

**General information**

Wellbore name	16/4-8 S
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Press release	<a href="#">link to press release</a>
Factmaps in new window	<a href="#">link to map</a>
Main area	NORTH SEA
Field	<a href="#">SOLVEIG</a>
Discovery	<a href="#">16/4-6 S Solveig</a>
Well name	16/4-8
Seismic location	LN0902:inline 4360 & crossline 1508
Production licence	<a href="#">359</a>
Drilling operator	Lundin Norway AS
Drill permit	1510-L
Drilling facility	<a href="#">BREDFORD DOLPHIN</a>
Drilling days	69
Entered date	19.06.2014
Completed date	26.08.2014
Plugged and abandon date	26.08.2014
Release date	26.08.2016
Publication date	26.08.2016
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL/GAS
Discovery wellbore	NO
1st level with HC, age	TRIASSIC
1st level with HC, formation	HEGRE GP
Kelly bushing elevation [m]	25.0
Water depth [m]	100.0
Total depth (MD) [m RKB]	2700.0
Final vertical depth (TVD) [m RKB]	2670.0
Maximum inclination [°]	23.2
Oldest penetrated age	TRIASSIC
Oldest penetrated formation	SKAGERRAK FM
Geodetic datum	ED50
NS degrees	58° 39' 53.32" N
EW degrees	2° 16' 24.76" E
NS UTM [m]	6503106.93



EW UTM [m]	457856.97
UTM zone	31
NPDID wellbore	7415

## Wellbore history

**General**

Well 16/4-8 S was drilled to appraise the Luno II discovery made by well 16/4-6 S in 2013 on the west flank of the Utsira High in the North Sea. Well 16/4-8 S targeted the Central South segment, located 4 km south of the Luno II discovery well. The objectives were to prove presence of good quality Jurassic/Triassic reservoir sandstone; to verify the petroleum potential in the Central South segment including the Luno II OWC at 1950 m MSL; and to calibrate the seismic interpretations for the Luno II sub-basin.

**Operations and results**

Appraisal well 16/4-8 S was spudded with the semi-submersible Bredford Dolphin on 19 June 2014 and drilled to 2700 m (2670 m TVD) in the Triassic Skagerrak Formation. The well was drilled deviated from 2100 m to avoid a prognosed fault. Mud losses occurred when drilling the interval 2391 m to TD. LCM pills were pumped to amend this. Otherwise, no significant problem was encountered in the operations. The well was drilled with spud mud down to 610 m and with Aquadril mud from 610 m to TD.

Top reservoir Hegre Group, was encountered at 1934 m (1934 m TVD). No Jurassic sediments were present. The Skagerrak Formation held a total oil column of about 30 m, of which about 15 m had very good reservoir properties. The oil is saturated with a thin gas column on top. Between ca 1970 m and ca 1980 m the reservoir was mainly water bearing, and then a separate zone with biodegraded oil and water was sampled from 1980 to 1987. No clear OWC could be established from the well data. The reservoir rocks, including the water zone, consist of 500-metre thick sandstones over a 200-metre thickness of conglomerate rock. Pressure data shows there is no pressure communication between 16/4-8 S and the 16/4-6 S discovery well.

The first oil show appeared in sidewall cores in Shetland Group limestone from 1928 m, six meter above top reservoir. Variable but generally good oil shows were described throughout the oil-bearing reservoir and down to 2030 m. Local weak oil shows were described in the Hegre Group below 2030 m down to 2382 m.

Seventy-three meter core was recovered in seven consecutive cores in the interval 1935 to 2009 m (98.7% total recovery). MDT fluid samples were taken at 1934.5 m (condensate), 1942.3 m (oil), 1942.5 m (oil), 1945.5 m (oil), 1955.7 m (oil), 1962 m (oil), 1962.8 m (oil), 1967 m (oil), 1975 m (water), 1980 m (slightly biodegraded oil/water/gas), 1987 m (water and traces of mildly biodegraded oil), 2024 m (water), and 2508.2 m (water).

The well was permanently abandoned on 26 August 2014 as an oil and gas appraisal well.

**Testing**

One production test was performed in the well 16/4-8 S. The interval 1940 to 1958 m was perforated and produced with a final flow rate of 63 Sm<sup>3</sup> oil and 12030 Sm<sup>3</sup> gas /day through a 28/64" fixed choke with a wellhead pressure of 17 bar. A GOR of 192 Sm<sup>3</sup>/Sm<sup>3</sup> was measured at separator conditions of 44.2 °C and 8.7 bar. The on-site measured oil density at 15 °C was 0.89 g/cc and the gas gravity was 0.91 (air = 1). The H<sub>2</sub>S and CO<sub>2</sub> contents were less than 0.1 ppm and 0.2 % respectively. The maximum temperature recorded at gauge depth 1919.37 was 81°C, but due to significant Joule-Thompson effects the recorded temperatures varied widely, and the true formation temperature could not reliably be established.

**Cuttings at the Norwegian Offshore Directorate**



Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
620.00	2700.00

Cuttings available for sampling?	YES
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**Cores at the Norwegian Offshore Directorate**

Core sample number	Core sample - top depth	Core sample - bottom depth	Core sample depth - uom
1	1935.0	1948.1	[m ]
2	1948.1	1960.0	[m ]
3	1960.4	1970.9	[m ]
4	1970.9	1985.8	[m ]
5	1986.0	1997.0	[m ]
6	1996.0	2002.2	[m ]
7	2002.2	2008.6	[m ]

Total core sample length [m]	74.0
Cores available for sampling?	YES

**Lithostratigraphy**

Top depth [mMD RKB]	Lithostrat. unit
125	<a href="#">NORDLAND GP</a>
760	<a href="#">UTSIRA FM</a>
1027	<a href="#">HORDALAND GP</a>
1042	<a href="#">SKADE FM</a>
1209	<a href="#">HORDALAND GP</a>
1747	<a href="#">ROGALAND GP</a>
1747	<a href="#">BALDER FM</a>
1750	<a href="#">SELE FM</a>
1800	<a href="#">LISTA FM</a>
1897	<a href="#">VÅLE FM</a>
1907	<a href="#">SHETLAND GP</a>
1907	<a href="#">EKOFISK FM</a>
1928	<a href="#">TOR FM</a>
1932	<a href="#">HOD FM</a>
1933	<a href="#">CROMER KNOLL GP</a>
1934	<a href="#">HEGRE GP</a>

1934 [SKAGERRAK FM](#)**Drill stem tests (DST)**

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	1940	1958	11.1

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0				44

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0	63	12030			192

**Logs**

Log type	Log top depth [m]	Log bottom depth [m]
ADT MDT	1934	2383
ADT MDT	1934	2673
ADT MDT	1962	2508
DSL CN ZDL ORIT XMAC RTEX MLL	1859	2704
DSL CN ZDL ORIT XMAC RTEX MLL	1865	2409
FLEX MREX	1917	2403
FLEX MREX	2337	2707
GEO WAVES	354	2389
GEO WAVES	829	2689
MAXCOR	1928	2365
MDT	1934	2024
MSCT	1928	2366
MWD - GR RES DEN NEU SON DIR PWD	573	2697
MWD - GR RES SON DIR PWD	125	607
STAR-HD ORIT UXPL	1875	2398
STAR-HD ORIT UXPL	2328	2696
XL-ROCK	2029	2682

**Casing and leak-off tests**

Casing type	Casing diam. [inch]	Casing depth [m]	Hole diam. [inch]	Hole depth [m]	LOT/FIT mud eqv. [g/cm3]	Formation test type
CONDUCTOR	30	203.0	36	203.0	0.00	
SURF.COND.	20	602.0	26	610.0	1.81	LOT
PILOT HOLE		610.0	9 7/8	610.0	0.00	
OPEN HOLE		615.0	17 1/2	615.0	0.00	
PROD.	9 5/8	1910.0	12 1/4	1918.0	1.50	FIT
OPEN HOLE		2700.0	8 1/2	2700.0	0.00	

**Drilling mud**

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
125	1.03	111.0		Water Based	
610	1.03	111.0		Water Based	
1174	1.35	21.0		Water Based	
1657	1.40	22.0		Water Based	
1913	1.20	19.0		Water Based	
1918	1.40	22.0		Water Based	
2009	1.20	19.0		Water Based	
2407	1.20	21.0		Water Based	
2700	1.10	30.0		Water Based	