP and results in correspondingly low test pressures that do not reflect the worst-case blowout scenario. *Ibid.*

<sup>12</sup> 30 C.F.R. § 250. 415, 420.

<sup>13</sup> Patton, interview.

<sup>14</sup> *Ibid.*

<sup>15</sup> 30 C.F.R § 250.422(a).

<sup>16</sup> Testimony of Walter Cruickshank, 198-99.

<sup>17</sup> MMS regulations do state that “[b]efore removing the marine riser, you must displace the riser with seawater. You must maintain sufficient hydrostatic pressure or take other suitable precautions to compensate for the reduction in pressure and to maintain a safe and controlled well condition.” 30 C.F.R § 250.442(e). A negative pressure test is a way to prove that the well will withstand that reduction of pressure as a means of satisfying this requirement. Testimony of John Smith (Expert witness), Hearing before the National Commission, November 9, 2010, 152.

<sup>18</sup> Internal BP document (BP-HZN-MBI 23711). Some have questioned whether the temporary abandonment procedures in the approved permit would have required a negative pressure test to be conducted at the wellhead before displacement, or whether it could be done at 8,367 feet in the middle of displacement (as was actually done at Macondo). Regardless of this argument, it is unlikely that the MMS would have rejected an APM that said the negative pressure test was to be conducted at a depth of 8,367 feet. Patton, interview. Discussed further in [Chapter 4.6](#) (Negative Pressure Test).

<sup>19</sup> Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf, 75 Fed. Reg. 63346, 63373 (October 14, 2010).

<sup>20</sup> John Smith (Expert witness), interview with Commission staff, October 26, 2010.

<sup>21</sup> Internal BP document (BP-HZN-OSC 1436).

<sup>22</sup> Internal BP document (BP-HZN-MBI 127906).

<sup>23</sup> During the Commission's public hearing, Dr. Walter Cruickshank stated that the official had also drawn reassurance from the fact that BP planned to conduct a negative pressure test on the surface cement plug prior to abandoning the well and that this test would help ensure safety. Testimony of Walter Cruickshank, 206. This makes little sense: The procedure that BP submitted specifies that the negative pressure test will be done *before* setting the surface cement plug. Internal BP document (BP-HZN-MBI 23711).

<sup>24</sup> Internal BP document (BP-HZN-CEC 20942).

<sup>25</sup> 30 C.F.R. § 250.448(c). The upper annular was rated to withstand 10,000 psi closed on pipe or 5,000 psi closed on an open hole. BP, Deepwater Horizon *Accident Investigation Report* (September 8, 2010), app. H, 227. After conversion to a stripping annular, the lower annular was rated to withstand 5,000 psi. *Ibid.*, 172. Post-explosion examination of the blue pod found regulated pressure on the lower annular preventer was set to approximately 1,700 psi. *Ibid.*, 145. According to subsea supervisor Chris Pleasant, he reset the lower annular regulator pressure to 1,500 psi soon after 9 p.m. Testimony of Chris Pleasant (Transocean), Hearing before the Deepwater Horizon Investigation Team, May 28, 2010, 120. According to BP, 1,500 psi was the normal regulator pressure setting for both annular preventers. BP, Deepwater Horizon *Accident Investigation Report*, 145.

<sup>26</sup> Internal BP document (BP-HZN-OSC 867).

<sup>27</sup> Internal BP document (BP-HZN-OSC 925).

<sup>28</sup> Internal BP document (BP-HZN-MBI 107364-65).

<sup>29</sup> 30 C.F.R. § 250.446(a).

<sup>30</sup> American Petroleum Institute, *Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells*, 3rd ed. (March 1997, reaffirmed September 2004), 56 (“API RP 53 § 18.10.3”).

<sup>31</sup> Internal Cameron document (CAM-GR 261-62).

<sup>32</sup> Testimony of Mark Hay (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, August 25, 2010, 32-33; Testimony of John Sprague (BP), Hearing before the Deepwater Horizon Joint Investigation Team, December 8, 2010, 79-80.

<sup>33</sup> Internal BP document (BP-HZN-MBI 136213).

<sup>34</sup> Internal Transocean document (TRN-USCG\_MMS 38652).

<sup>35</sup> Internal Transocean document (TRN-USCG\_MMS 38662). The BOP's fail-safe valves, designed to shut off choke and kill lines remotely and automatically, had not been certified since December 13, 2000. Internal Transocean document (TRN-USCG-MMS 38656).

<sup>36</sup> 30 C.F.R. § 250.446(a); Elmer Danenberger (Expert witness), interview with Commission staff, January 5, 2011.

<sup>37</sup> Internal MMS document.

<sup>38</sup> Testimony of Eric Neal (MMS), Hearing before the Deepwater Horizon Joint Investigation Team, May 11, 2010, 325.

<sup>39</sup> MMS, *National Potential Incident of Noncompliance (PINC) and Guideline List* (May 2008).

<sup>40</sup> Testimony of Eric Neal, 326.

<sup>41</sup> MMS, *National Potential Incident of Noncompliance (PINC) and Guideline List – Drilling* (May 2008).

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GRAPHICS AND LAYOUT BY TRIALGRAPHIX

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## Appendix C | Acronyms

AFE	Approval for Expenditure
AMF	Automatic mode function
APB	Annular pressure buildup
APD	Application for permit to drill
API	American Petroleum Institute
APM	Application for permit to modify
bbl	Barrels
BOEMRE	Bureau of Ocean Energy Management, Regulation, and Enforcement
BOP	Blowout preventer
bpm	Barrels per minute
BSR	Blind shear ram
CMMS	Computerized Maintenance Management System
DP	Dynamically positioned
DPO	Dynamic positioning officers
ECD	Equivalent circulating density
EDS	Emergency disconnect system
ERA	Efficient Reservoir Access
ESD	Equivalent static density
ETP	Engineering Technical Practice
FIT	Formation integrity test
gal/sack	Gallons per sack
gpm	Gallons per minute
HSSE	Health, safety, security, and the environment
LDS	Lockdown sleeve
LMRP	Lower marine riser package
LOT	Leak off test
MC 252	Mississippi Canyon Block 252
MD	Measured depth
MMS	Minerals Management Service



MOC	Management of change
MODU	Mobile offshore drilling unit
MUX	Multiplex
OIM	Offshore installation manager
OMS	Operating management system
PINC	Potential incidents and noncompliance
ppg	Pounds per gallon
PRV	Pressure relief valve
psi	Pounds per square inch
RCRA	Resource Conservation and Recovery Act
RMS	Rig Management System
ROV	Remotely operated vehicle
SG	Specific gravity
TD	Total depth
TIGER	Totally Integrated Geological and Engineering Resource
TOC	Top of cement
TVD	Total vertical depth
UWILD	Underwater Inspection in Lieu of Dry-docking

# Appendix D | Chevron Laboratory Report Cover Letter



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**NATIONAL COMMISSION ON THE  
BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING  
CEMENT TESTING RESULTS**

MR. SAMBHAV N. "SAM" SANKAR

This report summarizes the results of the testing conducted in the cementing laboratory at Chevron's Briarpark facility at the request of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling.

We conducted these tests using samples of cement and additives supplied by Halliburton and sent to the Chevron laboratory at the request of the Commission. To our knowledge, these materials were supplied by Halliburton as representative of materials used on the Deepwater Horizon but are neither bulk plant samples nor rig samples from the actual job.

The mud sample used in the contamination testing described in this report was supplied by MI Swaco at the Commission's request. It is a sample of drilling fluid from an actual drilling operation (i.e. not laboratory-prepared nor taken from a freshly-built mud in a liquid mud plant). MI Swaco supplied an analysis (mud check) with the sample, and a similar suite of tests were run in the Chevron drilling fluids laboratory to confirm the fluid characteristics. Both the MI Swaco results and the Chevron results compare reasonably well with the field mud check #79 dated April 19, 2010. Copies of the mud reports are contained in the Appendix.

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The testing was based on the Halliburton laboratory report dated April 12, 2010 and contained in Appendix J of the BP report *Deepwater Horizon Accident Investigation Report, September 8, 2010*, Appendix J. Most of the tests were conducted using multiple protocols. API and ISO cementing standards are, for the most part, technically identical standards which allow latitude in test procedures. The Halliburton report does not contain sufficient information to determine the exact test protocol used in the Halliburton lab in all cases. Halliburton elected not to provide additional information clarifying its testing protocols that was requested through the Commission. Therefore, a range of test procedures was selected to encompass a variety of test conditions.

Many of the test results were in reasonable agreement with those reported by Halliburton. However, we were unable to generate stable foam with any of the tests described in Section 9 of this report.



Craig Gardner

## Appendix E | Nile and Kaskida

**BP** faced MMS deadlines on the two projects planned for the *Deepwater Horizon* after Macondo—permanent abandonment of a Nile well and spudding of a Kaskida well. The Chief Counsel's team found that these regulatory deadlines did not significantly compound the already existing time pressure at Macondo.<sup>1</sup>

### Schedule When the *Deepwater Horizon* Arrived at Macondo

The high daily cost of employing the *Deepwater Horizon* put pressure not just on the immediate task of drilling, but also on how BP scheduled future projects for the rig. The schedule for a drilling rig should be seamless. Empty days on the calendar waste dollars. BP had to pay Transocean a daily lease fee regardless of whether the *Deepwater Horizon* was drilling or not.<sup>2</sup> Throughout the drilling of the Macondo well, BP focused on how it would keep the rig active after Macondo. Delays at Macondo, equipment delays at another well, and regulatory commitments to MMS complicated the task.

Long before the *Deepwater Horizon* arrived at Macondo, BP began planning work for the rig at future locations.<sup>3</sup> BP's schedule for the *Deepwater Horizon* stretched years into the future, up to 2013.<sup>4</sup> When the *Deepwater Horizon* arrived at Macondo, BP planned to have the rig on location for about 45 days.<sup>5</sup>

BP planned to then send the rig to Nile for 30 days.<sup>6</sup> Nile was in another tract in the Gulf of Mexico, located about a day's voyage from Macondo. BP faced a July 2, 2010 deadline to permanently abandon its well at Nile.<sup>7</sup> Federal regulations require a lease holder to “permanently plug all wells on a lease within 1 year after the lease terminates.”<sup>8</sup> Nile had been a productive well for BP, and it would be BP's first permanent abandonment of a subsea producing well in the Gulf of Mexico.<sup>9</sup> The task would be complex, and the rig crew worried about its challenges.<sup>10</sup>

After Nile, the *Deepwater Horizon* would go to Kaskida, located in yet another tract in the Gulf of Mexico leased by BP.<sup>11</sup> Kaskida is about 250 miles southwest of New Orleans and about a four-day voyage from Macondo.<sup>12</sup> In 2006, the *Deepwater Horizon* drilled an exploration well at Kaskida that proved to be a large discovery.<sup>13</sup> MMS required BP to conduct further activities at Kaskida by May 16, 2010 to keep its lease.<sup>14</sup> Federal regulations require activity on an exploration lease every 180 days.<sup>15</sup> MMS regulation 30 C.F.R. § 250.180 specifies that a lease ends after a certain period “unless you are conducting operations on your lease.”<sup>16</sup> Drilling counts as operations, so long as the “objective of the drilling” is “to establish production in paying quantities on the lease.”<sup>17</sup> Without activity or production, MMS could cancel the lease.<sup>18</sup> BP's original schedule allowed the *Deepwater Horizon* to carry out the abandonment of Nile first and still meet the deadline at Kaskida.<sup>19</sup>

## Request to Suspend Operations at Kaskida

While the *Deepwater Horizon* drilled the Macondo well, BP worried that delays for the Kaskida wellhead would leave the rig with too much time after it completed its current well.<sup>20</sup> BP required a first-of-its-kind wellhead at Kaskida.<sup>21</sup> Delivery of that wellhead proved a headache for BP.<sup>22</sup> The emergency seal for the wellhead failed tests.<sup>23</sup> These failures led to an ever-changing set of delivery dates. In February, BP engineering team leader David Sims expressed his concerns to several managers and executives: “Even with the delays we are experiencing on Macondo, I still feel that there is a significant risk that the Horizon will finish the Nile P&A before the DrilQuip 20K wellhead is delivered.”<sup>24</sup>

Fearing that the rig might be left idle because of the wellhead delays, BP considered several options. The company contemplated extending work at Macondo itself and having the rig stay longer.<sup>25</sup> It explored alternative projects for the *Deepwater Horizon* after the rig completed both Macondo and Nile.<sup>26</sup> And it thought about having the rig undergo maintenance to fill gaps in the schedule.<sup>27</sup>

Toward the end of March, the *Deepwater Horizon* fell far enough behind schedule at Macondo that BP stopped brainstorming additional projects to occupy the rig and determined that the Nile project would likely no longer fit in before the 180-day clock ran out at Kaskida. If the *Deepwater Horizon* were going to spud Kaskida despite the delay, that left BP two primary options. One option was to go to Nile first and ask MMS for an extension at Kaskida. Another option was to go to Kaskida directly and make alternative arrangements for Nile.

BP weighed going to Kaskida directly.<sup>28</sup> Reasons to go to Kaskida included avoiding the hurricane season in the Gulf of Mexico and maintaining the schedule for work on the well after the *Deepwater Horizon*'s spud.<sup>29</sup> Ultimately, BP concluded that it preferred to have the *Deepwater Horizon* do the Nile project first. Reasons to go to Nile included continuing concern about the wellhead: “[g]oing to Kaskida post Macondo assumes wellhead ready to utilize, currently planned ready ca. 23 April.”<sup>30</sup> BP also wanted to complete Nile in time to fit in a previously scheduled crane replacement operation.<sup>31</sup> On April 8, BP vice president of drilling and completions Pat O’Byrne concluded, “Sounds like we should leave [Nile] on the Horizon as originally planned.”<sup>32</sup>

Fitting in Nile before going to Kaskida became impossible from a scheduling perspective. BP anticipated that Nile would take about 30 days.<sup>33</sup> Because BP kept the Nile project on the *Deepwater Horizon*'s schedule, BP had no choice but to ask MMS for an extension of the deadline at Kaskida in order to avoid losing the lease. By April 16, BP had only 30 days until the May 16 deadline at Kaskida, not counting transit time to get from one well to the next.<sup>34</sup> Consequently, BP would need a “suspension of operations” at Kaskida. A suspension of operations “extend[s] the term of a lease.”<sup>35</sup>

On April 9, Sims began to draft BP’s request to MMS for a suspension of operations at Kaskida.<sup>36</sup> On one level, the request to suspend operations was straightforward. A suspension of operations may be granted “when necessary to allow you time to begin drilling or operations when you are prevented by reasons beyond your control, such as unexpected weather, unavoidable accidents, or drilling rig delays.”<sup>37</sup> The primary test on “whether you are ‘prevented beyond your control’ is whether the particular drilling rig was scheduled to conduct operations at your location *before* the lease expiration date.”<sup>38</sup> The *Deepwater Horizon* had been scheduled to conduct operations at the location before the expiration date, and it had faced delays at Macondo.

Nonetheless, a suspension of operations is granted only “on a case-by-case basis” and typically for “a short duration.”<sup>39</sup> Moreover, the delay at Macondo prevented the *Deepwater Horizon*'s timely arrival at Kaskida only because BP had kept Nile first on the *Horizon*'s schedule. Without Nile, there would be no need for a suspension. BP's situation fit the criteria for a suspension, but not definitively. A member of BP's offshore land negotiation team commented, “While the Nile P&A timing is critical path to us, the MMS unit group may not see it that way and suggest that operation be delayed to avoid the issuance of an SOO.”<sup>40</sup> He then remarked that whether MMS would grant the suspension was “anyone's guess.”<sup>41</sup> On April 20, BP sent the request for a suspension of operations to MMS.<sup>42</sup>

While waiting to hear from MMS, BP planned to send the *Deepwater Horizon* to Nile.<sup>43</sup> BP sent a team out to the rig to prepare for the move to Nile.<sup>44</sup> Some members of the BP team may have perceived pressure to complete the Macondo well quickly. Before the MMS request went out, BP subsea wells team leader Merrick Kelley emailed BP drilling engineer Brian Morel: “I know you all are under pressure to finish Macondo so we can get Nile P&A moving and not jeopardize the Kaskida well and IFT.”<sup>45</sup> Uncertainty about internal BP plans, or uncertainty about MMS's decision, may have prompted concern about time pressure.

Nonetheless, if there was concern, the Chief Counsel's team has found no evidence that it was widespread. BP drilling engineer team leader Gregg Walz, BP wells team leader John Guide, BP well site leader Murry Sepulvado, and Sims said that Nile put no pressure on the temporary abandonment of Macondo.<sup>46</sup> Similarly, Transocean offshore installation manager (OIM) Jimmy Harrell testified that he faced no pressure from BP or Transocean to move on to Nile.<sup>47</sup> Moreover, BP planned to send the rig directly to Kaskida if MMS denied the request to suspend operations and then to ask for an extension at Nile.<sup>48</sup> If that happened, the *Deepwater Horizon* would experience downtime, not pressure.<sup>49</sup> BP planned maintenance to “fill any gaps” if the wellhead arrived late.<sup>50</sup>

Though BP's decisions at Macondo appear to have been biased in favor of saving time and money, the rig's next wells do not appear to have been an important contributing factor. BP followed the rig's schedule closely and, when necessary, took action to relieve the pressure of regulatory deadlines.

<sup>1</sup> There has been some suggestion that these deadlines increased the time pressure to finish Macondo. See, e.g., Joel Achenbach, “BP Cost-cutting Measures are Focus of U.S. Inquiry into Gulf Spill,” *Washington Post*, October 8, 2010.

<sup>2</sup> Drilling Contract No. 980249.

<sup>3</sup> Internal BP document (BP-HZN-MBI 123225).

<sup>4</sup> Internal BP document (BP HZN MBI 98347).

<sup>5</sup> Internal BP document (BP-HZN-MBI 125958).

<sup>6</sup> Internal BP document (BP-HZN-MBI 123225).

<sup>7</sup> *Ibid.*

<sup>8</sup> 30 CFR § 250.1710.

<sup>9</sup> Internal BP document (BP-HZN-MBI 123225).

<sup>10</sup> Internal BP document (BP-HZN-MBI 21305).

<sup>11</sup> In its internal plans, BP described Kaskida as “one of the largest Paleogene discoveries to date.” The discovery had the potential to support the Gulf of Mexico division's goal to “sustain production over

450mboed” (million barrels of oil or equivalent daily). BP expected that the project would break even at oil prices over \$55/barrel and that returns would accrue rapidly above those prices. Internal BP document (BP-HZN-MBI 98022).

<sup>12</sup> Press Release, Anadarko Petroleum, BP & Partners Make Discovery at Kaskida Prospect in Gulf of Mexico, August 31, 2006, [http://www.rigzone.com/news/article.asp?a\\_id=35730](http://www.rigzone.com/news/article.asp?a_id=35730).

<sup>13</sup> *Ibid.*

<sup>14</sup> Internal BP document (BP-HZN-MBI 123225). Drilling at Kaskida would be cutting edge and challenging. The test that BP planned there in preparation for production would be a “very, very complicated” completion. Testimony of John Guide (BP), Hearing before the Deepwater Horizon Joint Investigation Team, October 7, 2010, part 2, 213. BP described the work as “the deepest and highest pressure completions ever attempted by the industry globally.” The reservoir was “tight” and the fluids “relatively viscous.” There were also “[s]alt sutures/inclusions” and “salt exit uncertainty.” On top of the difficult geology, the size of the casing limited the “number of contingency strings...imparting drilling complexities normally avoided by early appraisal wells.” And BP worried about the risks of a “poor quality cement job.” To limit the chance of encountering unexpected challenges, BP placed the planned well fewer than five football fields—only 1,400 feet—from the discovery well. BP would also use a relatively large 8½-inch production casing. Internal BP document (BP-HZN-MBI 98022).

<sup>15</sup> 30 CFR § 250.180.

<sup>16</sup> *Ibid.*

<sup>17</sup> *Ibid.*

<sup>18</sup> 30 CFR § 256.77.

<sup>19</sup> Internal BP document (BP-HZN-MBI 123225). In early January, BP contemplated a start at Kaskida as early as mid-March if the *Deepwater Horizon* performed well on the earlier projects. Internal BP document (BP-HZN-MBI 98069).

<sup>20</sup> In February, Richard Harland, the drilling engineer for Kaskida, speculated that the timing looked “tight” if the *Deepwater Horizon* delivered the Macondo well early and came in on schedule for Nile. If Nile also came in early, there was a “real schedule issue.” Internal BP document (BP-HZN-MBI 100909).

<sup>21</sup> Internal BP document (BP-HZN-MBI 98027).

<sup>22</sup> Testimony of Gregory Walz (BP), Hearing before the Deepwater Horizon Joint Investigation Team, 105; Pat O’Bryan (BP), interview with Commission staff, December 17, 2010; David Sims (BP), interview with Commission staff, December 14, 2010.

<sup>23</sup> Internal BP document (BP-HZN-MBI 100909).

<sup>24</sup> Internal BP document (BP-HZN-MBI 107569).

<sup>25</sup> Sims wrote Pat O’Bryan, BP vice president of drilling and completions, “Extend work on Macondo (bypass or deepen)...while waiting on 20K wellhead delivery.” Internal BP document (BP-HZN-MBI 108874). He then reiterated the original schedule for the *Deepwater Horizon*: “Do Macondo, Nile, then Kaskida IFT.” *Ibid.* At about the same time, on March 7, Sims explored engineering possibilities to deepen the Macondo well. He wrote BP senior drilling engineer Mark Hafle that he had been exploring whether there might be interest in “deepening or bypass core to buy us some time for Kaskida wellhead to arrive.” Internal BP document (BP-HZN-MBI 109036). He then asked if a liner or a tieback would be better fit if the well went deeper than planned. *Ibid.* A few days later, BP also considered having the rig undergo maintenance to fill gaps in the schedule. Internal BP document (BP-HZN-MBI 113535).

<sup>26</sup> Sims inquired if there was “any work of relatively short duration (+/-1 month) that we could plan and execute if necessary, to allow the wellhead time to be delivered.” Internal BP document (BP-HZN-MBI 107569). In response to Sims’ request, BP engineering manager John Sprague asked another team to evaluate if there was anything in the division’s “[h]opper” that might be available for the *Deepwater Horizon* after Kaskida. Internal BP document (BP-HZN-MBI 108133). On March 1, Sprague heard back that a colleague was “look[ing] through the hopper for any possibilities.” *Ibid.* Without good options forthcoming, Sims asked whether another well might be approved by MMS. He wrote on March 5, “For instance, if we needed to accelerate Tiber to follow Nile P&A because the wellhead equipment is not ready could we have regulatory approval to spud by mid-April?” Internal BP document (BP-HZN-MBI 108827).

<sup>27</sup> Sims asked John Guide if Transocean had “put together a wishlist of work for the rig.” Guide replied that “we do have a high level wish list.” Internal BP document (BP-HZN-MBI 113536).

<sup>28</sup> Sims, interview.

<sup>29</sup> Internal BP document (BP-HZN-MBI 118963).

<sup>30</sup> *Ibid.*

<sup>31</sup> Internal BP document (BP-HZN-MBI 123225).

<sup>32</sup> Internal BP document (BP-HZN-MBI 119027).

<sup>33</sup> Internal BP document (BP-HZN-MBI 123225).

<sup>34</sup> It would take about a day to get to Nile from Macondo.

<sup>35</sup> 30 CFR § 250.169.

<sup>36</sup> Internal BP document (BP-HZN-MBI 123225).

<sup>37</sup> 30 CFR § 250.175.

<sup>38</sup> NTL No. 2000-G17.

<sup>39</sup> *Ibid.*

<sup>40</sup> Internal BP document (BP-HZN-MBI 127785).

<sup>41</sup> *Ibid.*

<sup>42</sup> Internal BP document (BP-HZN-MBI 127785).

<sup>43</sup> Testimony of Brett Cocalis (BP), Hearing before the Deepwater Horizon Joint Investigation Team, August 27, 2010, 11; Testimony of Gregory Walz, 104.

<sup>44</sup> Testimony of Ross Skidmore, 210.

<sup>45</sup> Internal BP document (BP-HZN-MBI 126333).

<sup>46</sup> Walz, interview; Sims, interview; Murry Sepulvado, interview; Guide, interview, January 19, 2011.

<sup>47</sup> Testimony of Jimmy Harrell (Transocean), Hearing before the Deepwater Horizon Joint Investigation Team, May 27, 2010, 29.

<sup>48</sup> Internal BP document (BP-HZN-MBI 128990); Sims, interview, December 14, 2010.

<sup>49</sup> Internal BP document (BP-HZN-MBI 128990).

<sup>50</sup> *Ibid.*