

UNITED STATES DEPARTMENT OF THE INTERIOR  
MINERALS MANAGEMENT SERVICE  
GULF OF MEXICO REGION

ACCIDENT INVESTIGATION REPORT

1. OCCURRED

DATE: 15-MAY-2009 TIME: 1600 HOURS

2. OPERATOR: **Murphy Exploration & Production Co**  
REPRESENTATIVE: **Lanza, Robert**  
TELEPHONE: (281) 675-9135  
CONTRACTOR:  
REPRESENTATIVE:  
TELEPHONE:

- STRUCTURAL DAMAGE
- CRANE
- OTHER LIFTING DEVICE
- DAMAGED/DISABLED SAFETY SYS.
- INCIDENT >\$25K **Mooring line failure**
- 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: **G27306**  
AREA: **MC** LATITUDE:  
BLOCK: **736** LONGITUDE:

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

5. PLATFORM: **A(Thunder Hawk)**  
RIG NAME:

6. ACTIVITY:  EXPLORATION (POE)  
 DEVELOPMENT/PRODUCTION  
(DOCD/POD)

8. CAUSE:

7. TYPE:  
 HISTORIC INJURY  
 REQUIRED EVACUATION  
 LTA (1-3 days)  
 LTA (>3 days)  
 RW/JT (1-3 days)  
 RW/JT (>3 days)  
 Other Injury

- EQUIPMENT FAILURE
- HUMAN ERROR
- EXTERNAL DAMAGE
- SLIP/TRIP/FALL
- WEATHER RELATED
- LEAK
- UPSET H2O TREATING
- OVERBOARD DRILLING FLUID
- OTHER \_\_\_\_\_

FATALITY  
 POLLUTION  
 FIRE  
 EXPLOSION

9. WATER DEPTH: **6050** FT.

LWC  HISTORIC BLOWOUT  
 UNDERGROUND  
 SURFACE  
 DEVERTER  
 SURFACE EQUIPMENT FAILURE OR PROCEDURES

10. DISTANCE FROM SHORE: MI.

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

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

COLLISION  HISTORIC  >\$25K  <=\$25K 13. SEA STATE: FT.

17. INVESTIGATION FINDINGS:

Murphy's Thunder Hawk (FPU) is a four column, semi-submersible production platform and is moored in position by means of a mooring system anchored to the ocean floor and held in place by driven anchor piles. The mooring arrangement comprises twelve lines arranged as groups of three on each of the four FPU columns. Each mooring line consists primarily of polyester line with an anchor chain section and a vessel chain section. The anchors consist of driven anchor piles. A fairlead for each line is located on the FPU column. Each mooring line is tensioned via Rolls Royce electric/hydraulic mooring winches (windlass), located at the top of the four hull columns. Each Rolls Royce winch consists of three winch drums, connected to a single drive unit. Each windlass is capable of applying the necessary maximum pretension to its mooring line and each has an integral chain stopper that ratchets during retrieve. During pay out of the mooring line, the stopper is open and the tension is retained by the winch. A turndown sheave integral into the windlasses directs the chain into a chain locker.

On 15 May 2009 Murphy's Thunder Hawk FPU was on location undergoing final stages of installation with all 12 mooring lines attached and in place. During construction stretch removal (CSR) of mooring line #10, while in the process of relieving the tension on the #10 windlass, the windlass frame failed causing the sprocket to misalign and the chain to pay out, dropping the #10 mooring line and chain to the seafloor. Due to the fact that mooring line number 10 was paying out at the time of the incident, the chain stop was disengaged and unable to arrest the chain's deployment. The collapse resulted in the loss of mooring line number 10 to the seabed and the windlass units for lines 11 and 12 being damaged and inoperable. The frame failure happened under a 410-430 ton load, with a design load of 544 tons.

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

Rolls Royce, DNV, and SBMA each performed forensic engineering studies to identify the root cause of the incident.

- Rolls Royce performed internal re-analysis.
- DNV performed a fitness report of original design which showed full thickness overstresses in windlass frame.
- SBMA performed comprehensive finite element analysis of combined windlass and hull

structure which showed overstresses and related buckling issues of the windlass frame structure.

The forensic engineering studies indicated that the windlass frames were inadequate for the CSR loads experienced.

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

\*Chain stop design: There was a lack of secondary mooring line control when paying out.

\*Quality control flaws in design process: The design load was inadequate since it not account for the prescribed CSR load.

20. LIST THE ADDITIONAL INFORMATION:

Rolls Royce issued enhanced ABS approved design for all windlass frames. SBMA completed repairs to existing windlasses under supervision of ABS and RR and an independent NDE technician. An enhanced windlass was shipped new to replace the destroyed windlass #10.

The mooring line was retrieved on June 11th. ABS surveyors, NDE Technicians and

manufacturer's representatives conducted inspections of the rope, chains, H-links, LLLC links, Shackles and Ball Grab connector and found them satisfactory. Links and shackles have been replaced, while the chains and Ball Grab connector have been re-deployed.

Murphy/SBMA has elected to use new polyester rope (spare rope) to replace the No.10 mooring line (the testing required to revalidate the recovered polyester line would likely be completed after the limit date of July 31st). The recovered polyester ropes are being returned to shore for testing, storage and use as spare.

Based on post incident inspections on the FPU itself and underwater inspections via the ROV, there is no apparent damage to the FPU hull (internal or external), to the gas export SCR, or to the fairlead.

Incident highlights Quality Control issues during the design stage of these very complex offshore structures. Maximum tensions occurring during construction stretch removal were not adequately accounted for in the original design. Windlass frame design was insufficient for these forces. Also, a secondary means of mooring line control during play out would have prevented the line from falling to the sea floor. Messenger chain and shackle in bottom of cahin locker was too light to prevent line falling to sea floor.

21. PROPERTY DAMAGED:

- Number 10 Windlass (destroyed)
- All other windlasses 1-9,11,12 (undamaged but underdesigned)
- Drive shaft for #10,11&12 Windlasses (damaged)
- Mooring line #10 (damaged)

NATURE OF DAMAGE:

Total destruction.

ESTIMATED AMOUNT (TOTAL): **\$1,000,000**

22. RECOMMENDATIONS TO PREVENT RECURRENCE NARRATIVE:

**Due to the specific nature of this incident, the New Orleans District has no recommendations to report to the Regional Office of Safety Management.**

23. POSSIBLE OCS VIOLATIONS RELATED TO ACCIDENT: **NO**

24. SPECIFY VIOLATIONS DIRECTLY OR INDIRECTLY CONTRIBUTING. NARRATIVE:

**N/A**

25. DATE OF ONSITE INVESTIGATION:

**18-MAY-2009**

26. ONSITE TEAM MEMBERS:

**Sid Falk /**

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

OCS REPORT:

30. DISTRICT SUPERVISOR:

**David J. Trocquet**

APPROVED

DATE: **20-APR-2010**

