

VARG P&A

Repsol Norge AS



Subsurface

Varg Field



PL 038



Status before campaigns

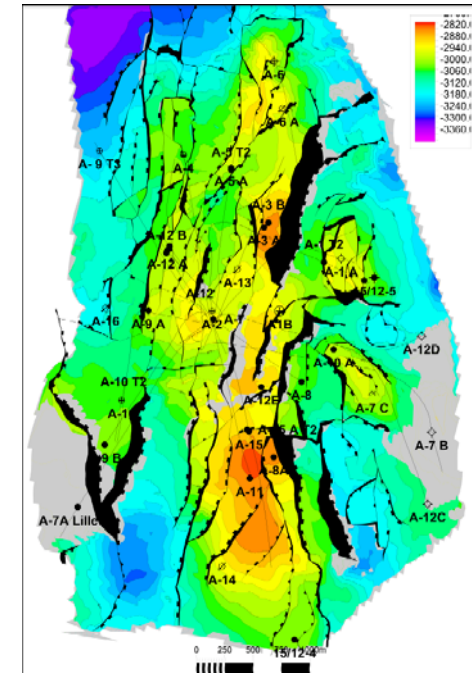


■ Prior to first P&A campaign Q2 2015

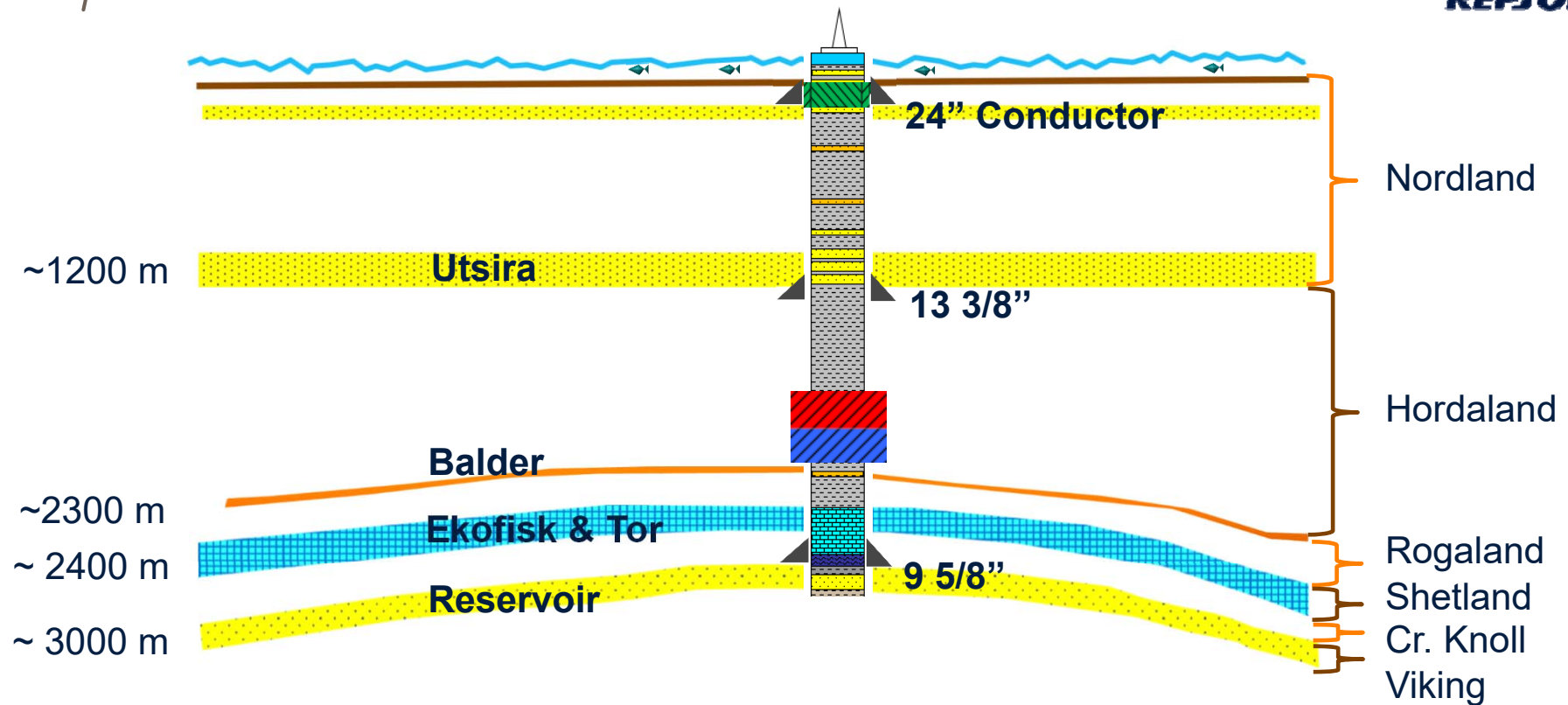
- 6 operators & 6 rigs
- 16 slots
- 12 wells in operation

■ Prior to second P&A campaign Q3 2017

- 1 well permanently P&A and no wells in operation
- 15 wells with remaining P&A work
- 8 wells with remaining deep plug logging (phase 2)




Overburden



/ Wells



2015 campaign

Well 15/12	Year	Objectiv	Logged
A-9 B	2009	Oil Producer	2734-100m
A-12 E	2013	Oil Producer	2704-232m
A-13	1999	Oil Producer Water Injector	2519-148m
A-15 AT2	1999	Oil Producer	2624-95m
A-16	2005	Water Injector	2503-108m
A-11 	1998	Oil Producer	2032-65m

Only shallow logging in A-2 (2015)

Only shallow logging in A-4 (2017)

2017 campaign

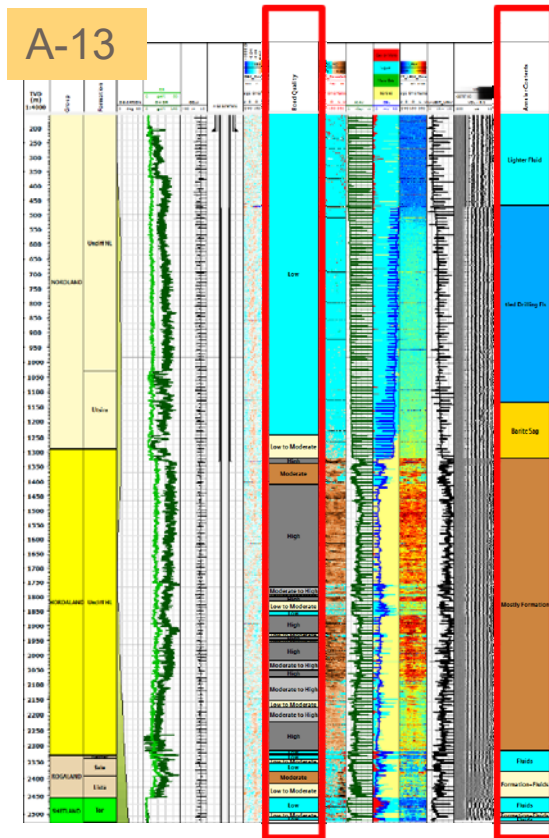
Well 15/12	Year	Objective	Logged
A-14	1998	WAG	3552-140m
A-3 B	2012	Oil Producer	2859-139m
A-1 B	2004	Oil Producer	2693-143m
A-5 A	1998	Oil Producer	2917-99m
A-7 C	2010	WAG	2955-139m
A-10 A	2009	Oil Producer	3073-142m
A-6 A	2004	Water Injector	3235-2383m 1467-136m
A-8 A	2008	Gas Producer	2880-1996m 1450-140m

Logging & Interpretation

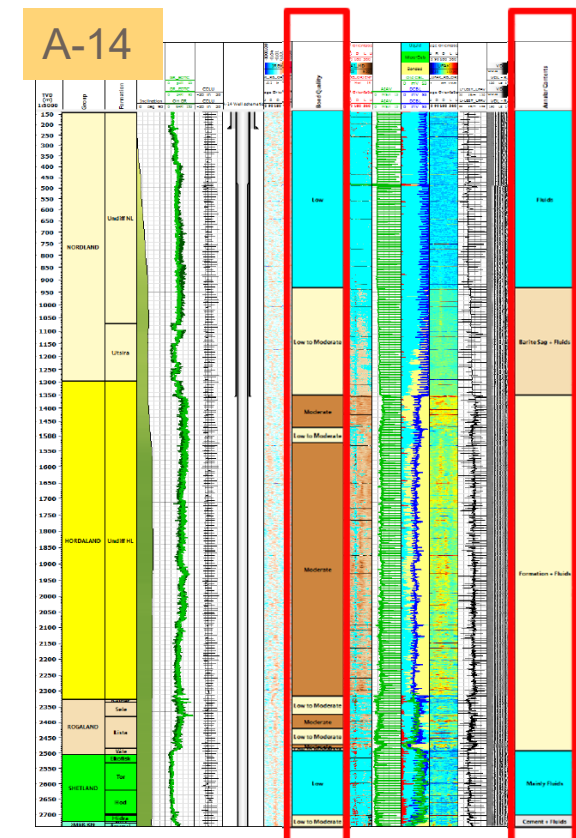


LAYOUT							
Well(s): 15/12-A-14							
<small>Project: Repsol_Varg_15_12-A-14_IBC-CBL_19Oct2017 Dataset(s): Log[6]_Up_608_TCE_Pro_Output,Log[6]_Up_608,Log[6]_Up_208,Deviation,P_A_LOGS_GR_1512A14_OCT2017_ELEV_58_9,02 AUG 1998 CBL_DS Scale: 1.500</small>							
<small>Author: Lillya NOBLE (ID: LKamalova)</small>							
	Bond Quality Assesment	VDL	CBL	Acoustic Impedance Average	Acoustic Impedance Map	Flexural Attenuation	Flexural Attenuation Map
2770	High Bonding Quality	Weak / no casing arrivals + clear formation arrivals	Frm: < 20 mV Cmt: < 10 mV	> 3.0 MRayl	Homogenous	< 70 dB/m	Homogenous
2775							
2780							
2785							
2790	Moderate Bonding Quality	Moderate contrast casing arrivals + Moderate contrast formation arrivals	Frm: 20-30 mV Cmt: 10-20 mV	2.6-3.0 MRayl	Isolated pockets / channels / slightly hetrogenous	60-70 dB/m	Isolated pockets / channels / slightly hetrogenous
2795							
2800							
2805							
2810	Low Bonding Quality	Strong casing arrivals + Weak / no formation arrivals	Frm: > 30 mV Cmt: > 20 mV	< 2.6 MRayl	Hetrogenous / connected pockets and channels	< 60 dB/m	Hetrogenous / connected pockets and channels
2815							

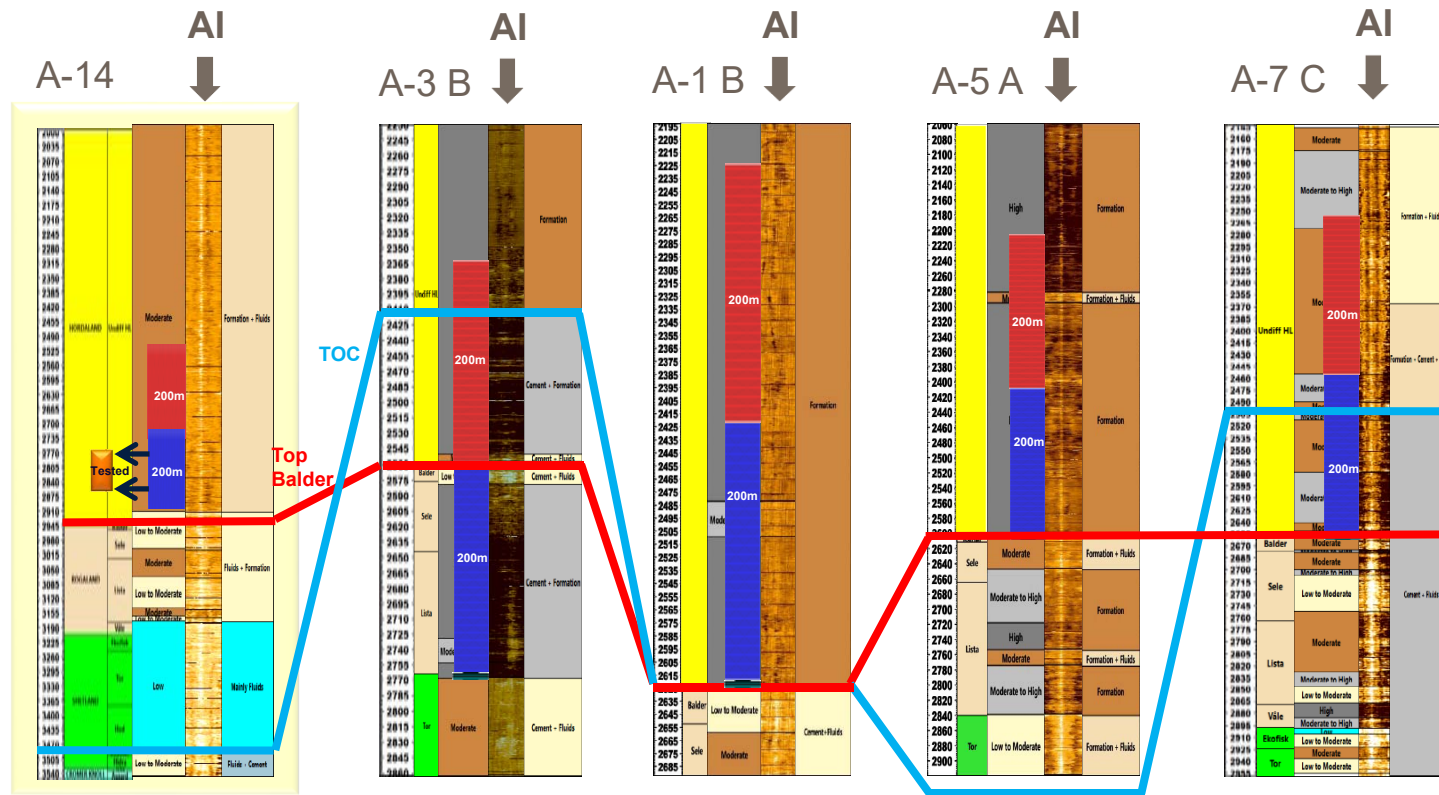
Logging results



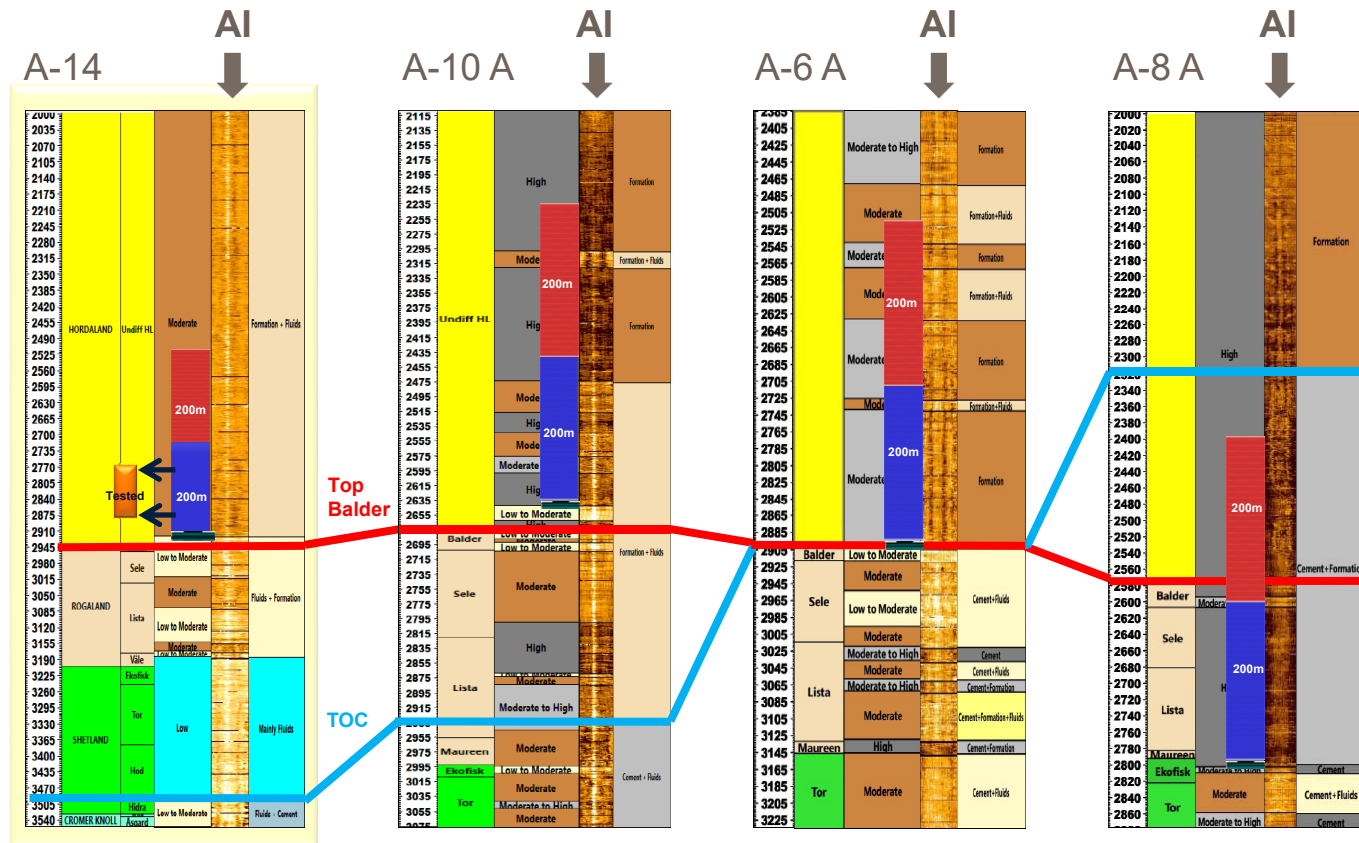
Well	VDL	CBL	AIA	AIM	FA	FAM	Bonding Quality & length > 200 m
A-8 A							
A-6 A	●			●		●	●
A-10 A							
A-7 C	●			●		●	●
A-5 A							
A-1 B	●					●	
A-3 B	●	●				●	
A-14	●	●		●		●	●
A-9 B						●	
A-11							
A-12 E							
A-13							●
A-15 T2							
A-16							



Deep plug – comparison of logs & interpretation



Deep plug – comparison of logs & interpretation



Deep plugs – annulus seal



- 6 wells with **creep** with bonding quality \geq A-14
 - 5 wells; 400m in total (Hordaland)
 - 1 well; 240m in total (Hordaland)
- 1 well with 400m high bonding quality **cement** (Rogaland & Hordaland)
- 1 well with a **combination** of creep and cement:
 - creep with bonding quality \geq A-14 (51m in Hordaland)
 - high bonding quality cement (148m in Rogaland & 141m in Hordaland)

Experience – Formation bonding quality



- Influenced by formation type:
 - Bonding quality; Hordaland > Rogaland > Shetland
- Inside Hordaland:
 - Quality increases with age
 - Quality better towards depth in younger wells
 - Quality relative homogenous in older wells
- Quality better in production wells than in injectors

Experience – Cement bonding quality



- Deep plug interval:
 - The cement quality was in general very variable
 - The cement quality was low inside [Shetland](#)

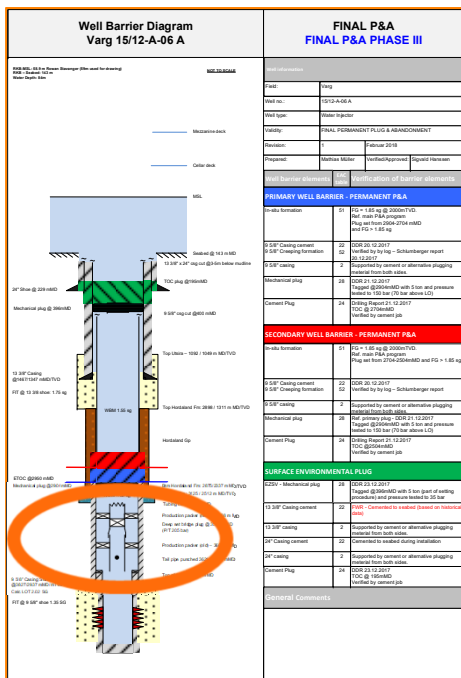
Experience – Other



- Interpretation of cement and barite presence between casings is difficult.
- Differences in Schlumberger and Archer logging results around shallow plug.
- Logging service was in general very good.

P&A

Operations Sequence Phase I



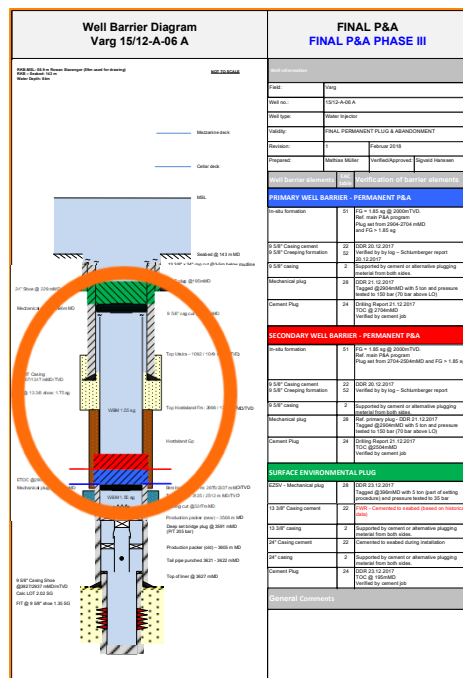
Well status prior to Rig arrival

- Tubing bull headed to seawater,
- A-annulus bled off and topped up with seawater.
- Deep set mechanical plug installed in the tailpipe.

Phase I P&A

- Punch and cut the tubing.
- Punch and release ASV (if installed).
- Set and test shallow pump open tubing plug.
- Nipple Down XMT.

Operations Sequence Phase II

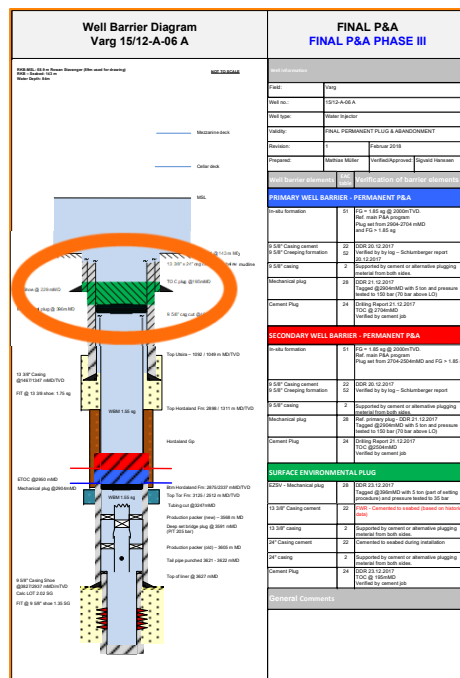


Operations Sequence Phase III

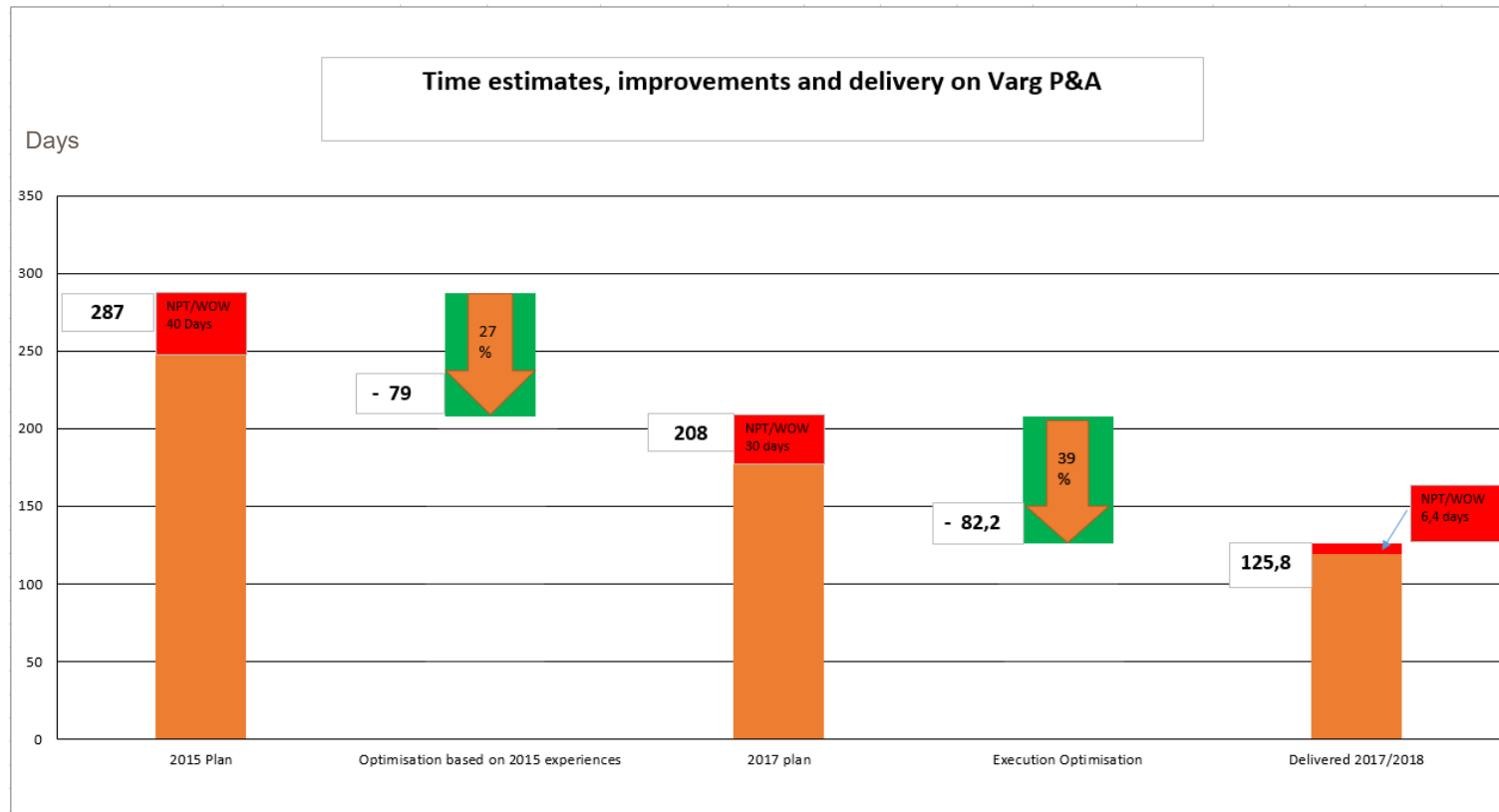


Phase III P&A

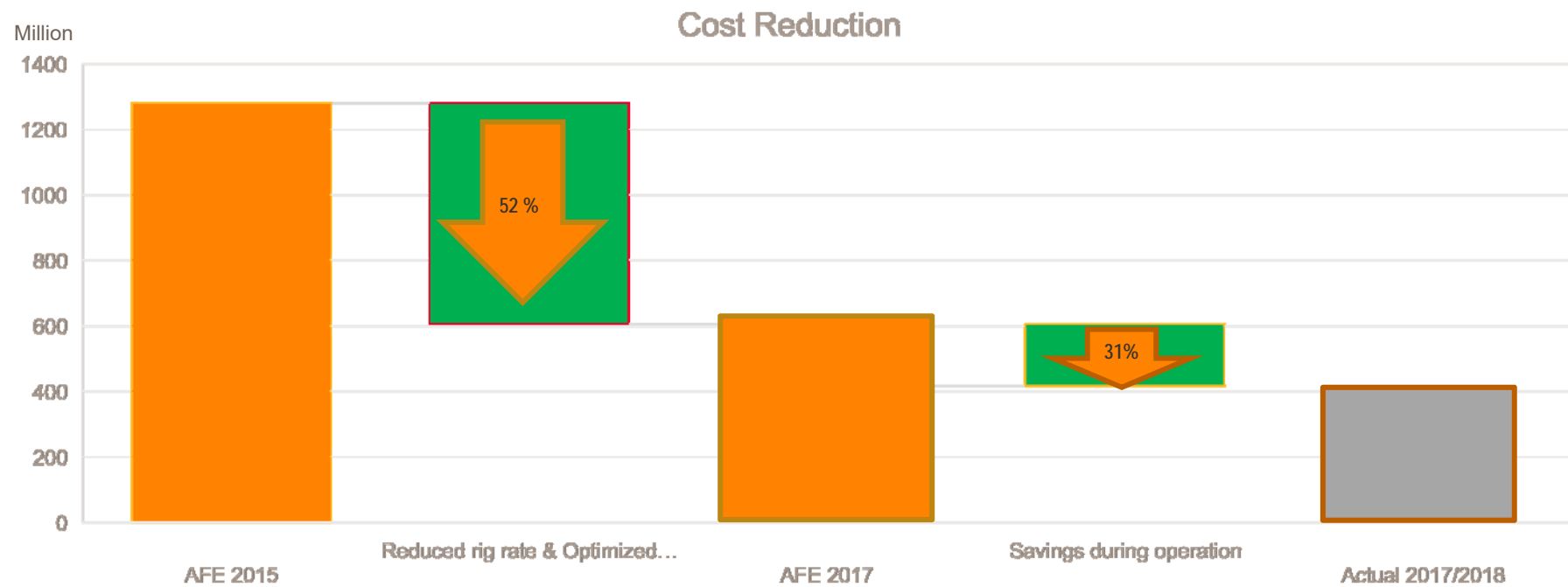
- Cut 13 3/8" casing and 24" conductor approximately 3m below seabed.
- Retrieve Wellhead, 13 3/8" casing and 24" conductor.



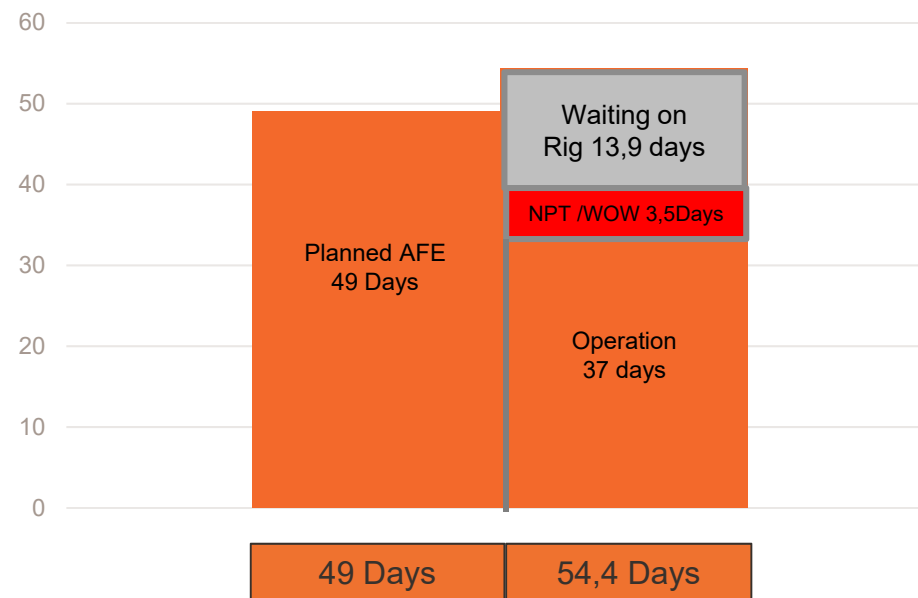
Improvements on delivery - Varg P&A



Cost in Planning vs Performed.



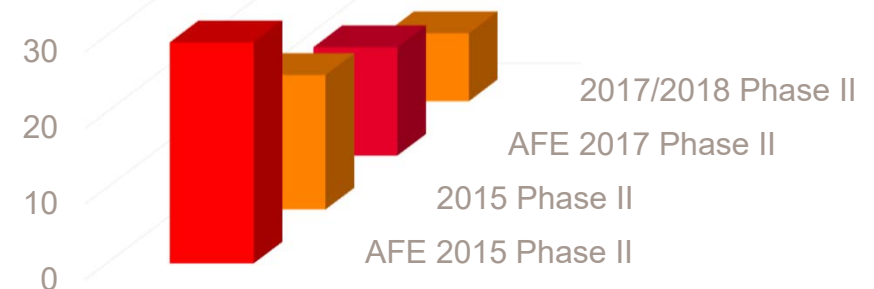
P&A Phase I, Performance



Average P&A times (rig days)

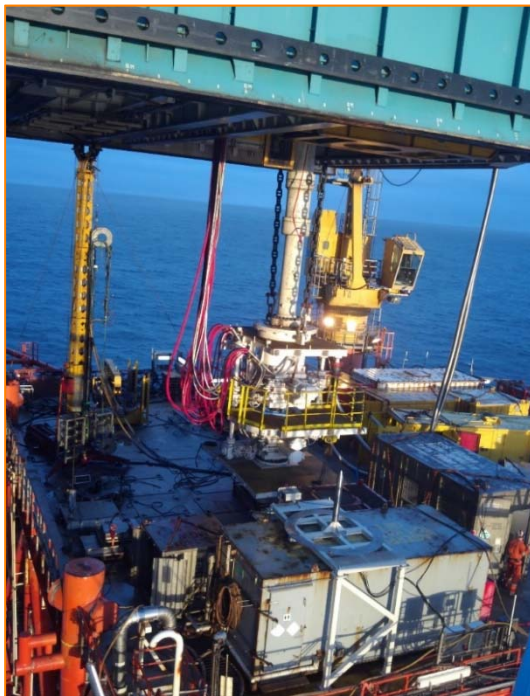


	Phase I	Phase II	Phase III
AFE in 2015		29,1 days	
2015		17,7 days	4,7 days (one well)
Revised AFE in 2017		14,2 days	4 days
2017/2018	5,4 days (One well)	8,9 days	1,5 days



Situation at Varg with RollSafe deck installed

working with both phase I & phase II



BOP on Varg main deck

© Repsol 10/05/2018.



BOP in moonpool on RS and RollSafe deck installed

Time Savings vs Budget

Operations and designs



- Reduced NPT vs Planned NPT,
 - Budget AFE: 12% = 23 days. Actual 2.9% = 3 days
Saved: 20 days
 - Contingency ASV (not required):
Saved: 4.5 days
- Drill & Pin operations
Planned drill & pin operation for Phase III, executed only 4 wells
Saved: 24 days
- Used Spartan plug for surface plugs in 4 wells.
Saved: 8 days

Time Savings vs Budget

Rig



- Skidding between wells and N/U on new well faster than plan (2015 vs 2017)
Saved: 12 days
- Efficient rig. Faster operations for pulling tubing (2015 vs 2017)
Saved: 4.5 days

Time Savings vs Budget

Reduced/delayed scope.



- Removed from rig scope:
Remove subsea wellheads with boat
instead of using rig.
Saved: ~ 10 days



