

**General information**

Wellbore name	16/1-11
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Press release	link to press release
Factmaps in new window	link to map
Main area	NORTH SEA
Field	IVAR AASEN
Discovery	16/1-9 Ivar Aasen
Well name	16/1-11
Seismic location	inline 886 & crossline 1149
Production licence	001 B
Drilling operator	Det norske oljeselskap ASA
Drill permit	1261-L
Drilling facility	SONGA DELTA
Drilling days	63
Entered date	23.02.2010
Completed date	26.04.2010
Release date	26.04.2012
Publication date	26.04.2012
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL/GAS
Discovery wellbore	NO
1st level with HC, age	MIDDLE JURASSIC
1st level with HC, formation	SLEIPNER FM
2nd level with HC, age	LATE TRIASSIC
2nd level with HC, formation	SKAGERRAK FM
Kelly bushing elevation [m]	29.0
Water depth [m]	112.0
Total depth (MD) [m RKB]	2625.0
Final vertical depth (TVD) [m RKB]	2625.0
Maximum inclination [°]	1.4
Bottom hole temperature [°C]	105
Oldest penetrated age	LATE TRIASSIC
Oldest penetrated formation	SKAGERRAK FM
Geodetic datum	ED50
NS degrees	58° 55' 36.15" N



EW degrees	2° 11' 7.48" E
NS UTM [m]	6532327.00
EW UTM [m]	453098.97
UTM zone	31
NPDID wellbore	6157

Wellbore history

**General**

Well 16/1-11 was drilled to appraise the 16/1-9 discovery on the Gudrun Terrace just west of the Utsira High in the North Sea. The discovery well 16/1-9 was completed in April 2008 and revealed oil shows in the Middle Jurassic Vestland Group, but neither coring or logging was completed according to programme due to hole problems. The extent and reservoir quality of the Sleipner Formation in the Vestland Group was a primary objective in the data acquisition programme for 16/1-11 and an extensive wire line logging suite was planned in order to get as much information as possible regarding the oil-water contact, depth conversion, reservoir thickness, facies, fluids, well productivity and possible barriers in the reservoir. The Sleipner Formation reservoir was prognosed to be 75 m thick and coring of the hydrocarbon bearing part of the reservoir was decided prior drilling. Planned TD was TD at 2579 m, approximately 100 metres below prognosed base of the Sleipner Formation.

Operations and results

Well 16/1-11 was spudded with the semi-submersible installation Songa Delta on 23 February 2010. The 8 1/2" section in was drilled to TD at 2625 m in the Skagerrak Formation. After logging problems with setting and cementing the 7" liner made it necessary to make a sidetrack, 16/1-11T2, in order to do a drill stem test. The 8 1/2" sidetrack was kicked off from 2193 m and drilled to 2532 m (2523 m TVD). The sidetrack was drilled deviated with up to 20 deg deviation at its TD. The well was drilled with seawater down to 603.5 m, with Aqua-drill mud with 6% glycol from 603.5 to 1770 m, and with Carbo-Sea oil based mud from 1770 m to TD.

Hydrocarbons were proven in the Sleipner and Skagerrak formations. Top Sleipner Formation came in at 2380.5 m. It consisted of 20 m coarse fining upward sandstones and contained gas. Analysis of core and log data showed good reservoir quality with calculated average effective porosity of about 19% and an average gas saturation of 31%. The Net Pay/Gross was nearly 1.0. The Skagerrak Formation came in at 2400.5 m. The core and log analysis proved a much lower reservoir quality than in the Sleipner Formation, mainly due to carbonate cementation. No contacts could be interpreted from the logs but pressure data gave a gas/oil contact at 2377.8 m TVD MSL. The log and pressure evaluation showed oil down to 2438 m (2409 m TVD MSL) and water up to 2445 m (2416 TVD MSL) in the Skagerrak formation. There were no pressure barriers between the Sleipner and Skagerrak formations. The deepest oil staining and fluorescence was recorded at 2502.8 m.

Five 90 ft cores were cut in the interval 2385.5 m to 2522 m with practically 100 % recovery. Fluid samples were taken with the RCI tool. Gas samples were taken at 2396 m and 2406 m while oil samples were taken at 2408.8 m and 2437.8. A water sample was taken at 2454.1 m.

The well was plugged back for a geological sidetrack on 26 April as an oil and gas appraisal well.

Testing

One DST was performed in the sidetrack. It was perforated from 2415 - 2425 m, underbalanced with TCP. It flowed 177 Sm³ oil /day through a 28/64" choke. The oil density was 0.835 g/cm³ and GOR was 127 Sm³/Sm. Initial formation pressure was 244.75 bar at reference depth 2377.8 m TVD MSL. Initial formation temperature at this depth (DST temperature) was 98 deg C.

Cuttings at the Norwegian Offshore Directorate



Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
610.00	2625.00

Cuttings available for sampling?	YES
----------------------------------	-----

Cores at the Norwegian Offshore Directorate

Core sample number	Core sample - top depth	Core sample - bottom depth	Core sample depth - uom
1	2385.5	2411.9	[m]
2	2412.5	2439.1	[m]
3	2439.5	2466.6	[m]
4	2466.5	2494.4	[m]
5	2494.1	2522.0	[m]

Total core sample length [m]	135.9
Cores available for sampling?	YES

Oil samples at the Norwegian Offshore Directorate

Test type	Bottle number	Top depth MD [m]	Bottom depth MD [m]	Fluid type	Test time	Samples available
DST		2445.00	2415.00	OIL	16.04.2010 - 00:00	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
141	NORDLAND GP
754	UTSIRA FM
811	NO FORMAL NAME
825	HORDALAND GP
825	SKADE FM
837	NO FORMAL NAME
939	SKADE FM
1226	NO FORMAL NAME
1609	GRID FM
1738	NO FORMAL NAME



1988	ROGALAND GP
1988	BALDER FM
2022	SELE FM
2075	LISTA FM
2128	HEIMDAL FM
2171	LISTA FM
2202	VÅLE FM
2208	SHETLAND GP
2208	EKOFISK FM
2233	CROMER KNOLL GP
2233	ÅSGARD FM
2267	VIKING GP
2267	DRAUPNE FM
2318	HEATHER FM
2381	VESTLAND GP
2381	SLEIPNER FM
2401	NO GROUP DEFINED
2401	SKAGERRAK FM

Geochemical information

Document name	Document format	Document size [MB]
6157 01 16 1 11 gch transfer 1	txt	0.00
6157 02 16 1 11 gch results 1	txt	0.01

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	0	0	24.0

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0				98

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0	525				



**Logs**

Log type	Log top depth [m]	Log bottom depth [m]
MARCH JAR TTRM GR RCI SAM	2396	2437
MRCH GYRO	2173	2174
MRCH GYRO	2202	2204
MRCH JAR TTR GR SBT	2356	2625
MRCH JAR TTR MREX ZDL CN	2325	2625
MRCH JAR TTRM DSL ZDL CN	2356	2521
MRCH JAR TTRM GR JRC GUNS	0	0
MRCH JAR TTRM GR JRC GUNS	0	0
MRCH JAR TTRM GR PERF	2383	2489
MRCH JAR TTRM GR SBT	2218	2489
MRCH JAR TTRM GR SBT	2356	2625
MRCH JAR TTRM GR SPOP	2405	2454
MRCH JAR TTRM GR XMAC C-STAR	1760	2610
MRCH JAR TTRM GR ZVSP	585	2615
MWD LWD - BR GR REMP BHPR MECH	2361	2625
MWD LWD - GR REMP BHPR MECH	196	2361

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	196.5	36	165.5	0.00	LOT
SURF.COND.	20	600.0	26	603.0	0.00	LOT
INTERM.	13 3/8	1764.5	17 1/2	1770.0	1.78	LOT
INTERM.	9 5/8	2356.0	12 1/4	2361.0	0.00	LOT
LINER	7	2530.0	8 1/2	2532.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
202	1.04			SPUD MUD	
1753	1.30	33.0		CARBO TECH	



1770	1.31	16.0		AQUACOL KCL/POLYMER/GLY COL	
2150	1.24	21.0		CARBO TECH	
2167	1.30	29.0		CARBO TECH	
2202	1.24	31.0		CARBO TECH	
2361	1.30	18.0		CARBO TECH	
2473	1.24	26.0		CARBO TECH	
2625	1.21	21.0		CARBO TECH	

Pressure plots

The pore pressure data is sourced from well logs if no other source is specified. In some wells where pore pressure logs do not exist, information from Drill stem tests and kicks have been used. The data has been reported to the NPD, and further processed and quality controlled by IHS Markit.

Document name	Document format	Document size [MB]
6157 Formation pressure (Formasjonstrykk)	pdf	0.23

