

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: 28-MAR-2021 TIME: 0100 HOURS

2. OPERATOR: Shell Offshore Inc.

REPRESENTATIVE:

TELEPHONE:

CONTRACTOR:

REPRESENTATIVE:

TELEPHONE:

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

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

8. OPERATION:

4. LEASE: G34529

AREA: GB LATITUDE:

BLOCK: 962 LONGITUDE:

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

5. PLATFORM:

RIG NAME: T.O. DEEPWATER POSEIDON

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 **Inadequate Well Design**

POLLUTION

FIRE

EXPLOSION

10. WATER DEPTH: 5062 FT.

11. DISTANCE FROM SHORE: 160 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:

LWC HISTORIC BLOWOUT

UNDERGROUND

SURFACE

DEVERTER

SURFACE EQUIPMENT FAILURE OR PROCEDURES

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

Summary:

On March 29, 2021, at 1257 hours (hrs), Shell Offshore Inc. (Shell) notified the Bureau of Safety and Environmental Enforcement (BSEE) Lafayette District of a shallow water flow incident occurring during riserless drilling operations with the Transocean Deepwater Poseidon (Poseidon) drillship located at Garden Banks (GB) Block 962 while drilling the Caramel Keg Well 001. The incident involved the shallow water flow of liquids from a port on the 38-inch (in) Low-Pressure Wellhead Housing (LPWHH). Shell analyzed fluid composition and found it to contain a limited amount of hydrocarbons. On April 16, 2021 at 1613hrs, Shell notified and reported the shallow water flow incident to the United States Coast Guard National Response Center (NRC), NRC Report #1302869.

On March 23, 2021, the Poseidon drillship arrived at the GB-962 location and spudded the Caramel Keg Well #001 on March 24, 2021. The 38-in conductor tagged the seafloor at 5,136 feet (ft) and was jettted to depth of 5,334ft measured depth/true vertical depth (MD/TVD). After soaking the jettted conductor for 2 hours, the 26-in hole was drilled from 5,334ft through top of salt to 8,898ft total depth which was still in the salt formation.

On March 27 and 28, 2021, Shell installed the 22-in surface casing and the High-Pressure Wellhead Housing. The 22-in casing, landing string/inner string were run and circulated with mud. The 22-in casing cement was then pumped with Lead Foam cement followed by Class A Tail cement.

Green dye and cement returns were observed by remotely operated vehicle (ROV) video at the seafloor mudline. Floats held and cement was in place at approximately 1215hrs on March 28. The ROV remained in place while waiting for the cement to cure before setting down the full casing weight. However, at approximately 1921hrs, 7 hours after the cement was in place, personnel observed and began to monitor a steady flow from the Lower Cement Port 1 on the LPWHH.

On March 29, 2021, the flow had slightly decreased but still contained a continuous bubble stream from the one port. Shell notified BSEE that well operations were suspended due to the flow.

On March 30, 2021, the flow appeared to be a dark sedimentary-like substance that was dropping and settling on the seafloor. Shell also reported that a dark buoyant fluid that was separating from the denser mud flow. At 2021hrs, a wireline crew ran in the hole with casing evaluation logging instruments. The wireline logging crew performed an Image Behind Casing inspection and Cement Evaluation.

On March 31, 2021, a wireline Noise/Temperature (Noise/Temp) survey was performed to determine where the flow initiated. The ROV collected two fluid, litho, samples from shallow flow to analyze as requested by BSEE.

On April 2, 2021, Shell received the analysis of the two fluid samples collected by the ROV. The first on-site sample showed no sediment, fluid at 8.0 pounds per gallon, presence of a hydrocarbon odor and segregation and film after settling out. The second sample indicated detectable levels of trace hydrocarbons and the presence of high chlorides indicative of high composition of seawater. Shell reported that the Temperature Log indicated that the likely source of flow was from a "dirty salt" interval encountered where strong deviation from expected temperature gradient appears to be prominent. The Ultrasonic Imager Tool/Cement Bog Log/Variable Density Log result suggested partial coverage and channeling. Some smaller amount of cement is above 7,000ft MD/TVD with increasing cement coverage observed in the 18-in x 22-in annulus. The results of the logging runs with the cement job results indicated the presence of cement behind the 22-in casing and channeling was observed based on logging interpretations. Shell conducted a multi-disciplinary study to

assess the impact of channeling cement on the integrity of the well. The study indicated that despite the channeling and contamination of the cement behind the 22-in casing due to the shallow water flow, there was no limitations to plans that impact bending or axial capacity. Shell concluded that the well integrity with cement after the shallow water flow remained intact for the intended well design. Shell requested a verbal approval from the BSEE Lafayette District to proceed with well operations as previously approved. BSEE Lafayette District gave verbal approval to continue well operations to run the BOP and riser.

April 5, 2021, BOP and casing tests were completed. Shell continued drilling operations while providing continuous updates to BSEE on the flow from the LPWWH cement port.

April 13, 2021, Shell submitted to BSEE a Structural Integrity Analysis presentation during a meeting. Shell reported that there are indications of channeling behind the 22-in casing, however according to Shell's analysis they can maintain structural integrity of the well. BSEE granted Shell approval to drill to the 18-in liner. However, Shell was not allowed to run the 18-in liner until the flow from the cement ports could be analyzed and both BSEE and Shell agree on a path forward. BSEE instructed Shell to conduct 24-hour monitoring of the cement ports and surrounding seafloor by ROV, remove the flow sleeve on the cement port when drilling to determine the state of the fluid flow, and submit daily International Association of Drilling Contractors reports with video to BSEE.

April 19, 2021, Shell updated BSEE on their proposed plan forward by report. Shell stated that it is safe to proceed with their current diagnostic plan and that they were prepared to abandon the well if structural integrity becomes a concern. Shell believed noise logs show the source of the flow appears to have originated from above the top of salt and migrating through a thin channel in the cement.

April 20, 2021, Shell installed ball valves with the ROV on the Lower Cement Port 1 and the Upper Cement Port 1 of the LPWWH. After a packer was set in the well and pressure tested, the ROV closed the ball valves. The ROV performed wagon wheel surveys of the wellhead and seafloor every 3 hours. From April 20 to April 24, Shell continued to monitor flow while conducting multiple Noise/Temp logs of the well. April 25, 2021, Shell submitted their proposed plan forward to BSEE that included analysis of the Noise/Temp logs of the 22-in casing section. After reviewing the results with BSEE, Shell decided to temporarily abandon the well.

The BSEE investigation team determined the probable cause of the incident was due to cement contamination during the cementing of the 22-in casing. The source of flow seems to originate from above the top of salt in a dirty salt section thus migrating through a thin channel in the cement behind the 22-in casing. A Low and High Noise Frequency Anomaly was noted at 6,075 ft measured depth, this is the most likely source of flow and the only acoustic response above the dirty salt section. The channeling likely occurred due changes in the expected transition time parameters in the salt contaminated cement causing the hydrostatic pressure at the flow zone to go unbalanced before the cement fully set. Since the 22-in casing was cemented back to surface and not cemented back to a casing shoe, the flow was able to migrate to the Lower Cement Port 1. Setting an additional casing string, such as a 28-in casing, just above the dirty salt section, would have possibly led to much better isolation of the dirty salt section when running and conducting the cement job on the 22-in casing.

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

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The BSEE incident investigation team determined that the probable cause of the incident was due to salt contamination causing the cement to go under-balanced at a zone with the ability to flow causing channeling behind the 22-in casing.

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

BSEE's incident investigation identified a contributing cause of the incident was due to degradation of the cement and micro-channeling of the shallow water flow from the top of the salt through the cement and was by not setting an additional casing string.

20. LIST THE ADDITIONAL INFORMATION:

21. PROPERTY DAMAGED:

NATURE OF DAMAGE:

No property was damaged during this incident.

Not applicable.

ESTIMATED AMOUNT (TOTAL):

22. RECOMMENDATIONS TO PREVENT RECURRENCE NARRATIVE:

The BSEE Lafayette District makes no recommendations to the Office of Incident Investigations regarding this incident.

23. POSSIBLE OCS VIOLATIONS RELATED TO ACCIDENT: NO

24. SPECIFY VIOLATIONS DIRECTLY OR INDIRECTLY CONTRIBUTING. NARRATIVE:

25. DATE OF ONSITE INVESTIGATION:

14-MAY-2021

28. ACCIDENT CLASSIFICATION:

29. ACCIDENT INVESTIGATION

PANEL FORMED: **NO**

OCS REPORT:

26. INVESTIGATION TEAM MEMBERS:

**Marty Rinaudo (Well Op Section Chief) /
Troy Naquin (Report Author) / Johnny
Serrette (On-site) /**

30. DISTRICT SUPERVISOR:

Marty Rinaudo

27. OPERATOR REPORT ON FILE:

APPROVED

DATE:

16-FEB-2022