

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: 29-JAN-2020 TIME: 1400 HOURS

2. OPERATOR: Shell Offshore Inc.

REPRESENTATIVE:

TELEPHONE:

CONTRACTOR:

REPRESENTATIVE:

TELEPHONE:

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

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

8. OPERATION:

4. LEASE: G33733

AREA: MC LATITUDE:

BLOCK: 437 LONGITUDE:

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

5. PLATFORM: A-Appomattox

RIG NAME:

6. ACTIVITY:

- EXPLORATION(POE)
- DEVELOPMENT/PRODUCTION (DOCD/POD)

9. CAUSE:

7. TYPE:

INJURIES:

HISTORIC INJURY

OPERATOR CONTRACTOR

REQUIRED EVACUATION

LTA (1-3 days)

LTA (>3 days)

RW/JT (1-3 days)

RW/JT (>3 days)

FATALITY

Other Injury

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

POLLUTION

FIRE

EXPLOSION

LWC HISTORIC BLOWOUT

UNDERGROUND

SURFACE

DEVERTER

SURFACE EQUIPMENT FAILURE OR PROCEDURES

10. WATER DEPTH: 7400 FT.

11. DISTANCE FROM SHORE: 92 MI.

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

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

14. SEA STATE: FT.

15. PICTURES TAKEN:

16. STATEMENT TAKEN:

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

On 29 January 2020 at 1400 hours, a Roller Ram Winch (RRW) mooring chain incident occurred at Shell Offshore Inc's Appomattox, Mississippi Canyon 437 A OCS-G 33733 facility. The Appomattox is stationary with 16 mooring line chains which are anchored on the seafloor. The estimated repair cost and recovery totaled \$5,750,000 to bring the L-11 mooring system back to its normal state.

Sequence of Events:

Between 24 January 2020 to 29 January 2020, the MacGregor Pusnes's (MGP) service techs on Shell's Appomattox documented a short summary of work performed. The maintenance was performed to change gaskets on mooring lines L-1 through L-12 of the 16 mooring chains, install clips, perform annual maintenance, and review and submit improvements on maintenance procedures. Additionally, the techs noted in the daily service report the MGP's mooring system had not been inspected since November 2018. In the service techs summarized report, chain wear was spotted on mooring line L7, underneath the Slack Chain Hang-off Unit (SCHU) stoppers resting on the chain link. The scope increased to measure and document this finding on all lines. The interlink wear also raised a concern and must be investigated further. In addition, there was corrosion on the SCHU lock bar, noting maintenance must be done to keep its function.

On 29 January 2020, the MGP's maintenance crew completed mooring line L-11's annual inspection. At approximately 1400 hours, the crew was conducting general housekeeping located on the Southwest (SW) side of the facility. Suddenly, the chain links started paying out from the chain locker. At the same time, the guide roller broke free from its bearing cradle. The chain paid out 22 chain links outboard from the chain locker. The chain stopper cylinders, angle transmitter, and SCHU stopper were also forced out of the frame. Furthermore, the MGP's maintenance crew assumed the mooring chain was in the lock position when work was completed. The maintenance crew did not visually observe the chain in a lock position.

According to personnel on Shell's Appomattox, at the time of the incident, red barricade tape restricted access to the SW Hull column only to personnel performing the maintenance activities on the mooring system. Following the incident, Shell's personnel on the deck called the control room to confirm all involved workers on the top of hull were accounted for. The top of the SW hull column was evacuated and the Offshore Installation Manager (OIM) was notified. The platform leadership gathered in the control room after the incident to assess the situation and to work with the Marine Supervisor and Ballast Control Operator (BCO) on the health check of all the mooring lines on the SW hull column.

With the knowledge that there was no pressurized process equipment on the south hull columns such as flowlines, export lines, or umbilicals, the decision was made to not muster or shut in the facility. This decision was based upon reviewing the damage on the top of the SW hull with closed circuit tv cameras and data analysis from the marine system confirming the satisfactory status of the remaining mooring lines, the underwater chain stoppers, and the tension and departure angle of the mooring lines.

On 5 March 2020, a representative from (MGP) conducted an on-site inspection of the damaged RRW assembly on the Appomattox. Additional photos and videos were obtained to assist in identifying all damaged components and to assist in planning the recovery execution. The remaining fifteen (15) RRW assemblies were also inspected. Shell and MacGregor discussed different scenarios of how to recover the loose chain links and how to execute repairs of the RRW.

Shell and the vendor performed calculations and agreed the RRW could be made stable for closer inspection once temporary securement was in place. Initial temporary securement was planned to anchor the inboard chain to prevent possible pay-out

outboard from the chain locker.

Shell worked toward achieving a "storm safe" condition before 1 June 2020. As it related to the effort, "storm safe" was defined as having the guide roller assembly repositioned back in place, the slack chain lifted and secured, and the chain stopper pawls engaged. With a total of 19,800 pounds of chain links dangling underwater, there was a strong possibility that the loose chain could strike and damage the SW hull in rough seas.

As of 23 May 2020, Shell's Offshore Execution Team completed the work to make the RRW storm safe. The guide roller assembly had been repositioned into its housing, the RRW had been tested to confirm operability, and the winch was utilized to pay out twenty links of belly chain into the locker with the upper chain stopper pawls engaged.

Shell will continue over the next several months to evaluate damaged components, complete repairs to the SCHU, and evaluate modifications to the system design. All maintenance activities associated with the mooring system were suspended, pending the results of the Causal Investigation. Shell has developed plans to resume maintenance on the remaining mooring lines, including addressing the action items in the referenced report.

BSEE Investigation:

On 24 February 2020, a team consisting of a Bureau of Safety and Environmental Enforcement (BSEE) New Orleans District (NOD) Accident Investigator and Supervisory Inspector conducted a follow-up investigation. The BSEE team interviewed multiple personnel, took photographs, and collected documents. The team also conducted a hazard assessment inspection of the area surrounding the SW hull of the facility. The team noted that Shell secured the mooring line assembly with chain falls and locked out the mooring line control system.

After reviewing requested documents provided to the NOD Office from Shell, the BSEE investigation team agreed with Shell's assessment that the guide roller stoppers A and B had a gap and imbalance thus creating a misalignment of the chain stopper pair. At the point of the chain payout, the crown of the chain link continued to push against stopper "2A", building pressure in the hydraulic cylinder and connection. The movement caused by the chain link on stopper "2B" broke the mount and stopper body from the SCHU plate. The connection between hydraulic cylinder and stopper "2A" body also broke free. This resulted in freeing the stopper body pushing the mooring chain outboard. This led up with the guide roller tooth contacting the inboard stopper pawl "B". Pawl "B" then contacted the structural steel of RRW. The guide roller shaft exerted an upward force on the bearing cap assembly, the bearing cap and retaining nuts launched, and the guide roller moved outboard and sheared the stud bolt. Then, chain stopper pawl "A" and "B" moved back inward toward the closed position. The guide roller tooth contacted the inboard stopper pawl "B" and stopper pawl "B" contacted the structural steel again. This resulted in the guide roller coming to a complete stop. There were 22 loose mooring chain links under the Eccentric Fairlead Chain Stopper below the surface of the water.

On Saturday May 23, Shell's Offshore Execution Team successfully completed activities to achieve a "storm safe" condition on RRW #11. The guide roller assembly has been repositioned into its housing, the RRW has been tested to confirm operability, and the winch was utilized to pay in twenty links of belly chain back into the locker with the upper chain stopper pawls engaged.

Conclusion:

On 16 June 2020, Shell and MacGregor briefed the New Orleans District Office of Appomattox Mooring Line L-11 Causal Learning findings. The report identified human factors and design modifications needed to prevent this type of incident from occurring again. First, the MGP's maintenance crew failed to check if the RRW roller assembly upper chain stopper pawls were engaged as well as updating the operating manual to identify how and when load is transferred to SCHU. Second, Shell identified the need for updating the maintenance procedures to strengthen/clarify roles and responsibilities for each member of the maintenance team. Third, Shell identified the need for updating the design modifications to install additional proximity switches and programmed interlocks to confirm SCHU stoppers are fully extended. Lastly, Shell permanently reinstated a gripper used during installation/ commissioning as a secondary barrier to prevent unplanned payout of chain.

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

- Human Performance Error-Not following proper procedure: The MGP maintenance crew assumed the mooring chain was in the lock position upon completion. The MGP maintenance crew did not visually observe the chain in a lock position resulting of the mooring chain payout outboard.

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

- Equipment Failure- Flawed equipment design or construction: The mooring line's design did not have proximity switches and programmed interlocks to confirm SCHU stoppers are fully extended.

20. LIST THE ADDITIONAL INFORMATION:

- Shell noted that the COVID-19 coronavirus pandemic presented a new challenge, especially with potential impacts to 3rd party design, fabrication, and/or delivery in support of their recovery/repair efforts. Shell continued with dynamic analysis of the chain for various storm conditions to assess potential effects to the host facility.

21. PROPERTY DAMAGED:

NATURE OF DAMAGE:

Roller Ram Winch

Misalignment of the chain stopper pair.

ESTIMATED AMOUNT (TOTAL): \$5,750,000

22. RECOMMENDATIONS TO PREVENT RECURRENCE NARRATIVE:

The New Orleans District recommends that BSEE provide training on mooring for large platforms.

23. POSSIBLE OCS VIOLATIONS RELATED TO ACCIDENT: NO

24. SPECIFY VIOLATIONS DIRECTLY OR INDIRECTLY CONTRIBUTING. NARRATIVE:

25. DATE OF ONSITE INVESTIGATION:

24-FEB-2020

26. INVESTIGATION TEAM MEMBERS:

**Pierre Lanoix (AI Specialist) / Lee
Carter (Production Supervisory
Inspector) /**

27. OPERATOR REPORT ON FILE:

28. ACCIDENT CLASSIFICATION:

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

OCS REPORT:

30. DISTRICT SUPERVISOR:

David Trocquet

APPROVED

DATE: **15-SEP-2020**