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

For Public Release

ACCIDENT INVESTIGATION REPORT

1. OCCURRED
   DATE: **19-JUN-2023** TIME: **0800** HOURS
2. OPERATOR: **Equinor USA E&P Inc.**
   REPRESENTATIVE:
   TELEPHONE:
   CONTRACTOR:
   REPRESENTATIVE:
   TELEPHONE:

- [ ] STRUCTURAL DAMAGE
- [ ] CRANE
- [ ] OTHER LIFTING
- [ ] DAMAGED/DISABLED SAFETY SYS.
- [X] INCIDENT >$25K **#9 Mooring Line Failure**
- [ ] H2S/15MIN./20PPM
- [ ] REQUIRED MUSTER
- [ ] SHUTDOWN FROM GAS RELEASE
- [ ] OTHER

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

4. LEASE: **G16661**
   AREA: **MC** LATITUDE:
   BLOCK: **941** LONGITUDE:

5. PLATFORM: **A(Mirage/Titan)**
   RIG NAME:

6. ACTIVITY:
   - [ ] EXPLORATION(POE)
   - [X] DEVELOPMENT/PRODUCTION (DOCD/POD)

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		

   - [ ] POLLUTION
   - [ ] FIRE
   - [ ] EXPLOSION

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

   COLLISION [ ] HISTORIC [ ] >$25K [ ] <=$25K

8. OPERATION:
   - [X] PRODUCTION
   - [ ] DRILLING
   - [ ] WORKOVER
   - [ ] COMPLETION
   - [ ] HELICOPTER
   - [ ] MOTOR VESSEL
   - [ ] PIPELINE SEGMENT NO.
   - [ ] DECOMMISSIONING
     - [ ] PA [ ] PIPELINE [ ] SITE CLEARANCE
     - [ ] TA [ ] PLATFORM
   - [ ] OTHER

9. CAUSE:
   - [X] EQUIPMENT FAILURE
   - [ ] HUMAN ERROR
   - [ ] EXTERNAL DAMAGE
   - [ ] SLIP/TRIP/FALL
   - [ ] WEATHER RELATED
   - [ ] LEAK
   - [ ] UPSET H2O TREATING
   - [ ] OVERBOARD DRILLING FLUID
   - [X] OTHER **Management Systems**

10. WATER DEPTH: **4050** FT.
11. DISTANCE FROM SHORE: **63** 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:

INCIDENT SUMMARY:

On 15 June 2023, an incident occurred at Mississippi Canyon (MC) 941, Platform A. MC 941 A (Titan) is a Single Point Anchor Reservoir (SPAR) platform owned and operated by Equinor USA E&P Inc. (Equinor). Titan is located approximately 63 miles offshore in Block 941 of MC in the Gulf of Mexico (GoM). During a planned inspection of the #9 Mooring Line (ML) from the Port Column, an abnormal amount of slack was observed. The inspection found a portion of the line was resting on the seabed. The other 3 MLs on the Port Column were inspected and found to be in good condition. As such, the platform was allowed to continue manned operations.

SEQUENCE OF EVENTS:

On 15 June 2023, in accordance with the In-Service Inspection Plan (ISIP), Titan was conducting a scheduled American Bureau of Shipping (ABS) Underwater Inspection in lieu of Drydocking (UWILD) when an abnormal amount of slack was observed on the ML #9. Further investigation revealed that a significant length of the ML was resting on the seabed. Once identified, the decision was made to shift the inspection to the remaining 3 MLs from the Port Column to maintain station keeping. All 3 remaining MLs on the Port Column were found to be in good condition, rendering the platform safe to remain manned.

On 19 June 2023, the slack in ML #9 was reported to Equinor by the ABS.

On 20 June 2023, Titan operations attempted to increase the tension on ML #9 by hauling in the anchor chain to pull the slack out of the line. The attempt was not successful.

On 21 June 2023, the incident was reported to BSEE and USCG. Titan facility operations team and subject matter experts (SMEs) from Equinor coordinated with the ABS to begin an investigation on ML #9. Using a Remotely Operated Vehicle (ROV) to perform the inspection, the H-link connector was found buried at the seabed with both polyester rope and chain still attached. The crane on the ROV marine vessel picked up the H-link and the chain slipped out of the soil at the seabed. The H-link then moved an estimated 400 ft towards the Titan. On 24 June 2023, the end of the anchor chain was located an estimated 260 ft from the H-link and the other end of the anchor chain was discovered roughly 210 ft from Pile #9.

On 2 July 2023, cutting operations began to attempt to retrieve the ends of the anchor chain and the broken H-link. The anchor chain, H-link, and adjacent links were recovered from the seabed and sent to Stress Engineering Services Inc. (SES) in Houston, TX for a detailed failure analysis. SES was contracted by Equinor to perform a metallurgical failure analysis on the 5-inch Grade RQ4 chain link that parted while in service and is part of ML #9. The links arrived at the SES lab on 14 July 2023. SES's analysis concluded that the failure within the link was most likely due to fatigue. The fatigue is believed to have initiated at the top of the crown where stresses are high. Surface cracks on the top of the crown were also found. It is believed that corrosion is also a contributing factor.

On 3 July 2023, Equinor notified BSEE that they would be performing a full investigation of the incident to determine all causes.

BSEE INVESTIGATION:

On 21 June 2023, BSEE received notification of the incident from Equinor. The

notification stated that on 19 June 2023, an abnormal amount of slack was observed on ML #9 during a regularly scheduled UWILD inspection. In response to this finding, Equinor shut in production and reduced the number of Personnel on Board (POB) to essential personnel only. The Titan SPAR is typically anchored to the seabed with a total of 12 MLs. All remaining MLs were inspected and found to be intact and in good condition. BSEE granted permission for Equinor to allow the facility to resume production on 7 July 2023.

On 13 July 2023, BSEE Accident Investigators (AI) accompanied by BSEE Inspectors flew out to the Titan SPAR to conduct an onsite investigation of the incident.

On 13 September 2023, SES provided their analysis report of the fractured 5-inch chain link. Based on the analyses completed during the investigation, SES concluded the following:

1. The link most likely failed due to fatigue initiating at the top of the crown where stresses are high. Hydrogen may also have contributed, but the fracture surfaces were too corroded to confirm embrittlement.
2. The fracture initiated within short, transverse surface cracks on the top of the crown. All links exhibited similar crown cracks, though most were concentrated along the sides of the crown within the interlink area rather than the top.
3. It is likely that corrosion contributed in some way to the formation of the crown cracks; however, the corrosion mechanism could not be conclusively determined from this investigation.
4. Tensile properties and chemical composition were acceptable for Grade RQ4/R4 links. Hardness and yield strength were on the high side for Grade R4 and were more typical of Grade R5. The measured diameter dimensions were only marginally below tolerance, which can easily be attributed to corrosion.

On 6 October 2023, Equinor provided BSEE with their investigation report. In the report, BSEE learned that following Hurricane Ida in August of 2021, an ROV inspection of the mooring lines was completed on 22 December 2021. This report found ML #9 to be in normal condition at that time. However, on 11 March 2022, Titan operations found a significant decrease in ML #9 tension recorded on the daily marine report. Six months later on 9 September 2022, low tension and an associated alarm for ML #9 were noted during an internal technical integrity review.

CONCLUSIONS:

BSEE's Office of Structural & Technical Support (OSTS) has reviewed and concurred with all analyses and documents related to the ML #9 failure performed by Equinor and SES.

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

• Equipment Failure – Capacity of equipment exceeded: ML #9 most likely failed due to fatigue initiating at the top of the crown where stresses are high.

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

• Management Systems – Weakness in maintenance management program for mooring system: Reliance on third party vendors to conduct corrective maintenance work orders on the mooring system caused delays due to unavailability.

20. LIST THE ADDITIONAL INFORMATION:

21. PROPERTY DAMAGED:

Mooring Line

NATURE OF DAMAGE:

Corrode Line
Replacement cost estimate $5,000,000 which includes engineering work, vessels to do the work, materials, etc. (per email from Erin Moore 1/16/24)

ESTIMATED AMOUNT (TOTAL): **$5,000,000**

22. RECOMMENDATIONS TO PREVENT RECURRANCE NARRATIVE:

The BSEE New Orleans District has no recommendations for the Office of Incident Investigations at this time.

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

24. SPECIFY VIOLATIONS DIRECTLY OR INDIRECTLY CONTRIBUTING. NARRATIVE:

25. DATE OF ONSITE INVESTIGATION:

13-JUL-2023

26. Investigation Team Members/Panel Members:

Nathan Bradley / Cody Jones / Pierre Lanoix /

27. OPERATOR REPORT ON FILE:

28. ACCIDENT CLASSIFICATION:

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

OCS REPORT:

30. DISTRICT SUPERVISOR:

David Trocquet

APPROVED DATE: **26-JAN-2024**