

Formation Pressures

WELL 34/7-13

Depth (TVD m RKB)	Hydrostatic Mud Pressure		Formation Pressure Temperature Corrected	
	Before (psia)	After (psia) HP-gauge	(psia)	(bar)
<u>Run 2</u>				
2491.4	5517.4	5517.3	4989.1	343.99
2493.4	5518.4	5518.5	4990.3	344.07 (seg sample)
2493.8	5522.8	5522.8	4989.1	343.99
2494.4	5522.1	5522.2	4992.6	344.23 (seg sample)
2494.4	5520.6	5521.0	4991.6	344.16 (lost seal)
2497.8	5531.8	5531.9	4995.8	344.45
2499.8	5536.4	5536.4	4997.8	344.59
2500.8	5537.1	5537.1	4998.6	344.64
2503.7	5545.0	5545.0	5001.3	344.83
2503.7	5542.0	5517.5	5000.8	344.79 (seg sample)
2509.4	5558.0	5558.3	5009.3	345.38
2515.3	5571.4	5571.5	5017.8	345.96
2523.3	5589.1	5589.3	5029.1	346.74
2533.1	5611.8	5611.8	5043.1	347.71
2547.5	5644.6	5644.7	5063.6	349.12
2560.4	5675.0	5674.6	5085.1	350.60
<u>Run 3</u>				
2870.5	6549.0	6538.5	5982.6	412.49
2870.5	6578.9	6574.3	5985.8	412.71
2879.1	6597.8	6587.0	5998.1	413.55
2890.6	6621.1	6611.2	6014.1	414.66
2898.8	6393.0	6395.0	6020.6	415.11
2923.7	6480.1	6464.0	6464.4	445.70
2927.0	6731.0	6713.0	6155.6	424.41
2927.0	6493.1	6484.0	6151.3	417.22
2940.4	6742.0	6698.0	6086.0	419.61
2940.4	6730.0	6690.0	6085.3	419.57
2950.8	6616.0	6587.1	6100.8	420.63

Summary of Flow Periods

EVENT	TIME	FLOWRATE (Sm ³ /D) (1)	SAND PRODUCTION (volume %) (2)	BOTTOM HOLE PRESSURE/TEMP (bar) (Deg C) (3)	WELLHEAD PRESSURE/TEMP (bar) (Deg C)	GOR (Sm ³ /Sm ³)	SEPARATOR PRESSURE TEMP (bar) (Deg C)	CHOKE (mm)
Well perforated	050488 02:14							
Initial Flow	02:14							6.4 fix.
	02:25			340.3/76.8	91.8/7.9			
Shut-in	02:30			340.3/76.8	95.1/7.9			
Clean-up flow	05:01							various adj.
	06:09			339.7/85.2	143.2/25.7			7.9 fix (4)
	07:30	333	0	340.7/86.1	157.4/17.0	48.2	49.5/28.0	
Shut-in	08:00	340	0	340.7/86.3	157.2/16.8	47.6	50.5/28.3	
Formation characteristics flow	10:31							11.1 fix
	12:00	966	<0.1	337.1/87.8	146.5/31.1	49.4	37.7/52.8	
	14:00	952	<0.1	337.1/88.6	146.9/38.0	49.5	37.9/53.8	
	16:00	949	0.1	337.1/88.9	146.7/40.7	48.9	37.9/54.8	
Shut-in	17:16	937	0.1	337.1/89.1	146.7/41.2	49.6	38.0/56.0	
Main flow	21:21							15.9 fix
	060488 00:00	1330	0.2	334.8/89.4	134.4/50.7			
	06:00	1320	0.1	335.0/89.7	133.6/56.3			
	12:00	1350	0.5	335.8/89.9	129.5/58.9			
	18:00	1360	<0.1	335.9/89.9	128.6/58.5			
	21:30	1060	<0.1	336.5/90.0	131.6/60.6			12.7 fix
	22:00	950	<0.1	337.6/90.0	136.8/58.9			11.1 fix
	070488 04:00	965	0	337.9/89.9	135.9/52.6			
	10:00	950	<0.1	337.8/90.0	134.0/51.6			
	16:00	960	0	337.9/90.0	128.4/48.4			
Shut-in	17:30	955	<0.1	338.0/90.0	128.9/50.9			

- (1) Includes both oil and water. The flowrates may be slightly uncertain due to poor water oil separation.
 (2) Measured at separator inlet
 (3) Measured at 2467.6 m RKB TVD (Matre Murr-1 no. 14). Initial pressure = 342.0 bar.
 (4) Partly plugged

Table 5.5 Summary of the flow periods, production test no. 1.1, well 34/7-13

Fluid Analysis

FMT Sample	STO 17
Sampling depth [TVD mRKB]	2493.4

Bubblepoint pressure at 90,0 °C [bar]	126.0
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From single stage flash:

Gas oil ratio [Sm ³ /Sm ³]	84.3
Density of oil at 15 °C [kg/m ³]	839.2
Gas gravity (air = 1)	0.925

Composition of reservoir fluid [mol%]

CO ₂	0.36
N ₂	0.44
C ₁	28.83
C ₂	5.33
C ₃	7.15
i- C ₄	1.49
n- C ₄	4.55
i- C ₅	1.75
n- C ₅	2.61
C ₆	3.34
C ₇₊	44.15

Molecular weight of C ₇₊	232
Density of C ₇₊ [kg/m ³]	860

Table 5.6 Analyses of oil from FMT-sampling, Well 34/7-13

Fluid Analysis

RESERVOIR FLUID COMPOSITION, PT 1.1

Component	Weight %	Mol %
CO ₂	0.12	0.35
N ₂	0.07	0.31
C ₁	3.72	28.25
C ₂	1.28	5.20
C ₃	2.68	7.42
i-C ₄	0.73	1.52
n-C ₄	2.24	4.70
i-C ₅	1.04	1.76
n-C ₅	1.56	2.64
C ₆	2.32	3.34
C ₇	3.64	4.77
C ₈	4.39	5.03
C ₉	2.82	2.85
C ₁₀₊	73.39	31.86
Average molecular weight		: 122.0
Molecular weight C ₇₊ (calculated)		: 231.0
Density of C ₇₊ (calculated)		: 858
Molecular weight of C ₁₀₊ (measured)		: 281
Density of C ₁₀₊ (measured)		: 877.7

Table 5.7 Reservoir Oil Composition, PT 1.1, Well 34/7-13

Fluid Analysis

SUMMARY OF GENERAL PVT DATA

WELL 34/7-13, PT 1.1

Initial pressure used in analysis	[bar]	:	344.3
Temperature used in analysis	[°C]	:	90.0
Saturation pressure	[bar]	:	127.0
Reservoir oil density	[kg/m ³]	:	724.8
Viscosity at initial pressure	[mPa • s]	:	0.589
Viscosity at saturation pressure	[mPa • s]	:	0.468

Differential liberation

Bo at reservoir condition	[m ³ /Sm ³]	:	1.329
GOR	[Sm ³ /Sm ³]	:	93.5
Residual oil density	[kg/m ³]	:	843.4

Flash data

		SINGLE	MULTI
Bo at reservoir condition	[m ³ /Sm ³]	1.286	1.243
GOR	[Sm ³ /Sm ³]	85.1	72.5
Residual oil density	[kg/m ³]	838.5	832.2

Separator conditions for single stage flash:

- 1) 1.01 bar and 15 °C

Separator conditions for multi stage flash:

- 1) 63 bar and 66 °C
- 2) 31 bar and 60 °C
- 3) 11 bar and 54 °C
- 4) 1 bar and 15 °C

Fluid Analysis

TRACE ELEMENT ANALYSES, PT 1.1

		Range	Arithmetic average	# of measure- ments
GASPHASE				
Hydrogen Sulphide	[ppm-mol]	<0.1-0.1		8
Mercaptans	[ppm-mol]	<0.1		3
Carbon Dioxide	[mol%]	0.8-1.0	0.9	6
Radon 222	[Bq/l]	0.15-0.24	0.20	4
Water	[mg/l]			
Total Mercury	[µg/m ³]	1.25-7.10	3.28	3
Helium	[mol%]	0.008-0.010	0.009	3
OILPHASE				
Density @25°C	[g/cm ³]	0.847-0.861	0.853	13
Water in Oil		See section 5.4		
Total Sulphur	[weight %]	0.16-0.18	0.17	3
Polonium - 210	[Bq/l]	0.1		1
Nickel	[ppm-weight]	<0.1		3
Vanadium	[ppm-weight]	2.3-2.4	2.3	3
Mercury	[ppm-weight]	<1-1.9		3

Table 5.9 Trace Element Analyses, PT 1.1, Well 34/7-13

Fluid Analysis

SAMPLING TIME: 09:30- 09:50

SAMPLING DATE: 07.04.88

CATIONS			NAC (1)	RRI (2)	
1.	Lithium	(Li)	42		mg/l
2.	Aluminium	(Al)	<0.5	-	mg/l
3.	Boron	(B)	56		mg/l
4.	Barium	(Ba)	53	57	mg/l
5.	Calcium	(Ca)	300	332	mg/l
6.	Cobalt	(Co)	<0.1		mg/l
7.	Cromium	(Cr)	<0.1		mg/l
8.	Copper	(Cu)	<0.1		mg/l
9.	Iron,dissolved	(Fe)		<0.1	mg/l
10.	Iron,total	(Fe)	14	6.4	mg/l
11.	Potassium	(K)	160	110	mg/l
12.	Magnesium	(Mg)	72	68	mg/l
13.	Manganese	(Mn)	0.25	-	mg/l
14.	Molybdenum	(Mo)	<0.1		mg/l
15.	Sodium	(Na)	9960	9500	mg/l
16.	Nickel	(Ni)	<0.1		mg/l
17.	Silicon	(Si)	21		mg/l
18.	Strontium	(Sr)	51		mg/l
19.	Zinc	(Zn)	<0.01		mg/l
20.	Phosphorus	(P)	<2		mg/l
21.	Vanadium	(V)	<0.1		mg/l

ANIONS

1.	Chloride	(Cl)		14700	mg/l
2.	Sulphate	(SO4)		4.7	mg/l
3.	Carbonate	(CO3)		00	mg/l
4.	Bicarbonate	(HCO3)		1220	mg/l

OTHER PROPERTIES

pH		7.7 (22 °C)	7.0 (20 °C) (3)
Specific gravity 15.6/15.6 °C		1.0170	g/cm3
Resitivity (25 °C)		0.239	ohm-m
Suspended solids (<0.45 µm)		290	mg/l

- (1) NAC - Nordic Analytical Center,
Cations are analysed by ICP-technique
- (2) RRI - Rogaland Research Institute,
Cations are analysed by atom absorption technique
- (3) The pH-value is measured offshore

Well no: 34/7-13

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf / Mf	Ca++ mg/l	Cl- mg/l	KCL ppb	Sand %	Solids %	Mudtype
880219	36	434.0	1.05											SPUD MUD
880220	36	434.0	1.05											SPUD MUD
880221	17-1/2	507.0	1.12	5	25	18/19								GEL MUD
880222	17-1/2	973.0	1.14	4	14	9/10								GEL MUD
880223	26	973.0	1.16	4	16	9/10								GEL MUD
880224	26	973.0	1.16	4	15	9/10								GEL MUD
880225	17-1/2	973.0	1.16											GEL MUD
880226	17-1/2	973.0	1.12	21	29	0/2	8.3	0.0/0.3	240	53000	35			KCL MUD
880227	17-1/2	1348.0	1.13	20	20	1/2	8.1	0.0/0.3	600	50000	35	0.3	7.0	KCL MUD
880228	17-1/2	1479.0	1.25	23	21	2/2	8.1	0.0/0.4	480	50000	32	0.5	10.0	KCL MUD
880229	17-1/2	1479.0	1.25	23	21	1/2	8.1	0.0/0.4	440	58000	37	0.5	10.0	KCL MUD
880301	17-1/2	1681.0	1.45	26	24	1/2	8.1	0.0/0.4	680	55000	30	0.3	16.0	KCL MUD
880302	17-1/2	1875.0	1.50	33	28	3/3	8.1	0.0/0.2	960	54000	32	0.6	17.0	KCL MUD
880303	17-1/2	1875.0	1.50	33	28	2/3	8.1	0.0/0.2	960	54000	32	0.6	17.0	KCL MUD
880304	17-1/2	1875.0	1.50	33	28	3/3	8.1	0.0/0.2	960	54000	32	0.6	17.0	KCL MUD
880305	17-1/2	1875.0	1.50	32	26	2/2	8.0	0.0/0.2	960	52000	30	0.3	17.0	KCL MUD
880306	17-1/2	1875.0	1.50	32	24	2/2	8.0	0.0/0.2	1640	53000	32	0.3	17.0	KCL MUD
880307	12-1/4	1875.0	1.50	31	25	2/2	8.0	0.0/0.2		53000	32	0.3	17.0	KCL MUD
880308	12-1/4	2017.0	1.55	30	22	2/4	8.5	0.2/4.5		54000	33	0.3	19.0	KCL MUD
880309	12-1/4	2106.0	1.60	35	19	3/12	8.4	0.3/1.4		52000	32	0.3	21.0	KCL MUD
880310	12-1/4	2232.0	1.60	33	17	3/20	8.3	0.3/1.1		52000	30	0.3	22.0	KCL MUD
880311	12-1/4	2404.0	1.65	28	16	4/35	8.2	0.3/1.0		50000	27	0.3	23.0	KCL MUD
880312	12-1/4	2496.0	1.65	27	16	3/24	8.0	0.1/0.8		38000	19	0.2	23.0	KCL MUD
880313	12-1/4	2508.0	1.65	25	14	3/20	8.0	0.1/0.7		38000	19	0.3	23.0	KCL MUD
880314	12-1/4	2532.0	1.65	26	16	3/23	8.0	0.1/0.6		39000	19	0.3	23.0	KCL MUD
880315	12-1/4	2550.0	1.64	26	16	3/23	8.0	0.1/0.6		39000	19	0.3	23.0	KCL MUD
880316	12-1/4	2582.0	1.61	24	12	3/15	8.0	0.1/0.6		38000	18	0.3	21.0	KCL MUD
880317	12-1/4	2588.0	1.61	20	10	3/13	8.0	0.1/0.6		40000	18	0.3	21.5	KCL MUD
880318	12-1/4	2589.0	1.61	19	13	3/16	8.0	0.1/0.6		40000	18	0.3	21.5	KCL MUD
880319	12-1/4	2615.0	1.61	20	13	3/15	8.5	0.1/0.6		38000	17	0.3	21.5	KCL MUD
880320	12-1/4	2682.0	1.61	25	13	3/4	8.3	0.1/0.7		33000	16	0.1	22.0	KCL MUD

Well no: 34/7-13

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf / Mf	Ca++ mg/l	Cl- mg/l	KCL ppb	Sand %	Solids %	Mudtype
880321	12-1/4	2682.0	1.61	25	13	3/14	8.3	0.1/0.7		33000	16	0.1	22.0	KCL MUD
880322	12-1/4	2682.0	1.61	27	13	3/12	7.9	0.1/0.7		33000	16	0.1	22.0	KCL MUD
880323	12-1/4	2682.0	1.61	27	13	3/12	7.9	0.1/0.7		33000	16	0.1	22.0	KCL MUD
880324	12-1/4	2682.0	1.61	27	12	3/12	8.0	0.1/0.7		31000	16	0.1	22.0	KCL MUD
880325	8-1/2	2682.0	1.61	27	13	3/12	8.0	0.1/0.7		31000		0.1	22.0	GEL MUD
880326	8-1/2	2690.0	1.61	26	13	3/13	9.7	0.4/1.7		30000		0.3	22.0	GEL MUD
880327	8-1/2	2777.0	1.61	29	16	3/20	9.3	0.2/1.5		31000		0.1	22.0	GEL MUD
880328	8-1/2	2873.0	1.61	29	16	4/30	9.1	0.1/1.1		27000		0.1	22.5	GEL MUD
880329	8-1/2	2900.0	1.61	26	15	3/16	9.0	0.1/0.9		27000		0.1	22.5	GEL MUD
880330	8-1/2	2994.0	1.61	26	15	4/31	8.8	0.0/0.9	260	25000		0.1	22.5	GEL MUD
880331	8-1/2	2994.0	1.61	26	15	4/31	8.8	0.0/0.9		25000		0.1	22.5	GEL MUD
880401	8-1/2	2994.0	1.61	26	15	4/31	8.8	0.0/0.9		25000		0.1	22.5	GEL MUD
880402	PB	2590.0	1.61	26	15	4/31	8.8	0.0/0.9		25000		0.1	22.5	GEL MUD
880403	PB	2630.0	1.50	16	9	1/10	9.5	0.1/1.2		22000		0.1	28.5	GEL MUD
880404	PB	2630.0	1.50	16	9	1/10	9.5	0.1/1.2		22000		0.1	28.5	GEL MUD
880405	PB	2630.0	1.50	16	9	1/10	9.5	0.1/1.2		22000		0.1	18.5	GEL MUD
880406	PB	2630.0	1.50	16	9	1/10	9.5	0.1/1.2		22000		0.1	18.5	GEL MUD
880407	PB	2630.0	1.50	16	9	1/10	9.5	0.1/1.2		22000		0.1	18.5	GEL MUD
880408	PB	2630.0	1.50	16	9	1/10	9.5	0.1/1.2	760	22000		0.1	18.5	GEL MUD
880409	PB	2630.0	1.50	18	14	2/14	8.2	0.0/0.8	800	22000		0.1	18.5	GEL MUD
880410	PB	2482.0	1.50	15	8	1/6	8.4	0.1/0.9		22000		0.1	18.5	GEL MUD
880411	PB	2482.0	1.50	15	8	1/6	8.4	0.1/0.9		22000		0.1	18.5	GEL MUD
880412	PB	350.0	1.50	15	8	1/6	8.4	0.1/0.9		22000		0.1	18.5	GEL MUD

SAGA PETROLEUM A.S.

6.2.2 MUD MATERIALS USED

Well no: 34/7-13

Materials	Unit	36 in hole	26 in hole	17-1/2 hole	12-1/4 hole	8-1/2 hole	Total
SAPP	50 KG	0	0	2	6	0	8
BARITE	M/T	0	50	433	310	101	894
BICARBONATE	50 KG	0	0	0	64	46	110
CAUSTIC SODA	25 KG	2	5	1	0	1	9
Antisol FL 30	25 kg	0	0	159	120	34	313
Magconol	25 l	0	0	0	0	1	1
Oilex	GALLO	0	0	0	2	1	3
Polysal	25 kg	0	0	0	229	54	283
LIME	40 KG	5	8	0	0	0	13
POT. BICABONAT	50 kg	0	0	0	10	0	10
POT. IODIDE	25 kg	0	0	0	3	0	3
CF DESCO	25 lb	0	0	0	12	82	94
HEC	25 kg	0	0	0	0	35	35
HYDROCLORIC A	liter	0	0	0	0	18	18
SODA ASH	50 KG	2	5	0	0	0	7
BENTONITE	M/T	18	29	2	0	0	49
BENTONITE SX	50 KG	26	63	40	6	0	135
ANTISOL FL 30	25 KG	0	0	257	44	6	307
MAGCO 101 INH	55 GA	0	0	0	1	0	1
OS-1L	55GAL	0	0	0	1	0	1
XC-POLYMER	25 KG	0	0	7	0	0	7
KCL - SXS	50 KG	0	0	1092	119	10	1221
KCL - BRINE	BBL	0	0	2135	0	0	2135