HomeRegulations & Guidance

SAFETY ALERT FOR THE MACONDO WELL BLOWOUT

National Safety Alert No. 10
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On April 20, 2010, while the crew of the Mobile Offshore Drilling Unit (MODU) Deepwater Horizon (DWH) was finishing work after drilling the Macondo well, an undetected influx of hydrocarbons escalated to a blowout. Shortly after the blowout, hydrocarbons that had flowed onto the rig floor ignited in two separate explosions. The flowing hydrocarbons fueled a fire on the rig that continued to burn until the rig sank on April 22, 2010. These events resulted in the tragic loss of eleven lives and multiple injuries. Due to the valiant efforts of the crews on the *Damon Bankston* and *Ramblin Wreck*, 115 survivors were able to evacuate the DWH and be immediately rescued. Crews of several other vessels in the area were first responders to the scene and also provided assistance to those in need. Over a period of 87 days, almost 5 million barrels[1] of oil were discharged from the Macondo well into the Gulf of Mexico resulting in the largest oil spill in U.S. history and affecting offshore and coastal areas of the Gulf of Mexico.

Because of the severity of the accident, the Bureau of Ocean Energy Management, Regulation and Enforcement (now the Bureau of Safety and Environmental Enforcement or BSEE) and the United States Coast Guard (USCG) published a preliminary Safety Alert on April 30, 2010. An extensive investigation was then conducted by a BSEE – USCG Joint Investigation Team (JIT). The JIT investigation report was published in two volumes. Volume I addresses the areas of USCG responsibility. Volume II addresses the areas of BSEE responsibility. These two volumes were published on April 22, 2011 and September 14, 2011, respectively.

This Safety Alert summarizes the investigative findings related to areas of BSEE responsibility (Volume 2), which include systems associated with exploration, drilling, completion, workover, production, pipeline and decommissioning operations.

The investigation concluded that at the time of the event, the drilling crew was preparing to finish the temporary plugging and abandoning of the Macondo well. Following a series of tests on the production casing, the well began flowing. As the crew attempted to take corrective actions to shut-in and divert the flow from the well, mud, gas and crude oil rained down on the rig as it exited the mud-gas vent line located in the derrick. Within moments of the blowout, explosions rendered the crew unable to activate the blind shear ram (BSR) or the emergency disconnect sequence for the rig's blowout preventer (BOP) stack.

In addition, the investigation found, in part, that:

- The operator did not follow the cementing recommendations identified in American Petroleum Institute (API) Recommended Practice (RP) 65 – *Cementing Shallow Water Flow Zones in Deep Water Wells and API RP 65, Part 2 – Isolating Potential Flow Zones During Well Construction.* Specifically, the operator did not:
  - circulate full bottoms up prior to pumping cement;
  - pump heavier weight mud into the rat hole before pumping cement to prevent swap out of the lighter rat hole mud (14.0 ppg) with the heavier (14.5 – 16.4 ppg) cement;
  - achieve a static gel strength; and
  - meet the minimum annular space guidelines between production casing and hole size in their well design.
- Pressure differential anomalies identified during negative pressure tests were not recognized as possible hydrocarbon influx and were instead misinterpreted as "annular compression" or "bladder effect."
- The rig crew did not detect the hydrocarbon influx, likely due at least in part to fluid movement among the various pits and fluid movement from the rig to the Damon Banskston.
- Even though various cementing anomalies occurred, the operator did not set a mechanical/cement plug above the float collar/wiper plugs prior to displacing the well to an underbalanced condition.
- In responding to the blowout, the rig crew used the mud-gas separator (MGS) to handle the hydrocarbon flow rather than diverting the well directly overboard through the diverter line(s).
- The MGS vent piping was located in the derrick and directed flow back down toward the rig floor.
- The operating philosophy of a dynamically-positioned MODU is to maintain power at all times for the purpose of keeping on station. This adds complexity to the response to a well control event. Further, this philosophy creates a conflict because the rig needs to maintain power to get off location while maintaining that power creates a possible ignition source.
- The air intakes for two of the engine room compartments were located in close proximity (~20 feet) to the edge of the rig floor classified area.
- A forensic examination of the BOP stack conducted by Det Norske Veritas and supported by a multi-party technical working group revealed that elastic buckling of the drill pipe had forced the drill pipe up against the side of the wellbore and outside the cutting surface of the (BSR) blades. As a result, the BSR did not completely shear the drill pipe nor seal the well which allowed hydrocarbons to continue to flow after the blowout.

Lessees and contractors are reminded that the interim final rule published on October 14, 2010 amended the regulations at 30 CFR 250.415(f) by adding a requirement for Lessees to submit a written description of how they have evaluated the best practices included in API RP 65-Part 2. The written description must identify the mechanical barriers and cementing practices they will use for each casing string. This must be included as part of the operator's casing and cementing programs, required in 30 CFR 250.411.

Based on the investigation, BSEE recommends that Lessees and contractors:

- Minimize the amount of fluid transfers during well operations so that accurate monitoring of flow-in versus flow-out can be achieved. Refer to Safety Alert #284 – Diverter Flow Event, for additional information regarding surface fluid system and fluid movement.
- Recognize the potential for a well to flow during a negative pressure test. It is recommended that Lessees and contractors ensure that their procedures for conducting negative pressure tests outline expected test results including failure indicators. These expected test results should be discussed at a pre-kill meeting prior to conducting the negative pressure test.
- Review their well control procedures to ensure that the initial response actions default to routing the well flow to the overboard diverter line(s) when appropriate.
- Evaluate and consider relocating the MGS vent line(s) to prevent directing gas, condensate and oil back down toward the rig floor.
- Inspect all dynamically-positioned MODUs and determine if all air intakes are located as far as practically possible from the rig floor.
- Evaluate the configuration and operation of subsea BOP stacks to maintain central alignment of the drill pipe and minimize the effects of elastic buckling during emergency activation of BSRs.

Lessees and contractors are urged to thoroughly examine the detailed investigation findings, conclusions and recommendations in the JIT Report located at http://www.boemre.gov/pdfs/maps/DWHFINAL.pdf.

[1] This estimate is based upon pressure readings, data and analysis conducted by U.S. scientific teams commissioned by the National Incident Commander. See http://www.doi.gov/news/pressreleases/US-Scientific-Teams-Refine-Estimates-of-Oil-Flow-from-BP-Well-Prior-to-Capping.cfm.

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