3.6 Muster and Evacuation
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3.6.1 Emergency Alarms and Mustering

This event created extremely challenging conditions for all persons onboard. The explosions and fire happened in the evening, when many off-tour crew members were asleep or in their cabins. There was blast damage to various portions of the rig, and some muster points were not accessible. Some crew members were injured and could not evacuate without assistance. It appears that, under the stress of the emergency, a few persons onboard evacuated independently rather than per procedure and as trained. However, despite these obstacles and challenges, muster, evacuation plans, and training facilitated the evacuation of all 115 survivors to the Damon B. Bankston supply vessel nearby. In addition to the heroic actions of many of the crew, assistance from the crew of the Bankston was critical in the rescue effort. The 17 most seriously injured survivors were airlifted to hospitals for treatment.1

The Deepwater Horizon emergency response plan required all personnel to assemble at their designated muster points immediately following the sounding of the general alarm and public address (PA) announcements.2 The “fire and emergency” alarm was seven or more short blasts followed by one long blast on the rig’s general alarm and supplemented by the rig’s whistle for no fewer than 10 seconds.3 The “prepare to abandon” signal was a continuous ringing of the general alarm and supplemented by the rig’s whistle for no fewer than 10 seconds.4 In areas with high noise levels, such as the engine and mud pump rooms, alarms were also indicated by lights, and all alarms were supported by PA announcements.5

Muster points were displayed on the rig’s station bill, which was posted on doors, walls, and passageways, and all cabins throughout the rig.6 All personnel were instructed on the location of their muster points and designated lifeboats when they first arrived onboard the rig and underwent induction and orientation.7 To verify that personnel were familiar with their primary and secondary muster locations, mustering response was practiced onboard the Deepwater Horizon during weekly emergency response drills.8

Location of Personnel on April 20

There were 126 people onboard the Deepwater Horizon on the night of April 20, 2010, including the Deepwater Horizon crew, the BP well site team, third-party contractors, and visitors from both Transocean and BP shore-based management.9 At the time of the incident, on-duty crew members were in work areas, such as the main deck, the rig floor (including the driller’s work station), mud pump room, engine control room (ECR), warehouse, workshops, and the vessel’s bridge and offices within the accommodations (living quarters). Off-duty crew members were in areas such as the living quarters, where many were sleeping at the time of the incident.

Initial Emergency Response

At approximately 9:45 p.m., a member of the drill crew called the bridge to report a well-control situation and then hung up.10 The bridge team attempted to return the call to get more information but got no response.11 Moments later, at about 9:47 p.m., the gas-detection system alarm panel on the bridge began to activate, first indicating the presence of gas in the shale shaker house, then the drill floor, and then other areas of the Deepwater Horizon.12,13 As trained, the bridge team immediately called the shale shaker house to alert personnel and gather information, but they got no response.13 Shortly thereafter, the bridge team received a call from the engine control room and informed the crew member of a well-control situation.14 The bridge team called the Bankston at about 9:48 p.m. and instructed her to move a safe distance away from the rig to a standby position.15

Senior rig personnel from both Transocean and BP were notified of the well-control event before the first alarms sounded and were attempting to respond to requests for assistance when the rig lost power and the first explosion occurred.16 Following the first explosion at about 9:49 p.m., the bridge team sounded the general alarm and made a PA announcement instructing personnel to muster in the galley and cinema.17 See Figure 1.

Survivors reported hearing both the alarms and the PA announcements in various areas of the rig, including the accommodations and on the deck. Although some do not remember hearing or seeing the alarms,18 it is likely

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A There also were gas detection system alarm panels at other locations on the rig, and these also would have lit up but were not being actively monitored. The alarm panel on the bridge is monitored constantly.
that some of the alarm-signaling devices were damaged by the explosions and subsequent fire.

At the sounding of the general alarm, the emergency command group mustered on the bridge. Other crew members with emergency response duties attempted to proceed to their muster stations, such as the ECR and fire-fighting stations. When the bridge team became aware that the galley and cinema were no longer viable muster stations because of damage and debris in the areas, they made another PA announcement at about 9:51 p.m., instructing personnel to proceed to the forward lifeboat stations. See Figure 1.

The response to the emergency and muster of personnel on the Deepwater Horizon was conducted under extremely difficult conditions, including:

- Loss of the rig’s main power system and associated primary lighting (although undamaged battery-powered emergency lights reportedly were still working)
- Drilling mud on the deck creating slippery surfaces
- Damage and debris blocking some escape routes
- Extremely loud noise, similar to a jet engine, coming from the well and blowing through the rotary table on the rig floor and through other openings
- Fires, extreme heat, and flying debris

Transmission of Distress Signals and Activation of the Emergency Disconnect System (EDS)

At 9:53 p.m., the bridge team sent two distress messages. They activated the Global Maritime Distress Safety System (GMDSS) and, at roughly the same time, sent the first of several MAYDAY messages using the VHF radio. These distress messages were received and responded to by the U.S. Coast Guard (USCG) and
vessels in the area, including the Bankston.28

At about 9:56 p.m., the offshore installation manager (OIM), one of the subsea engineers, and one of the BP well site leaders were on the bridge and attempted to activate the emergency disconnect system (EDS) on the blowout preventer (BOP) control panel to disconnect the rig and its marine riser from the BOP stack.29 The power and lights on the BOP control panel were still on, indicating that it was functioning, but post-incident analyses confirm that the EDS did not successfully separate the rig from the BOP stack.30 This is almost certainly due to the explosions and fire damaging or destroying BOP control cables.31 See Chapter 3.4 for a complete discussion on the Deepwater Horizon BOP.

**Attempt to Regain Power**

When the chief engineer mustered on the bridge, he tried to determine why the main power supply had failed and the main engines had stopped.32 When the ECR team reached the bridge, they reported that the engine control and pump rooms had been extensively damaged.33 The chief engineer and two colleagues then left the bridge and attempted to start the standby generator at about 9:59 p.m.,34 but they were unable to restore power. During the incident, display screens such as the fire and gas detection system and the BOP control panel were still operating, indicating that the uninterruptible power supply on the bridge was functioning.35

**On-rig Search and Rescue for Missing/Injured Personnel**

Search and rescue for injured personnel took place within the living quarters.36 One injured person found in the galley/mess room area was escorted to the rig medic.37 Three people were found in the starboard alleyway near the maintenance office on the second deck level.38 Two of these people were seriously injured and had to be rescued on stretchers; a third person, though disoriented from the explosion, was able to assist with the recovery of the other two. Due to the intense heat from the fires and damage caused by the explosions, search and rescue operations were limited in other areas.

**Mustering Prior to Abandonment**

Personnel responded to the general alarm and the PA announcements and reported to muster stations.39 As a result of the incident, some muster points such as the ECR were impaired.40 Personnel assigned to those points went to alternatives — either the bridge or the forward lifeboat station. The forward lifeboat station was not impaired, and all of the survivors who made their way to this point evacuated the rig. See Figure 1.

**Muster at Forward Lifeboats**

Personnel without designated emergency response duties responded to the PA announcements and started to muster at the forward lifeboats at about 9:52 p.m.41 The first personnel arrived at this muster station before the designated muster checkers were in position, and some ad hoc mustering occurred at this early stage.42 The off-duty assistant drillers — the designated muster checkers — arrived and started to check off personnel names against their designated lifeboats, Nos. 1 or 2.43 The muster checkers made several attempts to verify and check off the muster before personnel left the rig, but a full muster was not completed until all of the survivors were safely onboard the Bankston.44

**Decision to Abandon**

From the information the bridge team received, it quickly became apparent that it would be impossible to regain control of the well or to fight the fires, and the captain gave word to abandon.45 Before leaving the bridge at about 10:28 p.m., the bridge team made a PA announcement that they were abandoning the rig and sent a final distress message. They then went to the forward lifeboat muster station and evacuated the rig.46
### 3.6.2 Evacuation and Escape

As noted above, the Deepwater Horizon evacuation and escape systems worked as designed. One hundred people evacuated in the forward lifeboats, seven evacuated in one of the forward life rafts, and eight jumped from the forward end of the rig into the sea. After the survivors reached the Bankston, the 17 most seriously injured survivors were airlifted by USCG helicopters to hospitals for treatment.\(^{47}\)

#### Regulatory Compliance

The evacuation and escape systems on the Deepwater Horizon were designed and maintained in compliance with the International Standards of Safety of Life at Sea (SOLAS 1974 regulations) and USCG requirements under the Code of Federal Regulations (C.F.R.) for foreign flag vessels operating on the U.S. outer continental shelf.\(^{48}\) In addition, the systems were inspected independently by the American Bureau of Shipping (ABS) for the rig’s mobile offshore drilling unit (MODU) safety certificate, valid through Feb. 28, 2011, and as a part of the Report of Safety Inspection for MODU/MOU for the Marshall Islands, the rig’s flag state.\(^{49}\) They also were inspected by the USCG, most recently on July 27, 2009, when the inspectors noted the Deepwater Horizon’s "outstanding safety culture, performance during drills and condition of the rig. No deficiencies issued, none are outstanding.\(^{50}\)

#### Evacuation Methods

1. **Lifeboats:** The Deepwater Horizon had four lifeboats — two located at the forward end of the rig adjacent to the living quarters and two at the aft on the second deck level. See Figure 2. Each lifeboat was designed and certified to carry 73 people so that even if the rig had been at its full capacity of 146 (instead of the 126 onboard that day), every person could have been evacuated using only the two accessible lifeboats.\(^{51}\)

2. **Life Rafts:** The Deepwater Horizon was equipped with six self-inflating life rafts. The life rafts were located next to the lifeboats, three forward and three aft, on the second deck level. See Figure 2. The
life rafts had a maximum capacity of 25 people each and were davit launched (a suspension system that lowers the rafts to the sea).  

Evacuation Sequence

Based on witness testimony, personnel evacuated or escaped from the forward end of the Deepwater Horizon in the following order:

- 4 people jumped before the lifeboats were launched.
- 100 people evacuated on lifeboats Nos. 2 and 1.
- 7 people evacuated on a lift raft.
- 4 people jumped after the life raft was launched.

Evacuation by Lifeboat

One hundred\(^\text{B}\) of the 115 survivors evacuated the Deepwater Horizon on the forward lifeboats — No. 2, which launched first, followed by No. 1. Access to the aft lifeboats was blocked by damage from the explosions. See Figure 2. Not all evacuated in their designated lifeboats, and it has not been possible to establish how many people were in each lifeboat. The OIM checked the condition of its davits of lifeboat No. 1, and one injured person on a stretcher was loaded into this boat.

Lifeboat No. 2 was launched first at about 10:19 p.m. Witnesses did not report any significant issues during the launch from the rig. Once in the water, the coxswain operated the lifeboat fall release. There was a small problem releasing the aft fall, but this was remedied by opening the aft hatch and assisting the release by hand. Once the lifeboat was approximately 1,000 ft. from the rig, the coxswain handed the operation over to a more senior staff member, who then maneuvered the boat alongside the Bankston.

Lifeboat No. 1 was launched at about 10:25 p.m. Witnesses did not report any significant issues during the actual launch process from the rig (i.e., the brakes released as expected and the lifeboat descended to the water without any problems). Once in the water, the coxswain operated the fall release without any problems and used a portable VHF radio to contact the Bankston. Once in the water, a senior member of Transocean staff exited the boat to assist with navigation to the Bankston because the boat's windows were obscured by mud that had blown out from the well.

Evacuation by Life Raft

After the two lifeboats left the Deepwater Horizon, 11 survivors remained onboard. Because the aft lifeboats were not available, one of the forward davit-launched life rafts was prepared. After the raft was inflated, a problem with the launching arrangements caused a brief delay, and then one person boarded and assisted loading a person on a stretcher, followed by five others.

The life raft was lowered with seven people onboard at about 10:35 p.m. When the raft was approximately halfway down, it turned almost vertical, and all of its occupants were thrown to one side. What caused this is unknown, but the occupants managed to right the raft and continued the descent to the water.

Once the life raft reached the sea, four of the occupants entered the water. One person was picked up by the Bankston fast rescue craft (FRC). The other three entered the water intending to move the raft away from the rig but discovered it was still attached by the painter line to the rig's deck. The knife stored on the raft could not be found and efforts to detach the line by hand were unsuccessful. The FRC coxswain maneuvered into position so that a knife could be passed to one of the people in the water, who cut the line. The FRC crew then towed the life raft away from the Deepwater Horizon to the Bankston. (The knife was discovered in its designated location on the raft before the Bankston left the Macondo location.)

\(^{\text{B}}\) One hundred (100) is calculated by deducting those missing (11), those who evacuated by life raft (7), and those who jumped (8) from the total number of persons on board (126).
Alternative Escape Methods

Eight people jumped into the sea from the *Deepwater Horizon*. Four entered the sea before the lifeboats and life raft were launched, between about 9:59 p.m. and 10:09 p.m., and were picked up by the FRC and taken to the *Bankston*, where they were triaged. One of the four was physically injured when he jumped.

Four other survivors remained on the rig after the lifeboats and life raft were launched. They later said that because they could not access the aft lifeboats, they considered launching a second life raft or climbing down a ladder, but the fire was becoming so intense they decided to jump from the bow at approximately 10:37 p.m. After the four entered the water, they were able to reach the life raft, where they clung to its side or were picked up by the FRC. They were then taken to the *Bankston* and triaged.

Role of the Damon B. Bankston

All 115 survivors from the *Deepwater Horizon* were recovered by the *Bankston*. At the time of the incident, the *Bankston* was on station approximately 40 ft. off the port side of the *Deepwater Horizon*.

The *Bankston* crew first noticed that something was wrong on the *Deepwater Horizon* at about 9:44 p.m., when mud began to rain down onto the vessel from the rig. The *Bankston* then received a call from the bridge team onboard the *Deepwater Horizon* at about 9:48 p.m. to report the well-control incident and instruct the *Bankston* to move away from the rig to a standby position.

In response to distress messages from the *Deepwater Horizon*, and after observing the lifeboat launch preparations and people jumping into the water, the captain of the *Bankston* launched his FRC at about 10:12 p.m. Although the weather conditions were good, the captain of the *Bankston* maneuvered his vessel so that the lifeboats and life raft could tie up securely alongside the starboard side of the *Bankston* and disembark. Lifeboat No. 2 was unloaded first at about 10:34 p.m., followed by lifeboat No. 1 at about 10:39 p.m. and the life raft at about 10:53 p.m. Once all of the survivors were onboard the *Bankston* and the triage of the injured had begun, a muster was organized to determine how many people had evacuated the *Deepwater Horizon* and who was still missing; this was completed at about 11:30 p.m.

The *Bankston* had limited medical assistance capabilities and was not equipped to support the 115 survivors, but the captain and crew of the *Bankston* provided all possible aid, and another vessel provided additional medical supplies. The first USCG helicopters arrived at approximately 11:25 p.m. and passed down a number of rescue swimmers and a flight surgeon. After assessment, the 17 most seriously injured were airlifted to hospitals starting at approximately 12:06 a.m., April 21, 2010. The USCG and a number of vessels responded to the *Deepwater Horizon* distress calls and conducted extensive searches for the missing until approximately 7 p.m. on April 23, 2010.

### 3.6.3 Muster and Evacuation Findings of Fact

- All personnel who survived the explosions made their own way or were assisted by co-workers to the forward lifeboat muster station and successfully evacuated the rig.
- The fires were determined to be too intense to fight, and they limited search and rescue operations.
- With the exception of a few minor issues, both forward lifeboats launched as expected and were able to power their own way to the *Bankston*.
- The *Bankston* crew and fast rescue craft (FRC) were critical in assisting in the safe recovery of personnel in the sea and in moving the life raft away from the rig.
- The benign weather conditions contributed to the survival of those who jumped from the rig.
- The marine crew took appropriate actions to signal for help and ensure survivors evacuated the rig.
- Battery-powered uninterrupted power supplies and emergency lighting functioned as designed.
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2. Transocean Deepwater Horizon Station Bill, June 18, 2009, MDL-00522627.
3. Ibid.
4. Ibid.
6. Transocean Deepwater Horizon Station Bill, June 18, 2009, MDL-00522627.
22. Transocean Investigation Team Interview of Eric Estrada, June 24, 2010; Transocean Investigation Team Interview of Thomas Cole, June 2, 2010.


36. The United States Coast Guard, Stan Carden Witness Statement, April 21, 2010, TRN-HCJ-00121053; The United States Coast Guard, Chad Murray Witness Statement, April 21, 2010.

37. Statement of Robert Hearn taken by Norman Anseman, April 22, 2010; The United States Coast Guard, Chad Murray Witness Statement, April 21, 2010.

38. The United States Coast Guard, Chad Murray Witness Statement, April 21, 2010.


41. The United States Coast Guard, John Quidobeach, Jr. Witness Statement, April 21, 2010; The United States Coast Guard, John Lance Witness Statement, April 21, 2010; The United States Coast Guard, Carl Lavergne Witness Statement, April 21, 2010.

42. Transocean Investigation Team Interview of Caleb Holloway, May 28, 2010; Transocean Investigation Team Interview of Thomas Cole, June 2, 2010.


53. Transocean Investigation Team Interview of Eric Estrada, June 24, 2010; Transocean Investigation Team Interview of Thomas Cole, June 2, 2010.


74. The United States Coast Guard, Brandon Boullion Witness Statement, April 21, 2010; The United States Coast Guard, Gregory Meche Witness Statement, April 21, 2010; The United States Coast Guard, Shane Faulk Witness Statement, April 21, 2010; Transocean Investigation Team Interview of Matthew Hughes, June 29, 2010.

75. Transocean Investigation Team Interview of Matthew Hughes, June 29, 2010.

76. The United States Coast Guard, Curt Kuchta Witness Statement, April 21, 2010; The United States Coast Guard, Michael Williams Witness Statement, April 21, 2010, TRN-HCJ-00120997,1001; The United States Coast Guard, Yancy Keplinger Witness Statement, April 21, 2010, TRN-HCJ-00121037; The United States Coast Guard, Paul Meinhart Witness Statement, April 21, 2010.

77. Ibid.


