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

ACCIDENT INVESTIGATION REPORT

1. OCCURRED
   DATE: **01-NOV-2008** TIME: **1500** HOURS

2. OPERATOR: **Union Oil Company of California**
   REPRESENTATIVE: **Campise, Debra**
   TELEPHONE: **(832) 854-2617**
   CONTRACTOR: **Transocean Offshore**
   REPRESENTATIVE: **Huffenberger, Herb**
   TELEPHONE: **(713) 232-8447**

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

4. LEASE: **G21245**
   AREA: **WR** LATITUDE: **26.3047**
   BLOCK: **678** LONGITUDE: **-91.086**

5. PLATFORM:
   RIG NAME: **T.O. DISCOVERER DEEP SEAS**

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

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
   - [X] POLLUTION
   - [ ] FIRE
   - [ ] EXPLOSION
   - LWC
     - [ ] HISTORIC BLOWOUT
     - [ ] UNDERGROUND
     - [ ] SURFACE
     - [ ] DEVERTER
     - [ ] SURFACE EQUIPMENT FAILURE OR PROCEDURES
   - COLLISION [ ] HISTORIC [ ] >$25K [ ] <=$25K
   - [ ] STRUCTURAL DAMAGE
   - [ ] CRANE
   - [ ] OTHER LIFTING DEVICE
   - [ ] DAMAGED/DISABLED SAFETY SYS.
   - [ ] INCIDENT >$25K
   - [ ] H2S/15MIN./20PPM
   - [ ] REQUIRED MUSTER
   - [ ] SHUTDOWN FROM GAS RELEASE
   - [X] OTHER **Compromised csg/shallow leak**

6. OPERATION:
   - [ ] PRODUCTION
   - [X] DRILLING
   - [ ] WORKOVER
   - [ ] COMPLETION
   - [ ] HELICOPTER
   - [ ] MOTOR VESSEL
   - [ ] PIPELINE SEGMENT NO.
   - [ ] OTHER

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

9. WATER DEPTH: **7005** FT.

10. DISTANCE FROM SHORE: **181** MI.

11. WIND DIRECTION: **NE**
    SPEED: **14** M.P.H.

12. CURRENT DIRECTION: **NE**
    SPEED: **1** M.P.H.

13. SEA STATE: **3** FT.

17. DESCRIBE IN SEQUENCE HOW ACCIDENT HAPPENED:

On October 21, 2008, operations began for running the 9-7/8 inch Production liner. On October 22, 2008, while continuing to run the liner, the well began to lose mud. The liner was successfully run to bottom and the well was shut-in with the Annular Preventer to control losses. Interpretation of fluctuations in the shut-in BOP pressure indicated the losses were continuing. Several attempts to release the liner hanger running tool from the liner hanger went unsuccessful. On October 25, 2008, the liner was cemented in place with the well shut-in. The cement job went as planned with the estimated top of cement at 25,542 feet MD (top of Wilcox is 26,646 feet MD). Further attempts to release the running tool from the liner hanger were unsuccessful.

Diagnostic work determined that the 16 inch liner had a connection leak at 8,783 feet. The connection that failed is an Seal-Lock Semi-Flush (SLSF) type connection. Caliper data indicated wear in the area of the leaking connection. Noise and temperature logs were run to 21,480 feet with no indication of flow from the Wilcox. A Borax trace pill was pumped and Reservoir Saturation Tool (RST) logs run with no indication of Borax below 8800 feet. The noise and temperature logs were re-run to 21,500 feet with no indication of flow from the Wilcox.

The drill pipe was perforated from 21,010-21,015 feet and the well was displaced to WBM. A 1000 foot cement plug was placed from 20,015-21,015 feet. The noise and temperature logs were re-run to 19,400 feet and indicated slight temperature decline from 8600-8970 feet.

On November 1, 2008, 10 days after running the production liner, the Remote Operated Vehicle (ROV) discovered Synthetic Base Mud (SBM) had broached to the seafloor near the wellhead. On November 2, 2008, the ROV discovered a second location near the wellhead where SBM broached the seafloor.

The drill pipe was backed off at 16,772 feet and a 500 foot cement plug was placed from 16,272-16,772 feet. Attempted to set 16 inch Easy Drill Subsurface Valve (EZSV) at 16,159 feet to diagnose the liner hanger assembly problems. The EZSV failed to set. A 541 foot cement plug was placed from 15,700-16,159 feet. Attempts to caliper the 16 inch liner above the plug were unsuccessful. A Ultra Sonic Imager Tool (USIT) log was run from 9500-7000 feet and indicated irregularities below the liner hanger and at 8743 feet. A 16 inch Retrievable Treat Test Squeeze (RTTS) tool was run to locate any potential leak in the liner and found such from 8845-8750 feet. Ran and set 16 inch EZSV at 8707 feet and squeezed the discovered leak in the liner with 100 barrells of cement. A 500 foot cement plug was set on top of the EZSV from 8180-8680 feet. The well was displaced to seawater. A down hole video camera was run to inspect the 16 inch liner hanger and seal assembly and found to be in good condition. A 200 foot surface plug was set from 7400-7200 feet and the rig unlatched from the well.

It was later determined that a total of 10,688 bbls of mud was lost (4867 bbls of SBM and 5,821 bbls of WBM) and 293 gal (7 bbls) of SBM broached to the seafloor. The mud contained 59% synthetic base oil for a total of 173 gal (4 bbls) of pollutant material.

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

The failed connection in the 16 inch Surface liner was due to drill pipe wear. The liner was more susceptible to wear due to instability and hole angle in the 26 inch rathole. Temperature and pressure changes can cause casing to become unstable after the pipe is cemented in place. This instability will buckle and deflect laterally, producing buckles within the casing. This is more significant in areas with a larger hole diameter to casing ratio (i.e. 16 inch casing in 26 inch rathole compared to the 16 inch casing in 18-1/8 inch hole). In this case, the hole angle of 4 degrees and dogleg of 0.93 degrees per 100 inch in the 26 inch rathole contributed to the internal buckling inside the 16 inch liner. Rotating and tripping the drill string will wear the casing in the buckled area faster than casing without an internal buckle. This buckling, combined with the extended amount of rotating and tripping hours, significantly contributed to the casing wear in the 16 inch surface liner.

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

The risk for casing wear to be a potential threat was considered LOW due to near vertical geometry for the well. Therefore, no stability analysis was performed for the 16 inch Surface liner.

No excessive metal was recovered from the ditch magnets during any short duration of time. This indicates that the casing was gradually eroded as a result of the extended time rotating and tripping.

Preliminary analysis of the caliper log and USIT data did not identify significant casing wear. A 3D analysis of the caliper data was required to identify the leak in the casing.

20. LIST THE ADDITIONAL INFORMATION:

Due to no established guidelines for monitoring casing wear for deepwater drilling operations or recommended practices for when to tie back liners in casing design, the following will be implemented:

1. Management of Change (MOC) process and risk assessment should be used when Value Based Well Objectives change. Modify wear monitoring program when operations are extended.
2. Develop casing design and Standard Operating Practices (SOP's) specific for deepwater operations that address:

o engineering checklist for all deepwater wells
o casing wear modeling, monitoring, and mitigation
o trend monitoring guidelines
o shallow angles
o stability analysis
o model calibration with actual data
o guidelines for when tieback strings should be utilized

3. Use MOC guidelines when outside the SOP guidelines.
4. Enhance the training program for Chevron drilling engineers on stability analysis for deepwater casing design.
5. Develop plan to monitor drill pipe for heat checking and evaluate possibility of using drill pipe heat checking as an indication of casing buckling.
6. Review suitability of SLSF connection design and physically test alternative semi-

flush connections.

7. Perform additional connection testing for seal damage on 16 inch SLSF connections similar to tests conducted on 13-5/8 inch SLSF connections.

8. Evaluate various thread compounds to assess tertiary means of providing a seal.

9. Review minimum hard-banding specification.

21. PROPERTY DAMAGED:

Total loss of well.

NATURE OF DAMAGE:

Casing failure.

ESTIMATED AMOUNT (TOTAL): **$126,000,000**

22. RECOMMENDATIONS TO PREVENT RECURRANCE NARRATIVE:

The Houma District has no recommendtion to the Regional Office.

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

24. SPECIFY VIOLATIONS DIRECTLY OR INDIRECTLY CONTRIBUTING. NARRATIVE:

25. DATE OF ONSITE INVESTIGATION:

26. ONSITE TEAM MEMBERS:

Ben Coco /

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

OCS REPORT:

30. DISTRICT SUPERVISOR:

Bryan A. Domangue

APPROVED

DATE: **22-JAN-2009**

POLLUTION ATTACHMENT

1. VOLUME: GAL **4.1** BBL

   YARDS LONG X YARDS WIDE

   APPEARANCE: **BARELY VISIBLE**

2. TYPE OF HYDROCARBON RELEASED:
   - [x] OIL
   - [ ] DIESEL
   - [ ] CONDENSATE
   - [ ] HYDRAULIC
   - [ ] NATURAL GAS
   - [x] OTHER **Synthetic OBM**

3. SOURCE OF HYDROCARBON RELEASED: **Synthetic Base Mud release from subsea BOP**

4. WERE SAMPLES TAKEN? **NO**

5. WAS CLEANUP EQUIPMENT ACTIVATED? **NO**

   IF SO, TYPE:
   - [ ] SKIMMER
   - [ ] CONTAINMENT BOOM
   - [ ] ABSORPTION EQUIPMENT
   - [ ] DISPERSANTS
   - [ ] OTHER

6. ESTIMATED RECOVERY: **0** GAL BBL

7. RESPONSE TIME: HOURS

8. IS THE POLLUTION IN THE PROXIMITY OF AN ENVIRONMENTALLY SENSITIVE AREA (CLASS I)? **NO**

9. HAS REGION OIL SPILL TASK FORCE BEEN NOTIFIED? **NO**

10. CONTACTED SHORE: **NO** IF YES, WHERE:

11. WERE ANY LIVE ANIMALS OBSERVED NEAR: **NO**

12. WERE ANY OILED OR DEAD ANIMALS OBSERVED NEAR SPILL: **NO**