



## Chapter 4.10 | Maintenance

A deepwater drilling rig like the *Deepwater Horizon* has literally thousands of pieces of equipment that need routine monitoring and repair.<sup>1</sup> The *Deepwater Horizon*'s crew performed more than 550 preventative maintenance jobs each month on the *Deepwater Horizon* and had spent more than 30,000 work hours on maintenance in the 10 months prior to the explosion.<sup>2</sup>

In some respects the *Horizon* appeared to be operating quite well. The rig received several safety awards<sup>3</sup> and a place inside Transocean's "excellence box," which compares rigs based on safety performance and equipment downtime.<sup>4</sup> BP wells team leader John Guide described the rig as BP's most successful in terms of performance,<sup>5</sup> and one reason leaders from BP and Transocean were visiting the rig on the day of the blowout was to recognize the rig's high performance.<sup>6</sup>

It is nevertheless possible that poor maintenance contributed to technical failures. According to pre-explosion BP emails, the rig was "getting old and maintenance has not been good enough."<sup>7</sup> Most notably, [Chapter 4.9](#) of this report explains that certification of blowout preventer (BOP) equipment was overdue and that if blowout preventer maintenance was inadequate, it could have affected the ability to shut in the well. Other issues may have affected maintenance but, based on available information, likely did not contribute to the blowout.

### Transocean's Rig Management System

Transocean had in place comprehensive procedures and systems for scheduling, implementing, and monitoring maintenance.<sup>8</sup> Like all Transocean rigs, the *Deepwater Horizon* used the computerized "**Rig Management System II**" (RMS), which Transocean had implemented as a result of its merger with Global Santa Fe.<sup>9</sup> Transocean personnel used RMS to schedule maintenance work based on information including equipment data, maintenance records,<sup>10</sup> information on certification and surveys,<sup>11</sup> and risk assessments.<sup>12</sup> Based on these materials, the automated system generated preventative maintenance<sup>13</sup> items for the rig.<sup>14</sup> The rig crew would perform these tasks and then record their completion in the system.<sup>15</sup> Transocean's goal in using the system was to ensure consistency, consolidate information, and facilitate personnel movement from rig to rig.<sup>16</sup>

While the Chief Counsel's team interviewed *Deepwater Horizon* crew members who found the RMS useful (despite the fact that it "definitely had some bugs in it") and who used it daily,<sup>17</sup> the team also found evidence to suggest that the system had problems. Transocean installed the RMS on the *Horizon* in September 2009,<sup>18</sup> but according one witness it was "still a work in progress" at the time of the blowout.<sup>19</sup> For instance, while the system produced thousands of preventative maintenance orders for Transocean's fleet,<sup>20</sup> many orders were disorganized, erroneous, or irrelevant to individual rig crews. The *Deepwater Horizon*'s rig crew was forced to actively search the system for the *Deepwater Horizon*'s maintenance items and to continually submit requests to remove duplicate maintenance orders or orders meant for another rig.<sup>21</sup> The system also

generated work orders for equipment that had already been repaired, leaving the rig crew to determine if work orders generated by the system actually needed to be performed.<sup>22</sup> According to chief engineer Stephen Bertone, the rig crew “went through them as much as [they] could just poking through the system, but...there were still issues with it.”<sup>23</sup> According to assistant driller Allen Seraile, the system was chaos at one time.<sup>24</sup> Chief electronics technician Mike Williams described the system as “overwhelming.”<sup>25</sup>

The crew expressed confusion regarding the new system and concerns about its implementation. In a March 2010 Lloyd’s Register survey, crew members stated that system changes to the RMS and other rig systems were ineffectively implemented.<sup>26</sup> They thought that new systems were introduced too frequently and before the previous system was understood.<sup>27</sup> The rig crew also thought there was insufficient support to implement changes and that system changes required a level of technical capability not typically available throughout the rig.<sup>28</sup> An April 2010 Transocean assessment also found that the maintenance system was not understood by the crew.<sup>29</sup>

## Competing Interests Between Drilling and Maintenance

The rig services contract between BP and Transocean specifies that shutting down the rig to perform certain types of maintenance will trigger financial consequences. BP paid Transocean a daily operating rate of \$533,495 for the *Deepwater Horizon*, but under the contract BP was not obligated to pay for time in excess of 24 hours each month spent on certain equipment repairs.<sup>30</sup>

The Chief Counsel’s team cannot be certain whether these provisions or other financial pressures influenced maintenance decisions. However, some of the rig crew raised concerns that drilling priorities took precedence over planned maintenance.<sup>31</sup> The *Deepwater Horizon* had never been to dry dock for shore-based repairs in the nine years since it had been built.<sup>32</sup> BP and Transocean appear to disagree as to whether financial considerations influenced this decision. While Guide suggested the *Horizon* did not go to dry dock because Transocean insisted on being paid its daily rate during repairs,<sup>33</sup> Transocean operations manager Daun Winslow testified that any necessary repairs would have been made regardless of financial constraints.<sup>34</sup>

## Lack of Onshore Maintenance

Some maintenance can only be performed when a rig is moving between well sites or when the rig is brought into shore.<sup>35</sup> But the *Horizon* had never been to dry dock since it was built in 2001. Transocean instead conducted “Underwater Inspection in Lieu of Dry-docking” (UWILD) and other at-sea inspections.<sup>36</sup> In the March 2010 Lloyd’s Register survey some of the rig crew expressed concern that the lack of dry dock time could generally undermine equipment reliability.<sup>37</sup> According to the survey, the maintenance department was looking forward to a scheduled dry dock visit in 2011 “to carry out evasive [preventative maintenance] routines that they normally could not do.”<sup>38</sup> Lack of time in dry dock may have resulted in a lapse in BOP certification.<sup>39</sup>

Following company policy,<sup>40</sup> Transocean commissioned an inspection in April 2010 to assess equipment and prepare for the rig’s scheduled 2011 shipyard maintenance.<sup>41</sup> The inspection found that some problems identified in September 2009 remained unaddressed and identified

several new maintenance issues.<sup>42</sup> As of April 2010, Transocean documents listed 35 critical items of equipment that either were in bad condition, had shown excessive downtime, had passed manufacturer wear limits, or that the manufacturer no longer supported.<sup>43</sup> As discussed in [Chapter 4.9](#), the list included BOP elements that had passed their certification date.<sup>44</sup> According to witness testimony, Transocean had decided to extend the *Horizon's* anticipated time in dry dock because of the number of repairs necessary.<sup>45</sup> The Chief Counsel's team requested but was not able to obtain a list of repairs scheduled for the *Horizon's* 2011 dry dock visit.

## Maintenance Audits and Inspections

The *Horizon* was subject to audits and inspections by various government and private entities, including BP,<sup>46</sup> Transocean,<sup>47</sup> MMS,<sup>48</sup> the Coast Guard,<sup>49</sup> the American Bureau of Shipping,<sup>50</sup> and the Marshall Islands (the ship's flag state in 2010).<sup>51</sup> These audits varied in scope and duration. Both BP and Transocean had a vested interest in keeping the *Horizon* in working order. Witness testimony describing the response to a fall 2009 audit indicates collaboration by both companies to ensure necessary repairs were made.

### Transocean Resolved Many Maintenance Issues Identified in the September 2009 BP Audit

In September 2009 BP audited the *Deepwater Horizon's* drilling equipment and the vessel itself.<sup>52</sup> The audit found 390 maintenance jobs overdue and identified some of those as high-priority items.<sup>53</sup> BP estimated that the work would require 3,545 man-hours of labor.<sup>54</sup> The audit may have overestimated the sheer number of jobs that were overdue because of errors and duplicates in the RMS system, which Transocean had recently installed.<sup>55</sup> BP asked Transocean to undertake certain repairs before allowing the *Horizon* to resume operations.<sup>56</sup> A few days later, BP determined that the rig was operational,<sup>57</sup> and the rig resumed operations on September 22, 2009, five days after the audit ended.<sup>58</sup>

BP and Transocean increased communication and coordination to monitor implementation of outstanding audit recommendations.<sup>59</sup> For example, auditors communicated conditions to the rig crew during the audit itself in order to ensure that certain repairs were made promptly.<sup>60</sup> BP and Transocean held weekly meetings to track progress,<sup>61</sup> and Guide or well site leaders signed off on corrective actions taken in response to the audit.<sup>62</sup> By March 30, 2010, 63 of 70 had been completed, progress BP described as "commendable."<sup>63</sup> Twenty-six other outstanding items were in progress and deemed not safety-critical.<sup>64</sup>

### BP and Transocean Believed the Rig Was in Safe Working Order

At the time of the blowout, both BP and Transocean believed the *Deepwater Horizon* was in safe operating condition.<sup>65</sup> Well site leader Ronnie Sepulvado did not believe there were serious outstanding safety issues,<sup>66</sup> and neither he nor the other well site leaders indicated that the vessel was unsafe to operate.<sup>67</sup> Guide recognized that the rig was operating safely and making very good progress on addressing audit items.<sup>68</sup>

An April 1, 2010 MMS inspection of the rig found no incidents of noncompliance and did not identify any problems justifying stopping work.<sup>69</sup> But, as discussed in [Chapter 6](#), the inspection did not identify that the *Deepwater Horizon's* BOP had not been certified.<sup>70</sup>

## Maintenance Findings

Inspections, audit programs, and statements by rig- and shore-based leadership indicate that BP, Transocean, and government regulators believed the *Deepwater Horizon* was in safe operating order at the time of the blowout. With the exception of potential BOP maintenance issues, the Chief Counsel's team found no reason to believe that maintenance problems may have contributed to the blowout. However, the Chief Counsel's team believes the following issues may have compromised the rig's maintenance regime:

- Transocean's RMS system may have complicated routine maintenance and monitoring. The rig crew appears to have been confused about the system, and the system issued duplicate and erroneous maintenance instructions; and
- the fact that the *Deepwater Horizon* had never been in dry dock may have delayed or prevented certain repairs that could only have been done onshore. 🔦