

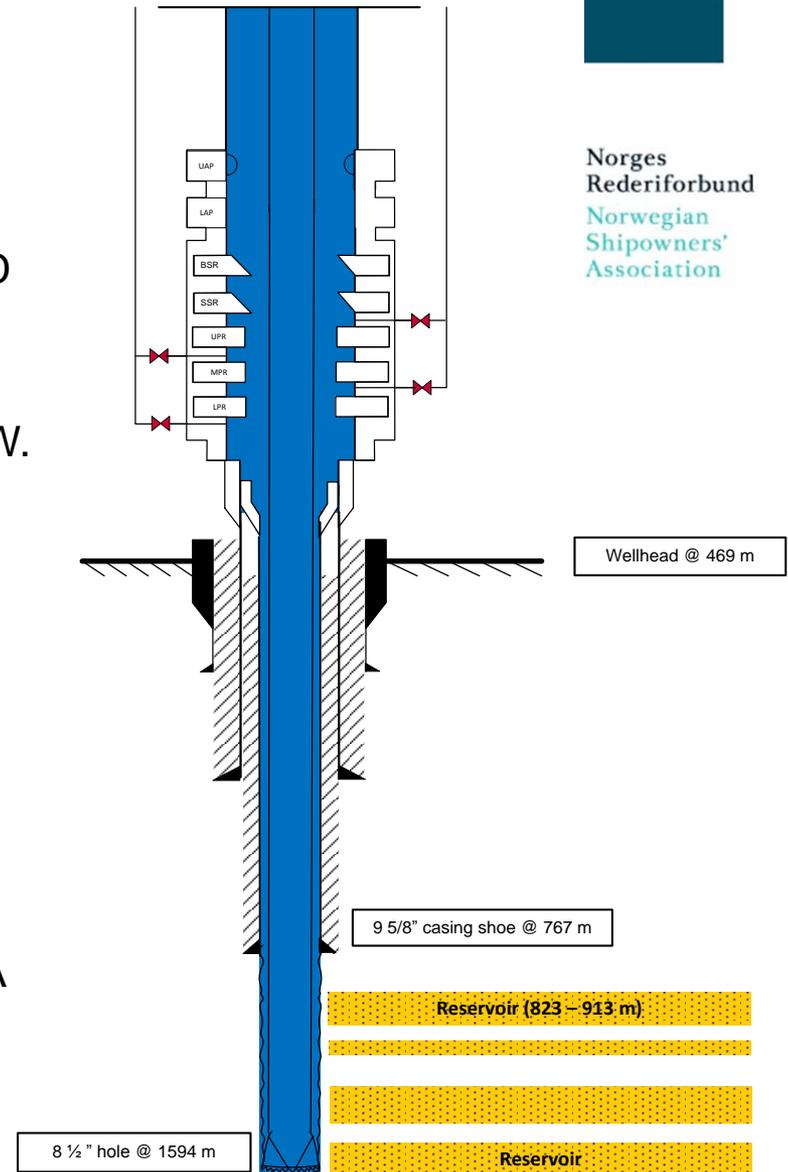


"Sharing To Be Better"

Swabbed kick from shallow reservoir in exploration well

Status prior to POOH with drilling BHA;

- 9 5/8" casing set and cemented at 767 m MD/TVD with hanger at 469 m.
- FIT on 9 5/8" shoe was performed to 1.45 sg EMW.
- Well filled with 1.17 sg WBM.
- 8 1/2" hole section was drilled to TD at 1594 m.
- Several potential hydrocarbon bearing formations exposed in open hole.
- Plan forward was to POOH with drilling BHA (BHA length 274 m) and perform WL logging.



Question 1: Can you identify any risks or potential problems?

Incident Summary:

- Drilled and cored 8 ½” hole section from 767 m to TD at 1594 m.
- Back-ream out of hole and into 9 5/8” casing shoe due to over-pull when pulling without circulation.
- Performed flow-check in shoe (767 m MD/TVD) and continued to trip out of hole.
- Observed rapid increase in trip tank at 531 m.
- Shut in well on LAP and evaluate situation.
- Performed off-bottom kill and circulate out gas.

Question 2: What do you think happened?

Incident details - Drill to TD:

- Drilled 8 ½” hole section from 9 5/8” casing shoe at 767 m to TD at 1594 m.
 - Cored three intervals from 800 – 827 m, 834 – 889 m and 889 – 935 m.
 - Drilled section with 1.17 – 1.18 sg WBM.
 - Gas reading were generally less than 1% during drilling. Max gas during coring was 17%.

- Circulated bottoms up at TD and performed flow check prior to POOH.

- Took weight when attempting to POOH and started back-reaming out of hole.
 - Stopped several times and attempted straight pull, but experienced over-pull every time.
 - Decided to back ream from TD to 9 5/8” casing shoe with 1700 LPM.

- Pulled BHA into casing shoe and performed flow check.

Geological hazards

Casings	Depth m MD RKB	Group	Formation	Lithology	Formation Top m MD	Hazards Code	Potential Geological and Drilling Hazards
30" 514m	400						
13 3/8" 660m	500			● ●	529	▲	Possible boulders
	600				640	▲	Shallow Gas Class 1
9 5/8" 775m	700					▲	
	800				829	▲	Reservoir sandstone, possible influx of hydrocarbons
	900				945		
	1000					▲	Interbedded Sand and Shale: Possible washouts or ledges
	1100				1123		
	1200						
	1300						
	1400						
	1500						
	1600				1605		

Analysis prior to POOH

- Performed swab calculations prior to POOH.
 - Well was filled with 1.17 sg WBM (1.16 sg used in calculations).
 - Predicted pore pressure in shallow reservoir at 823 m was 1.11 sg.
 - 2 points safety margin included in swab calculations.

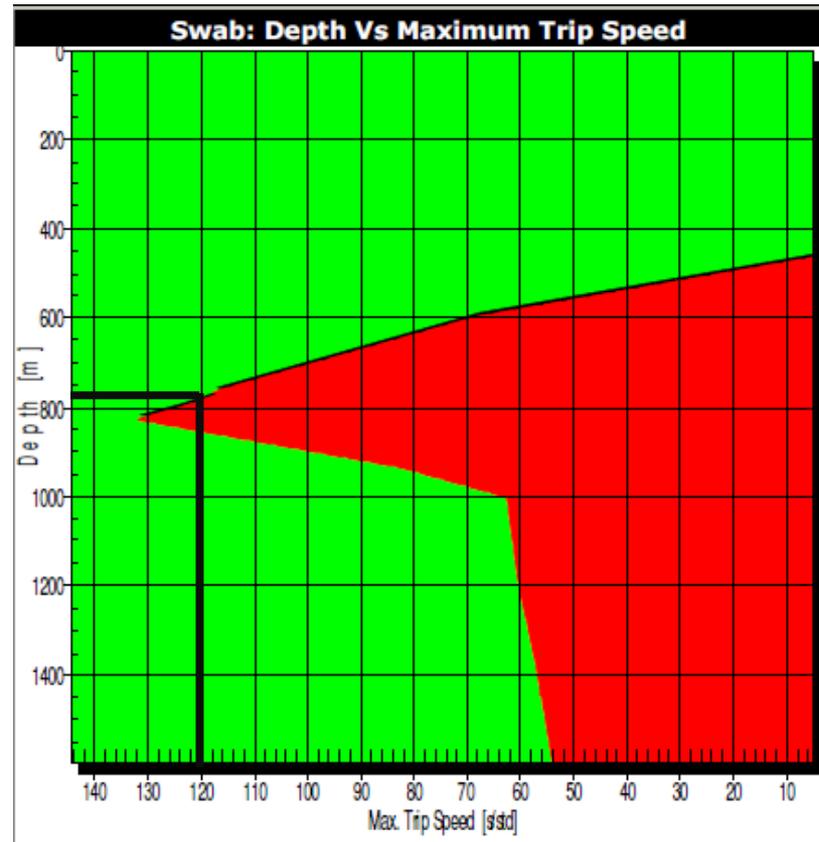
Question 3: Is this safety margin ok (based on TVD)?

Mud Properties		Input Data		Trip Details	
		Bit Details			
Density	1.160 sg	Size	8 1/2 in	Status	Pulling Out
Mud Type	Water Based	Bit Status	Non Blocked	Stand Length	26.00 m
PV	44 cP	TFA	0.7777 in ²	Fracture Pressure	1.430 sg
YP	16.28 Pa	Nozzles		Fracture Depth	835.00 m
FANN Rheology		Number & Size		Formation Press.	1.110 sg
600.0	122	6 * 13 [in/32]		Formation Depth	828.00 m
300.0	78			Safety Margin Swab	0.020 sg
200.0	59			Gel strength is broken prior to Tripping	
100.0	36				
6.0	7				
3.0	5				
10 min Gel	3.40 Pa				

Analysis prior to POOH

- The swab calculations show that maximum pulling speed at casing shoe was 120 sec/stand.
- Limited pulling speed (132 sec/stand) past reservoir.

Question 4: Are these valid once the bit is inside casing?



Pull out of hole inside casing:

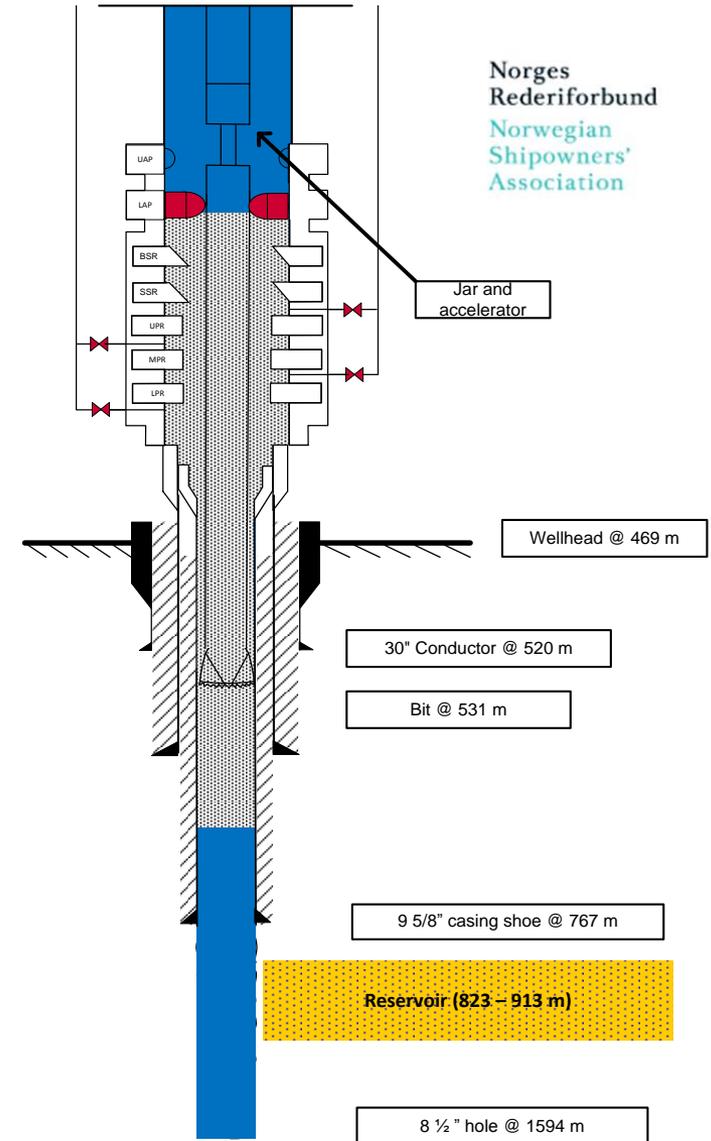
- Pumped slug and started tripping out of hole from casing shoe.
 - Pumped 3 m³ 1.46 sg slug.
 - Swab calculations and pulling speed restrictions not discussed prior to continue POOH.
- Noticed discrepancy in trip tank volume, but this was attributed to the slug not being in balance.
 - Pulled two more stands and trip tank was still not taking correct volume.
 - Driller discussed with tool pusher and decided to pull one more stand very slowly to verify slug effect.
- While breaking connection on the next stand (bit @ 531 m) there was a rapid gain of 5 m³ in the trip tank.
 - Shut in well with the lower annular preventer (LAP) on 6 ¾" spiral DC.
 - Secured drill string by making up top drive and lifting string out of slips.

Question 5: What could have been done differently?

Question 6: Do we need to pump slug in this situation?

Shut in well:

- Well shut in with LAP on 6 3/4" DC.
- Gain volume = 5,6 m3.
- SICP = 25,5 bar and SIDPP = 16 bar (after bumping float).
- Jar and accelerator part of the BHA above the closed LAP – stripping not an option.
- Well gas-filled from 658 m to LAP.
 - Based on gain in active system.
- Pressure at shoe = ~1.27 sg EMW
- Choke line pressure increased to 45 bar after bleeding off 800 liter – gas in choke line.
- FIT: 1,45 sg



Question 7: Any thoughts or comments to this situation?

Well Kill Operation:

- Circulated hydrocarbons out through choke with 460 LPM while keeping constant back-pressure on kill line.
- Completed five rounds of circulation. Observed erratic returns and large volumes of gas going through the poor-boy degasser.
- Very difficult to calculate maximum pressure at shoe due to unknown mud level.
 - Shoe pressure at shut-in: ~1,32 sg
 - Max estimated shoe pressure: ~1,41 sg
 - FIT: 1,45 sg

Critical issues:

- Gas filled well with bit ~300 m above most likely gain zone.
- Well successfully closed in with annular preventer on spiral drill collar.
- At the time the well was closed in it was uncertain whether the blind shear ram could shear and seal drill collar.
- Unable to strip in hole due to jar located above upper annular preventer.

Lessons Learned:

- Surge / Swab calculations are still valid when tripping in cased hole.
- Low pressure margins when dealing with shallow reservoirs.
 - 6 points (1,17 MW vs. Est PP of 1,11 sg) overbalance at 823 m is only 4,8 bar
- Small margins when circulating out an influx with a shallow casing shoe.
 - SICP of 25 bar equals 1,51 sg. – Estimated frac at casing shoe.
 - SICP of 18 bar equals 1,41 sg. – Max pressure at casing shoe.
- Perform flow check and circulate bottoms up if indications of gain.

Question 8: Any other lessons learned?