

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT
GULF OF MEXICO REGION

ACCIDENT INVESTIGATION REPORT

For Public Release

1. OCCURRED

DATE: 01-APR-2015 TIME: 1330 HOURS

2. OPERATOR: BP Exploration & Production Inc.

REPRESENTATIVE:

TELEPHONE:

CONTRACTOR:

REPRESENTATIVE:

TELEPHONE:

- STRUCTURAL DAMAGE
- CRANE
- OTHER LIFTING DEVICE
- DAMAGED/DISABLED SAFETY SYS.
- INCIDENT >\$25K
- H2S/15MIN./20PPM
- REQUIRED MUSTER
- SHUTDOWN FROM GAS RELEASE
- OTHER

3. OPERATOR/CONTRACTOR REPRESENTATIVE/SUPERVISOR
ON SITE AT TIME OF INCIDENT:

6. OPERATION:

4. LEASE: G30926

AREA: KC LATITUDE:

BLOCK: 147 LONGITUDE:

- PRODUCTION
- DRILLING
- WORKOVER
- COMPLETION
- HELICOPTER
- MOTOR VESSEL
- PIPELINE SEGMENT NO.
- OTHER

5. PLATFORM:

RIG NAME: SEADRILL WEST VELA

6. ACTIVITY: EXPLORATION(POE)

DEVELOPMENT/PRODUCTION
(DOCD/POD)

8. CAUSE:

- EQUIPMENT FAILURE
- HUMAN ERROR
- EXTERNAL DAMAGE
- SLIP/TRIP/FALL
- WEATHER RELATED
- LEAK
- UPSET H2O TREATING
- OVERBOARD DRILLING FLUID
- OTHER 22 inch casing shoe failure

7. TYPE:

HISTORIC INJURY

- REQUIRED EVACUATION
- LTA (1-3 days)
- LTA (>3 days)
- RW/JT (1-3 days)
- RW/JT (>3 days)
- Other Injury

- FATALITY
- POLLUTION
- FIRE
- EXPLOSION

- LWC
- HISTORIC BLOWOUT
 - UNDERGROUND
 - SURFACE
 - DEVERTER
 - SURFACE EQUIPMENT FAILURE OR PROCEDURES

9. WATER DEPTH: 4248 FT.

10. DISTANCE FROM SHORE: 167 MI.

11. WIND DIRECTION:
SPEED: M.P.H.

12. CURRENT DIRECTION:
SPEED: M.P.H.

13. SEA STATE: FT.

COLLISION HISTORIC >\$25K <=\$25K

Summary:

On 1 April 2015, the SeaDrill West Vela drill ship under contract to BP Exploration and Production (BP) reported a dark area identified by the rigs ROV approximately 400-500 feet from the well head located at Well 001 (Tiber #3) in Keathley Canyon Block 147. Recent results of samples collected from the dark area on the seafloor show the material to be gelatinous, resemble filter cake, 2% oil based on retort analysis and consistent with Synthetic Based Drilling Mud (SBM) used to drill the 16.5 inch hole section for the 14 inch casing. BP notified the National Response Center (NRC Report #1112477) and reported an unknown amount of SBM spill into the Gulf of Mexico.

Chronological Order of Events taken from the IADC Reports:

At 0830 hours on 14 November 2014, the 26 inch hole section total depth was reached at 8680 ft md/tvd. All tight spots were reamed until no restrictions were observed. Operations then proceeded to pull out of the hole (POOH).

At 1430 hours on 15 November 2014, the 26 inch bottom hole assembly (BHA) was recovered to surface. Equipment was then rigged up and operations began to run the 22 inch casing.

At 2330 hours on 17 November 2014, the 22 inch casing was latched into the wellhead per Drill Quip procedure. Pumping operations then began by pumping 11.5 ppg pad mud with green dye to achieve accurate annular volume at time of report.

At 0130 hours on 18 November 2014, operations continue to circulate with 11.5 ppg pad mud and observe green dye return at well head. At 1830 hours began pumping nitrogen foamed cement.

At 0200 hours on 19 November 2014, a review of the post cementing report was conducted and the job as pumped was deemed to meet the operation as designed. The circulated cement total pumped was 6872 cu ft of 13.2 ppg average density nitrogen foamed cement and 1564 cu ft of 16.4 tail cement. The circulated cement was visually observed at the mud line (confirmed by pH readings) and pump lift pressure also indicated cement to mud line. After BPs review of the post 22 inch cement job report, BP gave the approval to continue operations. Valves on low pressure well head were closed and plugs installed. Operations then proceeded to POOH.

At 0500 hours on 20 November 2014, trip in hole (TIH) to 8410 ft md/tvd and wash to 8460 ft md/tvd. Tag top of cement (TOC) with 15K pounds pipe weight at 8479 ft md/tvd. POOH to surface. Remote operation vehicle (ROV) install cap on well head. Prepare rig to depart location. The SeaDrill West Vela rig left location enroute to BP Thunderhorse project to conduct an intervention operation.

On 24 December 2014, the SeaDrill West Vela rig moved back on location.

On 31 December 2014, the subsea blowout preventer (SSBOP) was run and latched onto the well head.

On 1 January 2015, the testing of the SSBOP was completed.

At 1730 hours on 2 January 2015, the 22 inch casing was pressure tested to 4500 psi for 30 minutes with 8.6 ppg seawater. Test met BSEE requirements, pumped 29 bbls during test and bled back 29 bbls at end of test (GMTBR-DO-PR-00-03204). At 2230 hours review tasked based risk assessment (TBRA) for re-test of 22 inch casing positive test #1.

At 0000 hours on 3 January 2015, the 22 inch casing was pressure tested again per GMTBR-DO-PR-00-03204 to 4500 psi with 8.6 ppg seawater. At 0730 hours TIH with BHA and tag TOC at 1800 hours. At 2300 hours began displacing surface line equipment from

8.6 ppg seawater to 12.5 ppg Synthetic Base Mud (SBM).

At 1930 hours on 4 January 2015, the 22 inch casing was pressure tested to 3200 psi for 30 minutes with 12.5 ppg SBM.

At 1000 hours on 5 January 2015, the 22 inch casing shoe was drilled out to 8690 ft md/tvd and a formation integrity test (FIT) performed with 12.5 ppg SBM at 1,037 psi for an equivalent surface mud weight of 14.8 ppg (15.0 ppg down hole mud weight). Began drilling the 16.5 inch hole section.

From 6 January to 7 January 2015, continue drilling operations in the 16.5 inch hole section to a depth of 14,481 ft md/tvd with a 13.5 ppg SBM, no losses.

At 0300 hours on 8 January 2015, began to POOH to perform complete function test of SSBOPs. Began TIH at 1930 hours.

At 1330 hours on 9 January 2015, back on bottom and begin drilling operations to 15,565 ft md/tvd with 13.8 ppg SBM, no losses.

On 10 January 2015, drill from 15,565 ft to 17,873 ft with 14.1 ppg SBM, no losses.

On 11 January 2015, drill from 17,873 ft to 19,906 ft with 14.1 ppg SBM, no losses.

At 0930 hours on 12 January 2015, drill from 19,906 ft md/tvd to 21,090 ft md/tvd with 14.2 ppg SBM, no losses. This is the 14 inch intermediate casing point. Pump 100 bbl 14.2 ppg Hi-Vis sweep and began circulating bottoms up. At 1630 hours began POOH and encountered tight spots from the following depths in ft: 21,780; 20,777; 20,764; 20,755; and 20,730 md/tvd. At 1830 hours began to POOH from 20,705 ft tvd/md to 20,473 ft md/tvd and observing tight spot. Started reaming hole and pulling and setting down 30K. At 20,024 ft md/tvd, released 35K Torque. Continued working string while rotating and pumping, 45K Torque. At 2200 hours drill pipe stuck at 20,023 ft md/tvd, set down 75K and pulled 40K over; drill pipe freed. At 2300 hours pull 100K over and set down 60K, jars cocked and fired on up stroke at 50K over. Jars fired a total of 4 times at 140K down and freed string again at 2315 hours.

From 13 January to 14 January 2015, the mud weight was increased to 14.4 ppg SBM and back reaming operations were performed on several sections of the hole up to 19,039 ft md/tvd while POOH to 17,195 ft md/tvd.

On 15 January 2015, POOH to 5,546 ft md/tvd to begin diverter function testing and SSBOP testing. Continue SSBOP testing through 16 January 2015. Notified BSEE Lake Charles District at 1000 hours on 16 January that during ROV inspection for methane sources, it was discovered that 3 of the fittings where the upper shut off valves attached to the low pressure wellhead housing have started to bubble. POOH at 1600 hours.

On 17 January 2015 at 0530 hours, POOH and conduct rig maintenance; slip and cut drill line. At 1830 hours a total of 4 bbls SBM were loss to the hole. At 1830 hours, began boosting riser and pumped 1554 bbls of 14.4 ppg SBM with 20 bbls losses. Continue to rig up Franks casing equipment.

At 0300 hours on 18 January 2015, began TIH with 14 inch intermediate casing, BP Well Site Leader dropped Weatherford 3-1/2 inch float conversion ball into float collar joint. At 0730 hours 14 inch casing at 1085 ft md/tvd with a loss of 8 bbls SBM. At 2400 hours 14 inch casing at 2751 ft md/tvd (30 ft/min, 14.4 ppg SBM). Total loss for 12 hours = 146 bbls and total loss for 24 hours 273 bbls.

On 19 January 2015, continue to TIH with 14 inch casing (30 ft/min, 14.4 ppg SBM) to a depth of 8,614 ft md/tvd. Total losses for 24 hour period 456 bbls, cumulative total loss 727 bbls.

At 1200 hours on 20 January 2015, continue to TIH with 14 inch casing (20 ft/min, 14.4 ppg SBM) to a depth of 11,745 ft md/tvd, with 363 bbls loss. At 2400 hours 14 inch casing at 15,762 ft md/tvd (20 ft/min, 14.4 ppg SBM). Losses for 12 hours were 550 bbls, cumulative total loss 1640 bbls (727+363+550=1640).

At 0200 hours on 21 January 2015, continue to TIH with 14 inch casing to a depth of 16,666 ft md/tvd. Operations then proceeded to pick up casing hanger. From 0200 to 0500 hours prepare rig for running 14 inch casing on 6-5/8 inch landing string. From 0500 to 1200 hours RIH with 14 inch casing to 19,338 ft md/tvd. Losses for 12 hours were 712 bbls. At 1700 hours landed 14 inch casing in wellhead, casing depth at 21,004 ft md/tvd, static losses 2 bbls per minute. At 1730 hours circulate 1.5 times landing string volume. At 1800 hours pump 1915 cu ft of cement, after 280 bbls of slurry pumped started seeing returns. At 2100 hours started displacing with rig pumps using 14.4 ppg MW, observing 26% to 35% returns. Losses for 12 hours were 1280 bbls, cumulative total loss 3912 bbls (1640+712+280+1280 = 3912).

At 0345 hours on 22 January 2015, cement in place. At 0600 hours release running tool from hanger. Verified float holding and begin pressure testing 14 inch casing seal assembly. Losses for 12 hours were 890 bbls. Began operations to POOH at 1600 hours, pumped 40 bbl slug and held TBRA. At 2400 hours out of hole while monitoring well on trip tank. Total loss to date is 4802 bbls (3912 + 890 = 4802). The BP Incident Report states a total loss of 4805 bbls.

At 1030 hours on 23 January 2015, perform pressure test on 14 inch casing to 6600 psi for 30 minutes with 14.4 ppg MW. The rig begins SSBOP pressure testing. At 2000 hours the wear bushing is set.

At 2030 hours on 24 January 2015, begin making up the BHA and TIH.

At 1200 hours on 25 January 2015, TIH to 12,309 ft md/tvd. At 2230 hours tagged cement at 20,750 ft md/tvd.

On 26 January 2015, because of the gas bubbling BP received approval for installing a temporary deflector plate to prevent hydrates from forming on the SSBOP. Continue to test SSBOPs and held well control drill.

On 27 January 2015, held simulated well control drill for both tours, while continuing to test SSBOP.

At 0900 hours on 28 January 2015, operations began to drill out cement and the float collar from 20,750 ft md/tvd to a total depth of 21,008 ft md/tvd. The rat hole was washed and reamed from 21,008 ft to 21,046 ft md/tvd.

At 0400 hours on 29 January 2015, the rat hole was washed and reamed to 21,090 ft md/tvd. New formation was drilled from 21,090 ft to 21,102 ft md/tvd with 15.0 ppg SBM. Pump out of hole from 21,102 ft to 21,087 ft md/tvd. At 1100 hours a FIT was performed with 15.0 ppg SBM at 1,892 psi for an equivalent surface mud weight of 16.7 ppg (17.0 ppg down hole mud weight). Drilling operations then continued for the next hole section.

18. LIST THE PROBABLE CAUSE(S) OF ACCIDENT:

BSEEs incident investigation along with the review of the BP Incident Investigation

Report revealed that the probable cause of the incident was identified as the breakdown of the 22 inch casing shoe that was set at 8630 ft md/tvd in a salt formation (1230 ft md/tvd below top of salt).

19. LIST THE CONTRIBUTING CAUSE(S) OF ACCIDENT:

BP identified three possible contributing causes of the incident in their Incident Investigation Report and they are listed as follows:

1. The top of the salt formation was weaker than expected due to factors outlined in the Salt Fracture Initiation Line theory which discusses that salt strength assumptions in well planning processes may have underestimated potential salt strength failure modes.
2. Incremental pressure applies resulted in a formation breakdown below the 22 inch casing prior to or during the SSBOP test.
3. A potential 22 inch casing connection leak during the sea water pressure test which could have contributed to the creation of micro-fractures, which then propagated into a micro-annulus.

Of the possible contributing causes identified by BP, the BSEE 2010 Team feels that the most probable causes are #2 and #3 or combination thereof. Also, by continuing to run in the hole with the 14 inch casing, the 14 inch casing surge pressures placed on a weakened 22 inch casing shoe contributed to the severe losses experienced by BP.

The BSEE 2010 Team reviewed the available data for indication that the event could have been prevented by prior identification of geologic risk before drilling the well.

The geologic and seismic analysis by BP in their report on the event was also reviewed. The team could not identify any down-hole data that would have changed the location and design of the well or prevented the event once it was in progress.

20. LIST THE ADDITIONAL INFORMATION:

21. PROPERTY DAMAGED:

n/a

NATURE OF DAMAGE:

n/a

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ESTIMATED AMOUNT (TOTAL):

22. RECOMMENDATIONS TO PREVENT RECURRANCE NARRATIVE:

Management consider creating a "Condition of Approval (COA)" by the District Operations Support (DOS) Section to place on all drilling permits. Possible language could be that when extreme losses are experienced by an operator during drilling and casing running operations in any hole section, the district must be contacted before continuing operations.

23. POSSIBLE OCS VIOLATIONS RELATED TO ACCIDENT: **YES**

24. SPECIFY VIOLATIONS DIRECTLY OR INDIRECTLY CONTRIBUTING. NARRATIVE:

Based on the incident investigation findings; an E-100 Incident of Noncompliance (INC) and G-110 INC were issued "After the Fact" to document that BP Exploration and Production (BP) failed to provide adequate supervision during well operations on Well #001 (Tiber #3) located at the surface location in Keathley Canyon Block 147.

The E-100 INC was issued to BP for the failure to prevent the unauthorized discharge of pollutants into offshore waters. From January 18 to January 22, 2015, BP failed to prevent an unauthorized discharge of approximately 500 barrels of 14.4 pound per gallon synthetic oil base mud with a composition that ranged from 52% synthetic to 2% synthetic, into offshore waters from a broaching event that occurred at the 22 inch casing shoe while running and cementing the 14 inch intermediate casing during well operations on Well #001 located at Keathley Canyon Block 147 using the SeaDrill West Vela drill ship.

The G-110 INC was issued to BP for the failure to protect health, safety, property, and the environment by not performing all operations in a safe manner. While experiencing severe losses, BP failed to discontinue the 14 inch casing running operations to determine the cause of the losses (Total Loss was approximately 4802 bbls).

25. DATE OF ONSITE INVESTIGATION:

26. ONSITE TEAM MEMBERS:

29. ACCIDENT INVESTIGATION
PANEL FORMED: **NO**

Pat Daly / Royce Buford / Marty
Rinaudo /

OCS REPORT:

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30. DISTRICT SUPERVISOR:

Mark Osterman

APPROVED

DATE: **12-NOV-2015**