

”SHARING TO BE BETTER”

”SHARING TO BE SAFER”

“Sharing to be better”

Under the direction of OLF, a joint industry task force of Operator and Drilling Contractor personnel has been formed to recommend ways to reduce the number and potential severity of well control events on the NCS.

One team recommendation was communicating actual well control incidents that have recently occurred on the NCS so lessons are shared and understood.

This is the fifth in a series of case histories. This incident highlights the importance of following procedures, attention to detail and quality control of calculations performed on the rig

Please take some time at your next safety meeting to review this case history and discuss the questions raised during the presentation.

It is hoped that sharing of incidents is helpful and any feedback is welcome.



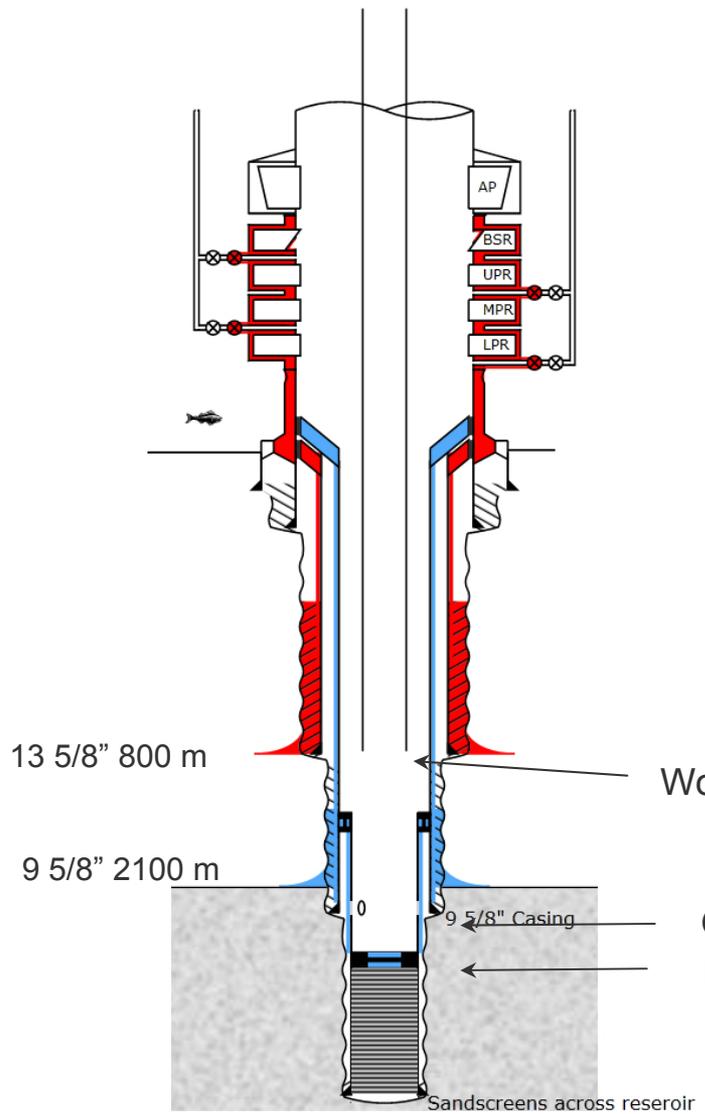
Offshore Semisub Rig

Well Control Incident during Completion



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Gravel Packing a Well from a Semi Sub



Situation

- Semi in 120 m of water
- Gravel pack operation completed
- The well is pressure tested (250 bar)
- **The well was believed to be secure.**

Plan ahead:

- Inflow Test.
- Circulate well to base oil.
- Pull out of hole with the work string and run the upper completion

Work string (drill pipe with FIV shifting tool on the end), at approx 2000 m.

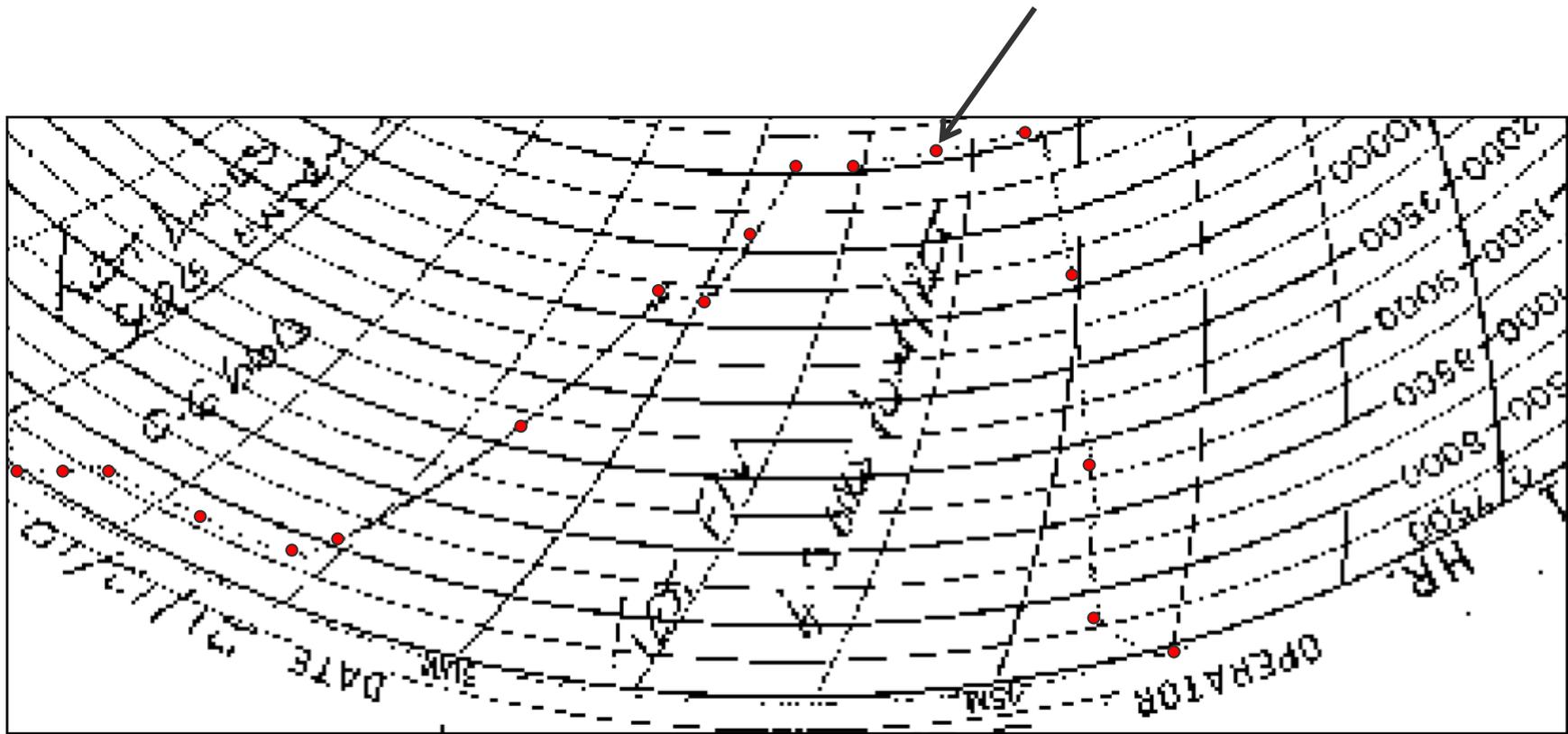
Gravel pack sliding sleeve
Formation Isolation Valve

Deviation at liner top 40 deg

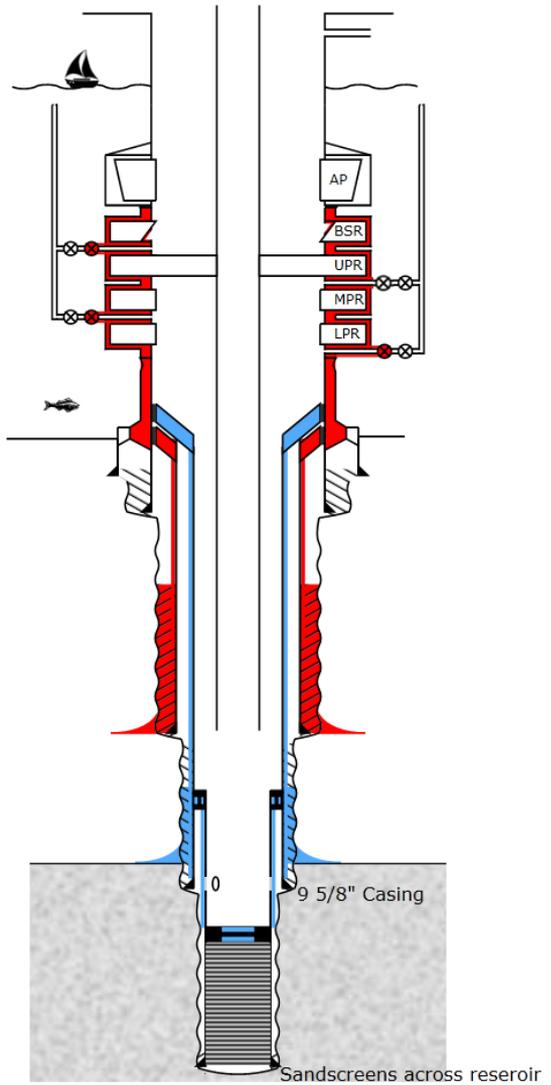


Pressure Test Results

Flat line, with no drop off on chart for 10 minutes

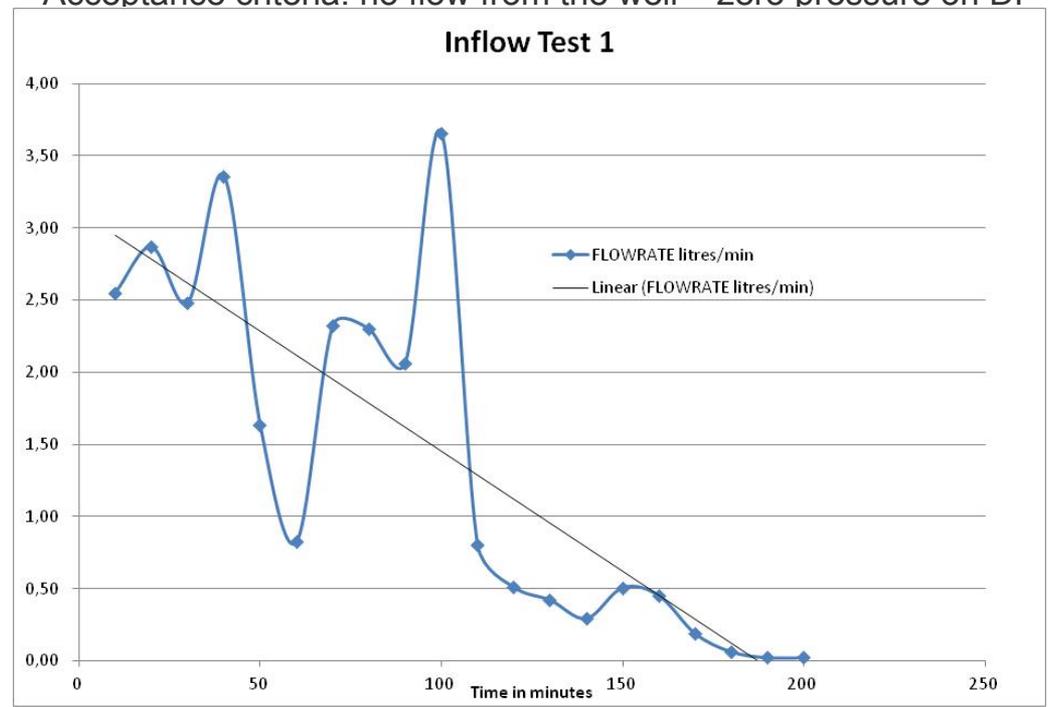


Inflow/Negative pressure Test Results



Procedure

- The well was displaced through the drill pipe above the lower completion under pressure-controlled conditions
- Approx 50 bar under balance created.
- Observe for flow on the choke line – drillpipe pressure should be zero
- Acceptance criteria: no flow from the well – zero pressure on DP



Questions

- What is the line up if we inflow tested ?
- If we influxed during an inflow test could we succesfully detect and recover ?
- Do we have clear pass fail criteria ?
- Do we have the right accuracy of measurement for pressure testing ?
- If we are displacing fluids in the completion phase how do we know if the well is loosing or gaining fluid and that we are in control ?

Preparing to POOH

- Day 1 19:15
 - After the inflow test the complete well was displaced to base oil.
 - When continuing to circulate bottoms up, at 3 a.m 5m³ gain was observed after having pumped only 25m³. The well was shut-in on a closed choke. The pressure built up in the drill string to 4 bar in 30 minutes and then stabilized.
 - At 05:45 the well was lined up and reverse circulation commenced. Returns were observed after 5m³ were pumped. During continuing reverse circulation, 15% gas levels were recorded.
 - From 08:15 to 04:45 the following day the well exhibited anomalous behavior, some checks indicated a static well, some checks gave a build-up of pressure at the choke manifold, and some checks showed small pit gains.
- What do you think is going on ?
- What would you do next ?



What was the teams diagnosis ?

- The rig team believed that the base oil was contaminated with brine and that there was an imbalance in the system
- They believed that the pressure test and inflow test showed that the well was stable
- *There was a leak present at this stage, either very small (hence not detected during the pressure test / inflow test) or a change happened after the inflow test.*

Trying to make the well gas free

- Day 2 17:30
 - Pressure tested the well again – this time to 140 bar
 - Leak not identified. (Downhole gauges recovered later showed a leak at this point)
 - Inflow tested the well again (negative pressure test)
 - Leak not identified.
 - Still, back-flow through work string was experienced
 - Belief that brine imbalance remains in the system
 - Also, there were gas readings when circulating

Was this the right conclusion at the time? What should the next action be?

- Decided to circulate the well to fresh base oil to remove the gas
 - Gas readings were seen while circulating to fresh base oil.
- Flow checked – the well was static
- Decided to pull out of hole with the work string (next operation: run completion)

The leak was still present at this stage, but still not recognized.



Key events

- Day 3 05:45
 - Pulled out with the work string from approx 2100 m to 1500 m
 - Observed strong backflow when breaking a DP connection
 - Subsequent monitoring showed the well to be static
 - Circulated and observed 2 m³ losses.
 - Ran in hole to displace to an overbalanced kill fluid.
 - *Was this a good strategy given that the fluid was underbalanced and losses occurred during circulation implying a connection to the reservoir ?*

Another unexpected event happens:

- As the stinger enters the gravel pack assembly a sudden gain from the well is observed, the well is shut in, 5 m³ gain is taken.



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Review of the event

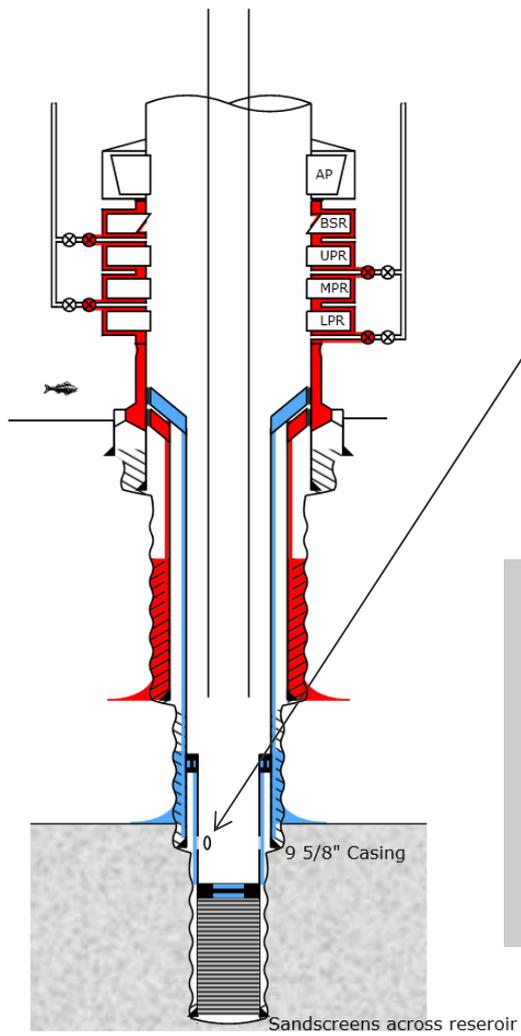
What was causing the gas in the system ?

- Small leak but significant in the gravel pack sliding sleeve



O-rings on sliding sleeve were leaking

- The well was believed to be 'secured'. *The leak was 'explained away'*



The final 5 m3 influx cause

- While running in hole with the work string, the FIV shifting tool accidentally opened the gravel pack sleeve, providing unrestricted communication to the reservoir.
- The FIV shifting tool was "drifted" rather than checked for clashes with the sliding sleeve.

Pretesting should mimic actual tools, weights and inclinations !



Learnings

- Are we still alert enough to well control during the completion of a well ?
- Do we have sufficient control during change out of fluids that we can detect an influx ?
- How do we keep open to other explanations of what is causing a problem ?

Thank you



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