

1 The Macondo Prospect and the *Deepwater Horizon*

1.1 The Macondo Well

In March 2008, BP Exploration & Production Inc. (BP) leased the Mississippi Canyon Block 252 (MC252) for oil and gas exploration and designated it the Macondo Prospect. BP subsequently sold interests in the prospect to Anadarko (25%) and MOEX (10%) but remained the operator and majority owner (65%).^A As operator, BP was responsible for all aspects of the design and development of the Macondo well.

BP's original Application for Permit to Drill was submitted to the Minerals Management Service (MMS) on May 13, 2009, and was approved on May 22, 2009. The plan specified using the Transocean *Marianas* to drill a well about 50 miles off the coast of Louisiana, southeast of New Orleans, in 4,992 feet (ft.) of water. The total depth of the well was planned to be 20,200 ft.

Once a drilling permit is secured, the operator designs the well in accordance with the geological conditions of the prospect. The operator's engineers and geologists determine the type and strength of the well casing, cement, well head, and other equipment, and their interpretation is critical to ensuring well integrity and preventing its failure.

The operator then selects and manages various contractors to perform specific procedures such as drilling, cementing, well monitoring, vessel support services, and other well-related tasks. The operator has the final authority and responsibility to make decisions throughout the design, cementing, testing, and final temporary abandonment phases of drilling the well.

At Macondo, BP began exploration on Oct. 6, 2009, using the Transocean *Marianas* rig.¹ On Nov. 9, 2009, Hurricane Ida damaged the *Marianas*, and drilling on Macondo was suspended following the installation and cementing of the well casing. The *Marianas* was demobilized to a shipyard for repairs, and BP applied to the MMS for permission to use the Transocean *Deepwater Horizon* rig to continue drilling. MMS approved this change on Jan. 14, 2010.

The various responsibilities of the operator and examples of tasks assigned to its respective contractors are summarized below.

Operator Responsibilities

- Conduct geological and geophysical surveys of the prospect
- Analyze proprietary geological and geophysical data when designing the well to specify the type and strength of casing, cement, centralizers, reamers, shock absorbers, well head, and other equipment and materials used to maintain well integrity
- Design and submit a detailed plan to MMS, now the Bureau of Ocean Energy, Management, Regulation and Enforcement (BOEMRE), specifying where and how the well is to be drilled, cased, cemented, and completed
- Serve as general contractor and hire various specialists to work on its lease and perform specific functions in the construction of the well, and direct contractors with respect to their areas of responsibility
- Retain full authority over drilling operations, casing and cementing processes, and temporary abandonment testing and procedures (quality assurance and quality control of well)
- Approve all work to be performed by contractors/subcontractors
- Assist with overall safety on the rig
- Advise and consult with various rig owner personnel on key decisions in heightened-risk situations
- Determine and implement appropriate well-control procedures
- Contain the well and address any pollution from the well

^A BP Exploration & Production Inc., Anadarko Petroleum Corporation, and MOEX Offshore 2007 LLC were the leaseholders in the specified percentages of lease number G32306 for MC252 at the time of the incident.

Examples of Tasks Assigned to Contractors

- Provide rig and rig personnel for drilling operation (Transocean)
- Supervise cement operations, including but not limited to: designing cement program, maintaining equipment for cement jobs, maintaining inventory logs for cementing materials and equipment, and conduct cementing operations (Halliburton)
- Maintain logs of formations drilled during drilling operations (Sperry Sun)
- Monitor and report the presence and quantity of gas in drilling mud (Sperry Sun and Transocean)
- Provide separate measurement equipment for pit volumes, penetration rates, pump pressures, mud flow returns (loss/gain), and sample catching for geological analysis (Sperry Sun)
- Survey the hole and provide information to the operator with respect to the target (Sperry Sun and Schlumberger)
- Recommend mud additives and conduct mud testing (M-I SWACO)
- Calculate mud circulating times and volumes (M-I SWACO)
- Monitor mud properties of the drilling fluid and maintain drilling fluid logs (M-I SWACO)
- Design drilling fluid program and monitor fluid properties (M-I SWACO)
- Execute adjustments to mud properties and monitor mud weight (Transocean and M-I SWACO)

1.2 Companies Involved in Drilling the Macondo Well

The primary companies involved in drilling the Macondo well were:

BP

BP personnel in Houston, Texas, managed the development and operation of the Macondo well, and provided direction and support to their personnel onboard the *Deepwater Horizon*. These onshore personnel consisted of three engineers, an engineer team leader, an operations team leader, and a manager. BP offshore personnel consisted of two well site leaders, a well site trainee, and three subsea personnel. The well site leaders exercised BP's authority on the rig, directed and supervised operations, coordinated the activities of contractors, and reported to BP's shore-based team.

BP's contractors for the Macondo well included:

Transocean

BP contracted Transocean to provide the *Deepwater Horizon* drilling rig and the personnel to operate it. The Transocean team included the drill, marine, and maintenance crews. The senior Transocean personnel involved in day-to-day operations were the offshore installation manager (OIM) and the captain. The OIM was the senior Transocean manager onboard who coordinated rig operations with BP's well site leaders and generally managed the Transocean crew. The captain was responsible for all marine operations and was the ultimate command authority during an emergency and when the rig was underway from one location to another.

The Transocean drill team was led by a senior toolpusher, who supervised two toolpushers responsible for coordinating the round-the-clock drilling operations. The toolpushers supervised the drillers and assistant drillers, who operated the drilling machinery and monitored the rig instruments. At the time of the incident, there were 79 Transocean personnel onboard the *Deepwater Horizon*, including nine who lost their lives.

Halliburton

BP contracted Halliburton to provide specialist cementing services and expertise and to support the BP teams both onshore and on the *Deepwater Horizon*. At the time of the incident, two Halliburton cementing specialists were onboard the *Deepwater Horizon*.

Sperry Sun

BP contracted Sperry Sun to install a sophisticated well monitoring system on the *Deepwater Horizon*. Sperry deployed trained personnel, or mud loggers, to monitor the system, interpret the data it generated, and detect influxes of hydrocarbons, or kicks. At the time of the incident, there were two Sperry Sun mud loggers onboard the *Deepwater Horizon*.

M-I SWACO

BP contracted M-I SWACO to provide specialized drilling mud and mud engineering services on the *Deepwater Horizon*, which included mud material, equipment, and personnel. At the time of the incident, there were five M-I SWACO personnel onboard the *Deepwater Horizon*, including two who lost their lives.

Schlumberger

BP contracted Schlumberger to provide specialized well and cement logging services on the *Deepwater Horizon*, which included equipment and personnel. At the time of the incident, no Schlumberger personnel were onboard the *Deepwater Horizon*.

Weatherford

BP contracted Weatherford to provide casing accessories, including centralizers, the float collar, and the shoe track on the *Deepwater Horizon*. Weatherford also provided specialist personnel to advise BP and the drill crew on the installation and operation of their equipment. At the time of the incident, two Weatherford personnel were onboard the *Deepwater Horizon*.

Tidewater Marine

BP contracted Tidewater Marine to provide the offshore supply vessel the *Damon B. Bankston*. The *Bankston* carried supplies (such as drilling equipment, drilling chemicals, food, fuel oil, and water) to and from the *Deepwater Horizon*. At the time of the incident, the *Bankston* was alongside the *Deepwater Horizon* and provided emergency assistance.

Other personnel onboard the *Deepwater Horizon* included 14 catering staff, two BP executives, and 14 BP subcontractors for a total of 126 personnel onboard.

1.3 *Deepwater Horizon* History of Operations

A fifth-generation, dynamically positioned, semi-submersible mobile offshore drilling unit (MODU), the *Deepwater Horizon* was capable of working in water up to 10,000 ft. deep.^{2, B} This capability put the *Deepwater Horizon* at the forefront of oil and gas exploration, as the oil industry looks to deeper waters for new development. In 2009, the *Deepwater Horizon* crew drilled the deepest oil and gas well in the world, which had a vertical depth of 35,050 ft., or more than six miles.

The *Deepwater Horizon* entered service in April 2001 and went to work for BP in the Gulf of Mexico that September. With the exception of one well drilled for BHP Billiton in 2005, the *Deepwater Horizon* worked exclusively for BP. The *Deepwater Horizon* crew drilled more than 30 wells on the U.S. outer continental shelf (OCS) during the course of the rig's career, in water depths between 2,333 ft. and 9,576 ft., and maintained an excellent performance and safety record.^C In September 2009, BP extended its drilling contract on the *Deepwater Horizon* through September 2013.

1.4 Inspections of the *Deepwater Horizon*

The U.S. Coast Guard (USCG), the MMS, the Marshall Islands (the flag state of the *Deepwater Horizon*) and the American Bureau of Shipping (ABS) regularly inspected and certified the *Deepwater Horizon*.

Coastal State Certification – U.S. Coast Guard (USCG)

From the time of her delivery in 2001, the *Deepwater Horizon* operated in the Gulf of Mexico on the outer continental shelf. The USCG certifies all mobile offshore drilling units that operate within the OCS. On July 27, 2009, the USCG renewed the *Deepwater Horizon* Certificate of Compliance, which was valid through July 27, 2011.³

Coastal State Inspection – Minerals Management Service (MMS)

The MMS conducted regular inspections of the *Deepwater Horizon*. These inspections included reviews of test results for the blowout preventer (BOP), the gas detection system, and drilling areas, such as the drill floor and mud pit room. The MMS inspected the *Deepwater Horizon* three times in 2010. The MMS conducted its last inspection of the *Deepwater Horizon* on April 1, 2010, and the inspectors made no findings that required action by the rig crew.⁴

Flag State Inspection – Marshall Islands (MI)

The Marshall Islands inspects its flagged vessels annually using its own inspectors or those from the ABS. In addition to safety inspections, the Marshall Islands requires that its flagged vessels undergo a variety of statutory surveys.^D

The *Deepwater Horizon* last passed her Marshall Islands flag inspections in December 2009, and the rig was current with all inspection requirements at the time of the incident.⁵

B Dynamic positioning is a computer-controlled system to automatically maintain a vessel's position and heading by using its own propellers and thrusters. Position reference sensors combined with wind sensors, motion sensors, and gyroscopic compasses, provide information to the computer about the vessel's position and the amount and direction of environmental forces affecting its position.

C The *Deepwater Horizon* work on the BP Stones well in 9,576 ft. of water set a record for the deepest water depth well drilled by a semisubmersible rig.

D These statutory surveys include the following: International Oil Pollution Prevention; International Sewage Pollution Prevention; International Air Pollution Prevention; International Maritime Organization MODU Code; International Load Line Convention; Annual Ship Radio Station License; Crane Inspection; International Safety Management Code; and International Ship Security Code.

Class Certification – American Bureau of Shipping (ABS)

A classification society verifies that marine vessels and offshore structures comply with the society rules for design, construction, and periodic surveys. The *Deepwater Horizon* was “classed” by the ABS and inspected in accordance with ABS rules. The ABS Class Certificate was renewed on Oct. 19, 2009, and was valid through Feb. 28, 2011.⁶

1.5 Well Operations – February–April 2010

The *Deepwater Horizon* arrived at Macondo on Jan. 31, 2010.⁷ The crew performed maintenance work on the BOP stack, including function and pressure testing, before lowering it onto the wellhead on Feb. 8, 2010. The crew then performed another successful pressure test of the BOP stack after it was attached to the wellhead.⁸ Drilling operations resumed on Feb. 11, 2010.⁹

BP encountered a number of obstacles while drilling Macondo. Two cement repair operations, or squeezes, were required because of weak formations and possible problems with cement. On several occasions, fluid losses into the formation necessitated the use of lost-circulation material (LCM) to stop the escape of fluids. On March 8, 2010, a 35-barrel (bbl) influx of hydrocarbons, or “kick,” occurred, sticking a section of drill pipe in the well.¹⁰ The drill crew had to plug the affected section of the well with cement and drill a side-track in order to continue. In early April, additional fluid losses to the formation prompted BP engineers to change the total planned depth of the well from 20,200 ft. to 18,360 ft. to maintain the integrity of the well.

After drilling was completed on April 9, 2010, Schlumberger conducted a detailed analysis of the well’s geological formations, or well logging, for BP over a period of approximately four-and-a-half days. The logging data from the new depth indicated that the well had reached a sizable reservoir of hydrocarbons. BP began planning for the next phase of the development, in which the *Deepwater Horizon* would run casing and prepare the well for temporary abandonment. On April 16, 2010, BP submitted its proposed temporary abandonment plan to the MMS and received approval the same day.¹¹ Temporary abandonment plans are discussed in further detail in *Chapter 3.2*.

1. Daily Drilling Report, Oct. 6, 2009, TRN-USCG_MMS-00011649.
2. *Deepwater Horizon* Operations Manual, March 2001, TRN-HCEC-00018328.
3. Certificate of Compliance, July 27, 2009–July 27, 2011, TRN-MDL-00272564.
4. Rig Inspection Summary Report, April 1, 2010, TRN-HCEC-00066722.
5. Inspection O.N. 2213, Dec. 17, 2009, TRN-MDL-00268111.
6. ABS Survey Manager, April 26, 2010, TRN-HCJ-00127953.
7. Daily Drilling Report, Jan. 31, 2010, TRN-MDL-00011384.
8. Daily Drilling Report, Feb. 11, 2010, TRN-MDL-00026122.
9. *Ibid.*
10. Daily Drilling Report, March 8, 2010, TRN-MDL-00026179.
11. Application for Permit to Modify, April 16, 2010, BP-HZN-SNR00018177.