

Denne rapport  
tilhører

 **STATOIL**

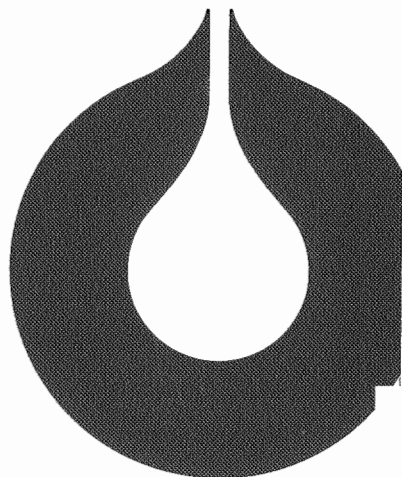
99. 595. 274-15

**L&U DOK.SENTER**

L.NR. 30284140009

KODE Well 34/10-11 nr3

Returneres etter bruk



**statoil**



Classification

Requested by

Jon Hanstveit, PL-050

Subtitle

Co-workers

Tone Ørke

Title

Reservoir Fluid Study  
for  
Statoil, Well 34/10-11  
**STATOIL**  
**EXPLORATION & PRODUCTION**  
**LABORATORY**  
by  
Arne M. Martinsen

March-84

LAB 84.214

Prepared

29/3-84 | Knut K. Meisingset  
*Knut Knutsen Meisingset*

Approved

29/3-84 <sup>for</sup> Per Thomassen  
*Per Thomassen*

## SUMMARY

This report presents PVT and compositional data for three samples from the Statfjord formation of well 34/10-11: One bottom hole sample and one set of separator samples from DST no. 1, collected at 2018 - 2028 m, and one set of separator samples from DST no. 2, collected at 1891 - 1896 m.

Compositional analysis and physical recombination has been performed on the separator samples.

Constant mass experiments have been carried out at three temperatures for the bottom hole sample and at the reservoir temperature for the recombined samples.

A three stage separator test has been carried out for the recombined sample from DST no. 2.

Compositional analysis after flash to standard conditions have been performed on the bottom hole sample and the recombined samples. The experimental data are compared in table 1.

Table 1. Comparison of experimental data for reservoir fluid samples from 34/10-11, Statfjord formation.

Composition, mole%\*

Components	DST no.1 bottom hole sample	DST no.1 recombined sep.sample	DST no.2 recombined sep.sample
Carbondioxide	0.21	0.17	0.18
Nitrogen	0.75	0.97	1.03
Methane	44.43	54.37	50.82
Ethane	6.08	5.86	5.86
Propane	4.74	4.12	4.39
iso-Butane	0.99	0.81	0.91
n-Butane	2.61	2.01	2.35
iso-Pentane	1.08	0.82	0.99
n-Pentane	1.52	1.07	1.37
Hexanes	2.22	1.53	1.98
Heptanes	3.79	2.61	3.39
Octanes	4.57	3.28	4.08
Nonanes	3.32	2.32	2.94
Decanes+	23.69	20.06	19.71
	100.00	100.00	100.00

Table 1 (continued)

	DST no.1 bottom hole sample	DST no.1 recombined sep.sample	DST no.2 recombined sep.sample
Reservoir temp. (°C)	80.0	80.0	75.6
Bubble-point pressure at res.temp. (barg)	213.9	301.9	272.1
Density at bubble point (g/cm <sup>3</sup> )	0.687	0.643	0.658
Gas/oil ratio from single flash (Sm <sup>3</sup> /m <sup>3</sup> )	149.5	207.6	195.0
Formation volume factor from single flash (m <sup>3</sup> /Sm <sup>3</sup> )	1.447	1.612	1.562
Mean molecular weight of stock-tank oil*	209	218	207
Density of stock-tank oil (g/cm <sup>3</sup> at 15°C)	0.840	0.843	0.837
Gravity of single flash gas (air = 1)	0.84	0.76	0.80

\* Stock-tank oil, flash gas and compositional data are from single flash of reservoir fluid to standard conditions: 15°C and 1 atm.

## 1. INTRODUCTION

Statoil Prolab was requested by the 34/10 license to perform PVT analyses on three different samples from well 34/10-11: One bottom hole sample and one set of separator samples from DST no. 1, and one set of separator samples from DST no. 2.

The analyses were carried out and preliminary results reported in 1981. The present report has been completed in March 1984. The present compositions have been slightly altered on the basis of a new value for the molecular weight of the C<sub>10</sub><sup>+</sup> distillation fraction, which was measured in 1984. No other change of the older data has been made.

## 2. SAMPLE DESCRIPTION

### Samples from DST no. 1

The samples were collected during the test in perforated interval 2018 - 2028 m.

The bottom hole sample was marked 8088-28. The opening pressure was about 95 bar and the bubble-point pressure at ambient about 175 bar. One should, however, note that the sampling equipment was dropped down the well by an accident at the end of the test (see test reports). One of the bottom hole samplers was reported to be undamaged; however, the risk of a leak was obviously increased.

The separator samples were marked 9024-91 (oil) and A-10914 (gas). The opening pressure of the oil bottle was approx. 15 barg. A validity check gave a bubble point pressure of about 16 barg at ambient, which is in agreement with the separator pressure of 17 barg at 4°C. The opening pressure of the gas bottle was also consistent with the separator pressure.

### Samples from DST no. 2

The separator samples were collected during the test in perforated interval 1891 - 1896m.

The samples were marked 20438-46 (oil) and A-10996 (gas). The opening pressure of the oil bottle was approx. 9 barg at ambient. The bubble-point pressure at ambient was about 11 barg, which is equal to the separator pressure at 13°C. The opening pressure of the gas bottle was also consistent with the separator pressure.

See sampling sheets in Appendix.

### 3. METHODS AND EQUIPMENT

PVT analyses were performed in a Ruska visual PVT cell. Single flash to standard conditions (15°C and 1 atm) was performed in a Ruska Flash Separator. The gas was sampled in a Ruska Gasometer.

Component analysis was performed using a Hewlett Packard 5880 gas-chromatographic system. For gas analysis, non hydrocarbons were determined on a poropak R 1/8" x 3 m steel column with TC detector, and hydrocarbons on chromapack Cp<sup>tm</sup>Sil 5 50 m x 0.22 mm quartz capillary column with FI detector. Oil analysis were performed on a gas chromatograph fitted with chromapack CP<sup>tm</sup>Sil 5 25 m x 0.22 m quartz capillary column and FI detector. Molecular weight was determined by freezing point depression of benzene, density by a Paar DMA 602 frequency densitometer.



## 4. RESULTS

### 4.1 Bottom hole sample no. 8088-28, DST no. 1

Results from the constant mass expansion experiments on the bottom-hole sample are shown in tables 2 to 4 and figures 1 to 3. The bubble-point pressure was found to be 191.1 barg at 34.0°C, 203.3 barg at 54.6°C, and 213.9 barg at 80.0°C. Results from single flash and the calculated reservoir-fluid composition are given in table 5.

### 4.2 Separator samples 9024-91 and A-10914, DST no. 1

Results from flash of separator liquid to standard conditions and a calculated separator-liquid composition are given in table 6. Data from analysis of separator gas and the calculated reservoir fluid composition are shown in table 7.

Results from the constant mass expansion experiment on the recombined fluid are shown in table 8 and fig. 4. The bubble-point pressure at 80°C was found to be 301.9 barg.

Results from single flash of the recombined reservoir fluid to standard conditions are shown in table 9. The derived reservoir-fluid composition agrees well with the calculated composition in table 7.

### 4.3 Separator samples 20438-46 and A-10996, DST no. 2

Results from flash of separator liquid to standard conditions and the calculated separator-liquid composition are given in table 10. Data from analysis of separator gas and the calculated reservoir-fluid composition are shown in table 11.

Results from the constant mass expansion experiment on the recombined fluid are shown in table 12 and fig. 5. The bubble-point pressure at 75.6°C was found to be 272.1 barg. Results from single flash of the recombined fluid and the derived reservoir-fluid composition are given in table 13. Results from a 3 stage separator test of the reservoir fluid are given in tables 14 and 15.

Table 2. Constant mass pressure volume analysis of bottom hole sample from DST no. 1, at 34°C (93.2°F)

Pressure Barg	Relative Volume	Y-factor
377.1	0.9764	
333.9	0.9808	
293.7	0.9854	
245.7	0.9915	
214.8	0.9960	
200.5	0.9987	
191.1 bubble point	1.0000	
186.8	1.0045	5.10
177.7	1.0153	4.94
163.3	1.0357	4.78
147.8	1.0672	4.39
118.8	1.1636	3.69
90.7	1.3570	3.10
63.3	1.7358	2.75
57.6	1.8724	2.66

$$\text{Y-factor} : \left( \frac{P_B - P}{P} \right) / \left( \frac{V}{V_B} - 1 \right)$$

$P_B$  = bubble point pressure

$V_B$  = bubble point volume

$P < P_B$

Table 3. Constant mass pressure volume analysis of bottom hole sample from DST no. 1, at 54.6°C (130.3°F)

Pressure Barg	Relative Volume	Y-factor
385.9	0.9762	
343.7	0.9810	
295.7	0.9875	
252.0	0.9935	
212.8	0.9993	
203.3	bubble point	1.0000
198.6	1.0051	4.64
190.1	1.0152	4.56
176.5	1.0360	4.21
154.3	1.0839	3.79
125.5	1.1841	3.37
100.5	1.3390	3.02
73.0	1.6634	2.69
50.0	2.2389	2.47

$$\text{Y-factor: } \left( \frac{P_B - P}{P} \right) / \left( \frac{V}{V_B} - 1 \right)$$

$P_B$  = bubble point pressure

$V_B$  = bubble point volume

$P < P_B$

Table 4. Constant mass pressure volume analysis of bottom hole from DST no. 1, at 80°C (176°F)

Pressure Barg	Relative Volume	Y-factor	Compressibility of saturated oil
391.6	0.9728		
338.9	0.9793		Average compressibility above bubble point: 16.1 x 10 <sup>-5</sup> vol/vol/bar
292.4	0.9876		
247.1	0.9951		
221.9	0.9997		
213.9	bubble point	1.0000	
211.5	1.0031	3.72	
198.5	1.0220	3.53	
184.2	1.0469	3.45	
154.9	1.1196	3.18	
118.3	1.2807	2.88	
88.9	1.5357	2.62	
68.2	1.8508	2.51	
58.3	2.1305	2.36	

$$\text{Y-factor} = \left( \frac{P_B - P}{P} \right) / \left( \frac{V}{V_B} - 1 \right)$$

$P_B$  = bubble point pressure

$V_B$  = bubble point volume

$P < P_B$

Table 5. Analysis of products from single flash of bottom hole sample from DST no. 1 and calculated reservoir fluid composition

Components	Oil		Density* g/cm <sup>3</sup>	Mol.weight* g/g mole	Gas mole%	Reservoir
	wt%	mole%				fluid mole%
Carbondioxide	-	-			0.34	0.21
Nitrogen	-	-			1.22	0.75
Methane	-	-			72.70	44.43
Ethane	0.025	0.17			9.84	6.08
Propane	0.155	0.73			7.29	4.74
iso-Butane	0.111	0.40			1.36	0.99
n-Butane	0.432	1.55			3.28	2.61
iso-Pentane	0.431	1.25			0.98	1.08
n-Pentane	0.712	2.06			1.17	1.52
Hexanes	1.800	4.32	0.681	87	0.88	2.22
Heptanes	4.041	8.70	0.736	97	0.67	3.79
Octanes	5.756	11.34	0.754	106	0.26	4.57
Nonanes	4.820	8.53	0.776	118	0.01	3.32
Decanes+	81.717	60.95	0.870	280	-	23.69
	<u>100.000</u>	<u>100.00</u>			<u>100.00</u>	<u>100.00</u>

Gor, SM <sup>3</sup> /M <sup>3</sup>	:	149.5
Bo, M <sup>3</sup> /M <sup>3</sup>	:	1.447
Density of oil, g/cm <sup>3</sup>	:	0.840
Gravity of gas	:	0.84
Density of res. fluid, g/cm <sup>3</sup>	:	0.687
Calculated mol. weight of oil, g/g mole	:	209

\* From TBP distillation reported in LAB 84.213.

Table 6. Hydrocarbon analysis of oil and gas from flash of separator oil. DST no. 1

Components	Oil		Gas mole%	Recombined	Density* g/cm <sup>3</sup>	Mol.weight* g/g mole
	wt%	mole%		separator fluid mole%		
Carbondioxide	-		0.32	0.06		
Nitrogen	-		0.08	0.02		
Methane	-		41.37	7.43		
Ethane	-		20.29	3.64		
Propane	-		21.42	3.84		
iso-Butane	0.544	1.90	3.67	2.22		
n-Butane	1.288	4.49	7.64	5.06		
iso-Pentane	0.703	1.98	1.72	1.93		
n-Pentane	0.997	2.80	1.84	2.63		
Hexanes	2.018	4.70	1.05	4.05	0.681	87
Heptanes	3.792	7.93	0.52	6.60	0.736	97
Octanes	5.379	10.29	0.08	8.46	0.754	106
Nonanes	4.167	7.16	-	5.88	0.776	118
Decanes+	81.112	58.75	-	48.18	0.870	280
	<u>100.000</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>		

Gor of sep. oil, SM<sup>3</sup>/m<sup>3</sup> : 21.3  
 Bo of sep. oil, M<sup>3</sup>/m<sup>3</sup> : 1.094  
 Density of stock-tank oil, g/cm<sup>3</sup> : 0.835  
 Calculated mol.weight of stock-tank oil, g/g mole : 203

\* From TBP distillation reported in LAB 84.213.

Table 7. Hydrocarbon Analysis of Separator Products and Calculated Wellstream Composition. DST no. 1

Components	Separator Liquid mole%	Separator gas mole%	Reservoir fluid mole%
Carbondioxide	0.06	0.27	0.18
Nitrogen	0.02	1.58	0.93
Methane	7.43	86.77	53.61
Ethane	3.64	7.17	5.70
Propane	3.84	2.94	3.32
iso-Butane	2.22	0.32	1.11
n-Butane	5.06	0.60	2.46
iso-Pentane	1.93	0.11	0.87
n-Pentane	2.63	0.11	1.16
Hexanes	4.05	0.07	1.73
Heptanes	6.60	0.05	2.79
Octanes	8.46	0.01	3.55
Nonanes	5.88	-	2.45
Decanes+	48.18	-	20.14
	100.00	100.00	100.00

GOR (separator):  $151.1 \text{ SM}^3/\text{M}^3$  (848 SCF/sep.bbl).

Table 8. Constant mass pressure volume analysis of recombined sample from DST no. 1, at 80°C (176°F)

Pressure Barg	Relative Volume	Y-factor	Compressibility of saturated oil
387.8	0.9828		
346.2	0.9900		Average compressibility above bubble point: 19.5 x 10 <sup>-5</sup> vol/vol/barg
319.6	0.9954		
305.0	0.9987		
301.9	bubble point	1.0000	
294.2	1.0056	4.69	
275.9	1.0211	4.48	
266.0	1.0310	4.37	
256.4	1.0413	4.29	
247.6	1.0512	4.29	
237.8	1.0648	4.16	
227.0	1.0809	4.08	
216.7	1.0993	3.96	
206.9	1.1189	3.86	
177.7	1.1955	3.58	
139.7	1.3632	3.20	
138.8	1.3733	3.15	
111.5	1.5807	2.94	
97.6	1.7466	2.80	
74.0	2.1801	2.61	
44.3	3.4541	2.37	

$$\text{Y-factor: } \left( \frac{P_B - P}{P} \right) / \left( \frac{V}{V_B} - 1 \right)$$

$P_B$  = bubble point pressure

$V_B$  = bubble point volume

$P < P_B$



Table 9. Analysis of products from single flash of recombined separator fluid and calculated reservoir fluid composition. DST no. 1

Components	Oil		Density* g/cm <sup>3</sup>	Mol.weight* g/g mole	Gas mole%	Reservoir
	wt%	mole%				fluid mole%
Carbondioxide	-	-			0.25	0.17
Nitrogen	-	-			1.40	0.97
Methane	-	-			78.37	54.37
Ethane	0.001	0.01			8.44	5.86
Propane	0.103	0.51			5.72	4.12
iso-Butane	0.080	0.30			1.03	0.81
n-Butane	0.299	1.12			2.40	2.01
iso-Pentane	0.343	1.03			0.73	0.82
n-Pentane	0.531	1.60			0.83	1.07
Hexanes	1.510	3.78	0.681	87	0.54	1.53
Heptanes	3.558	7.98	0.736	97	0.24	2.61
Octanes	5.169	10.61	0.754	106	0.05	3.28
Nonanes	4.101	7.56	0.776	118	-	2.32
Decanes+	84.305	65.50	0.870	280	-	20.06
	<u>100.000</u>	<u>100.00</u>			<u>100.00</u>	<u>100.00</u>

Gor, SM <sup>3</sup> /M <sup>3</sup>	:	207.6
Bo, M <sup>3</sup> /M <sup>3</sup>	:	1.612
Density of oil, g/cm <sup>3</sup>	:	0.843
Gravity of gas	:	0.76
Density of res. fluid, g/cm <sup>3</sup>	:	0.643
Calculated mol. weight of oil, g/g mole	:	218

\* From TBP distillation reported in LAB 84.213.

Table 10. Hydrocarbon analysis of oil and gas from flash of separator oil. DST no. 2

Components	Oil		Gas	Recombined separator fluid	Density* g/cm <sup>3</sup>	Mol.weight* g/g mole
	wt%	mole%	mole%	mole%		
Carbondioxide	-	-	0.30	0.04		
Nitrogen	-	-	0.11	0.01		
Methane	-	-	38.56	4.96		
Ethane	0.024	0.16	20.58	2.79		
Propane	0.386	1.75	23.08	4.49		
iso-Butane	0.292	1.00	4.03	1.39		
n-Butane	0.976	3.35	8.26	3.98		
iso-Pentane	0.766	2.12	1.82	2.08		
n-Pentane	1.067	2.95	1.96	2.82		
Hexanes	2.195	5.03	0.93	4.50	0.681	87
Heptanes	4.342	8.92	0.34	7.82	0.736	97
Octanes	5.662	10.65	0.03	9.28	0.754	106
Nonanes	4.142	7.00	-	6.10	0.776	118
Decanes+	80.148	57.07	-	49.74	0.870	280
	<u>100.000</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>		

Gor of sep. oil, SM<sup>3</sup>/m<sup>3</sup> : 14.5  
 Bo of sep. oil, M<sup>3</sup>/m<sup>3</sup> : 1.062  
 Density of stock-tank oil, g/cm<sup>3</sup> : 0.828  
 Calculated mol. weight of stock-tank oil, g/g mole : 199

\* From TBP distillation reported in LAB 84.213.

Table 11. Hydrocarbon Analysis of Separator Products and Calculated Wellstream Composition. DST no. 2

Components	Separator Liquid mole%	Separator gas mole%	Reservoir fluid mole%
Carbondioxide	0.04	0.28	0.18
Nitrogen	0.01	1.58	0.92
Methane	4.96	85.38	51.57
Ethane	2.79	7.57	5.56
Propane	4.49	3.54	3.94
iso-Butane	1.39	0.42	0.83
n-Butane	3.98	0.79	2.13
iso-Pentane	2.08	0.15	0.96
n-Pentane	2.82	0.17	1.29
Hexanes	4.50	0.07	1.93
Heptanes	7.82	0.04	3.31
Octanes	9.28	0.01	3.91
Nonanes	6.10	-	2.56
Decanes+	49.74	-	20.91
	100.00	100.00	100.00

GOR (separator):  $146.2 \text{ SM}^3/\text{M}^3$  (82.8 SCF/sep.bbl)

Table 12. Constant mass pressure volume analysis of recombined sample from DST no. 2 at 75.6°C (168°F)

Pressure Barg	Relative Volume	Y-factor	Compressibility of saturated oil
387.8	0.9794		
357.2	0.9846		Average compressibility above bubble point: 18.7 x 10 <sup>-5</sup> vol/vol/bar
330.0	0.9899		
299.1	0.9958		
278.0	0.9997		
272.1	bubble point	1.0000	
268.2	1.0033	4.30	
254.0	1.0174	4.09	
229.8	1.0466	3.95	
196.6	1.1030	3.73	
171.0	1.1682	3.51	
141.5	1.2919	3.16	
96.6	1.6596	2.75	
70.6	2.1212	2.54	
32.4	4.3046	2.24	

$$\text{Y-factor: } \left( \frac{P_B - P}{P} \right) / \left( \frac{V}{V_B} - 1 \right)$$

$P_B$  = bubble point pressure

$V_B$  = bubble point volume

$P < P_B$

Table 13. Analysis of products from single flash of recombined separator fluid and calculated reservoir fluid composition. DST no. 2

Components	Oil		Density* g/cm <sup>3</sup>	Mol.weight* g/g mole	Gas mole%	Reservoir
	wt%	mole%				fluid mole%
Carbondioxide	-	-			0.27	0.18
Nitrogen	-	-			1.54	1.03
Methane	-	-			75.68	50.82
Ethane	0.016	0.11			8.67	5.86
Propane	0.126	0.59			6.24	4.39
iso-Butane	0.098	0.35			1.19	0.91
n-Butane	0.384	1.37			2.83	2.35
iso-Pentane	0.418	1.20			0.89	0.99
n-Pentane	0.696	2.00			1.06	1.37
Hexanes	1.856	4.43	0.681	87	0.79	1.98
Heptanes	4.245	9.08	0.736	97	0.60	3.39
Octanes	6.120	11.98	0.754	106	0.22	4.08
Nonanes	5.074	8.92	0.776	118	0.02	2.94
Decanes+	80.967	59.98	0.870	280	-	19.71
	<u>100.000</u>	<u>100.00</u>			<u>100.00</u>	<u>100.00</u>

Gor, SM <sup>3</sup> /M <sup>3</sup>	:	195.0
Bo, M <sup>3</sup> /M <sup>3</sup>	:	1.562
Density of oil, g/cm <sup>3</sup>	:	0.837
Gravity of gas	:	0.80
Density of res. fluid, g/cm <sup>3</sup>	:	0.658
Calculated mol. weight of oil, g/g mole	:	207

\* From TBP distillation reported in LAB 84.213.

Table 14. Separator test of the recombined separator fluid.  
DST no. 2

Pressure Barg	Temp. °C	Gas/oil ratio(1)	Gas/oil ratio(2)	Stock-tank oil density 15°C(g/cm <sup>3</sup> )	Formation volume factor(3)	Separator volume factor(4)
67.9	41.2	112.6	134.0			1.191
to						
21.5	85.6	31.9	36.6			1.147
to						
0	15	17.0	17.0	0.8291	1.539	1.000

- (1) Gas/oil ratio in cubic meters of gas at 15°C and 0 Barg per cubic meter of oil at indicated pressure and temperature.
- (2) Gas/oil ratio in cubic meters of gas at 15°C and 0 Barg per cubic meter of stock tank oil at 15°C.
- (3) Formation volume factor is cubic meters of saturated oil at 272.0 Barg and 75.6°C per cubic meter of stock-tank oil at 15°C.
- (4) Separator volume factor is cubic meters of oil at indicated pressure and temperature per cubic meter of stock-tank oil at 15°C.

Table 15. Analysis of Separator Gases from 3 stage separator test of the reservoir fluid. DST no. 2

Pressure, Barg	68.9	22.5	0
Temperature, °C	41.2	85.6	75
Components	mole%	mole%	mole%
Carbondioxide	0.26	0.44	0.61
Nitrogen	1.97	0.58	-
Methane	88.32	73.65	41.77
Ethane	5.78	12.33	21.93
Propane	2.32	7.25	20.69
iso-Butane	0.29	1.06	3.37
n-Butane	0.56	2.24	6.83
iso-Pentane	0.13	0.58	1.54
n-Pentane	0.15	0.68	1.58
Hexanes	0.11	0.52	0.92
Heptanes+	0.11	0.67	0.76
	100.00	100.00	100.00
Calculated gas gravity (air=1)	0.640	0.798	1.130

FIG.1

# CONSTANT MASS EXPANSION AT 34.0 °C

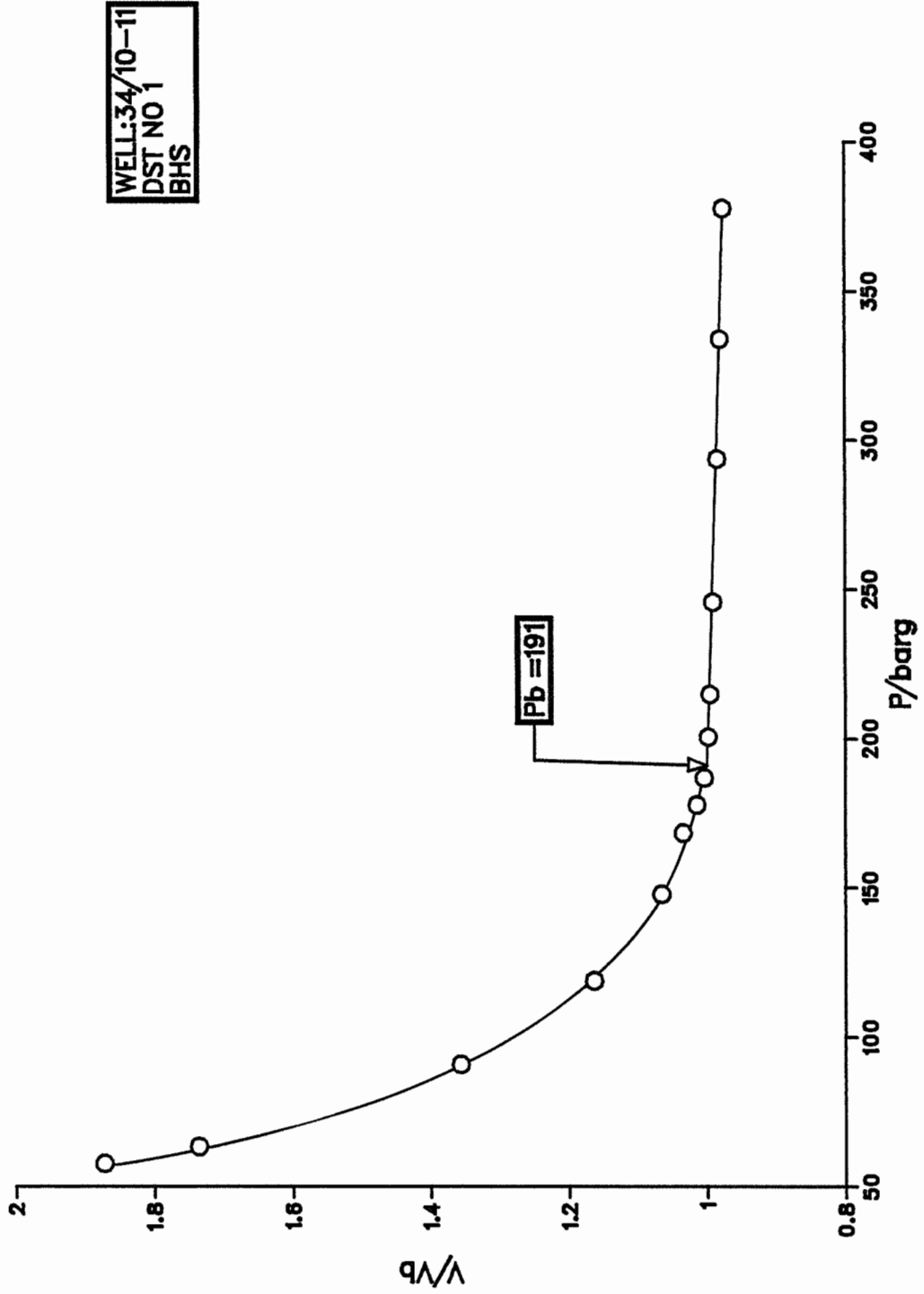




FIG.2

# CONSTANT MASS EXPANSION AT 34.1 °C

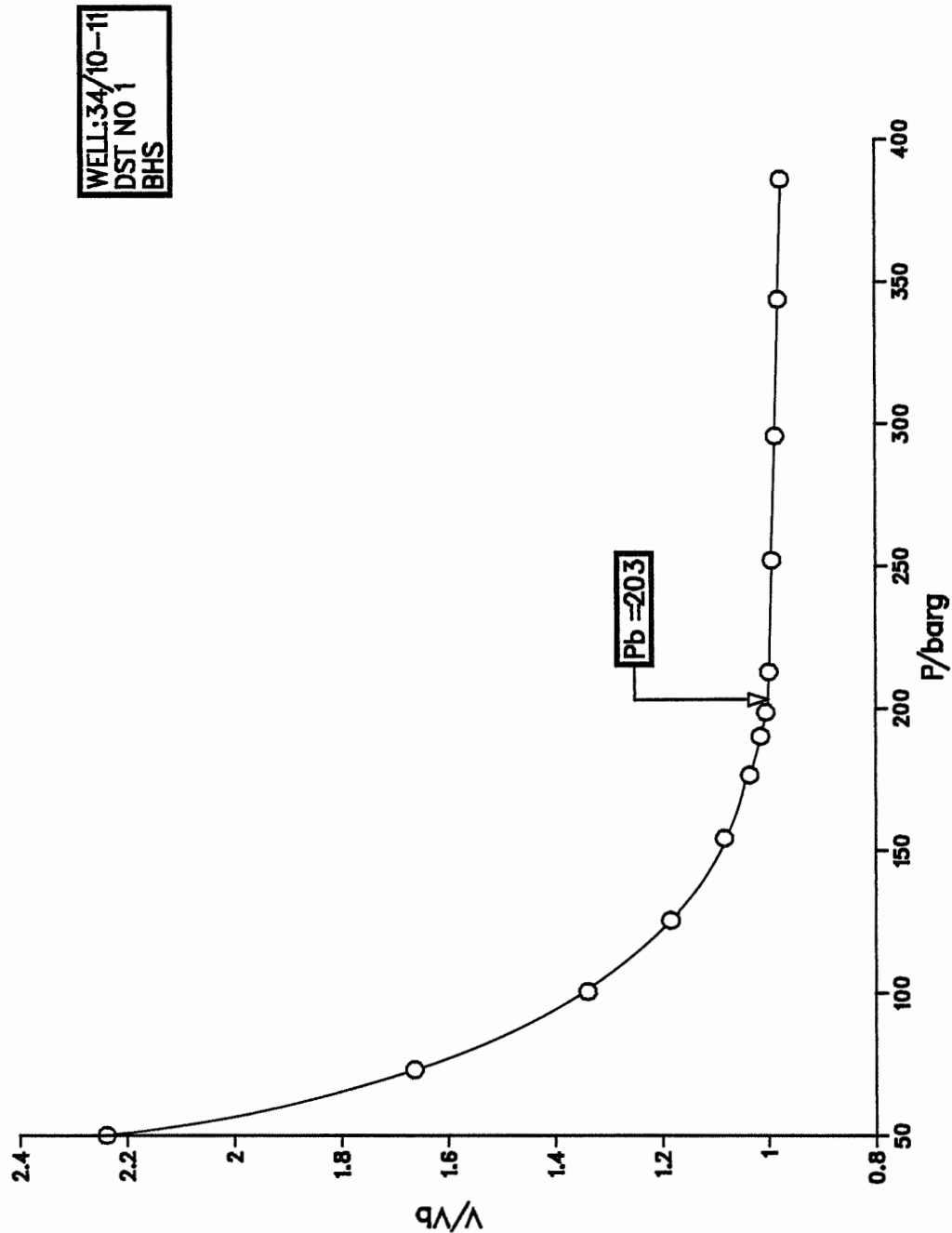


FIG.3

CONSTANT MASS EXPANSION AT 80.0 °C

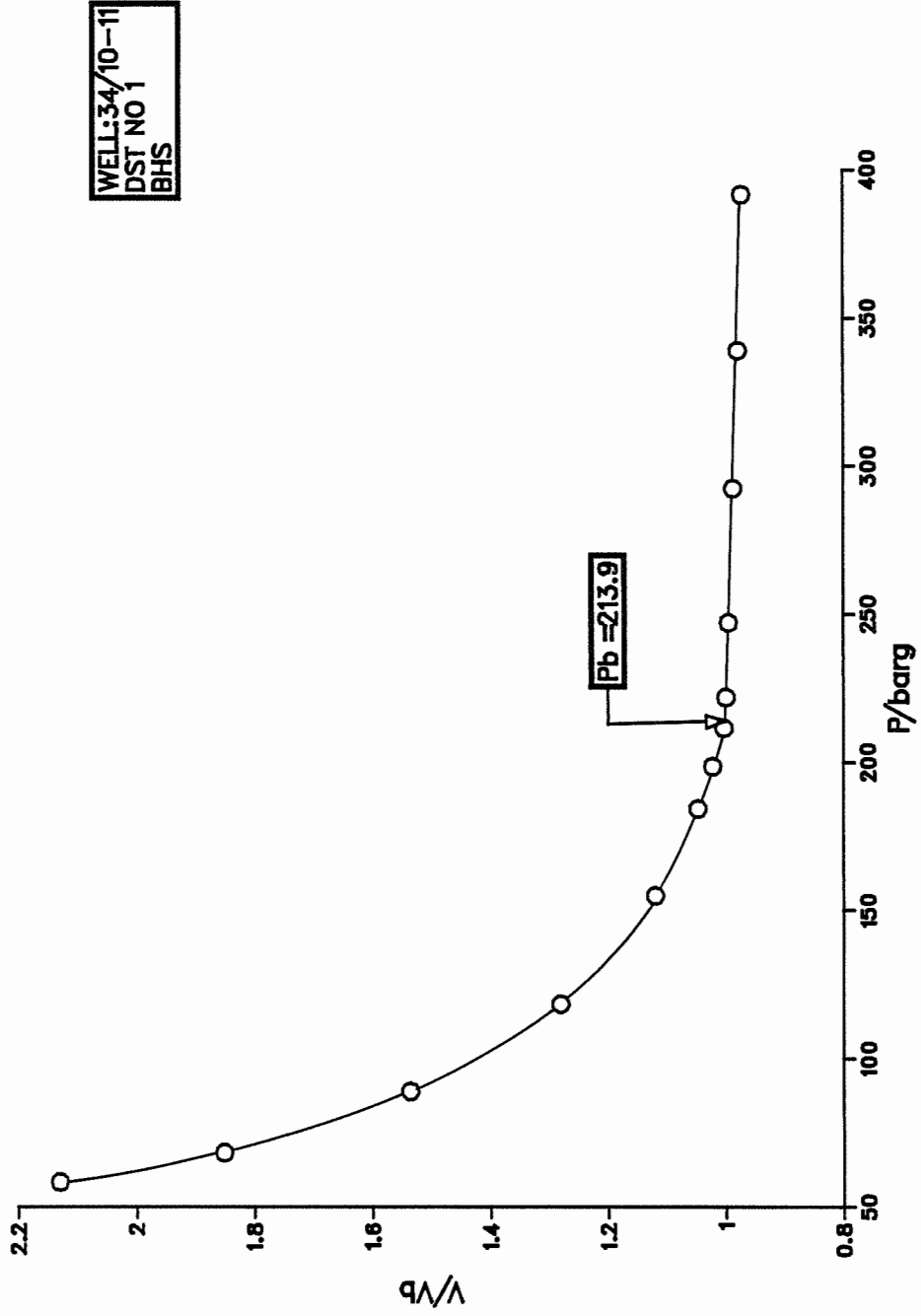


FIG.4

# CONSTANT MASS EXPANSION AT 80.0 °C

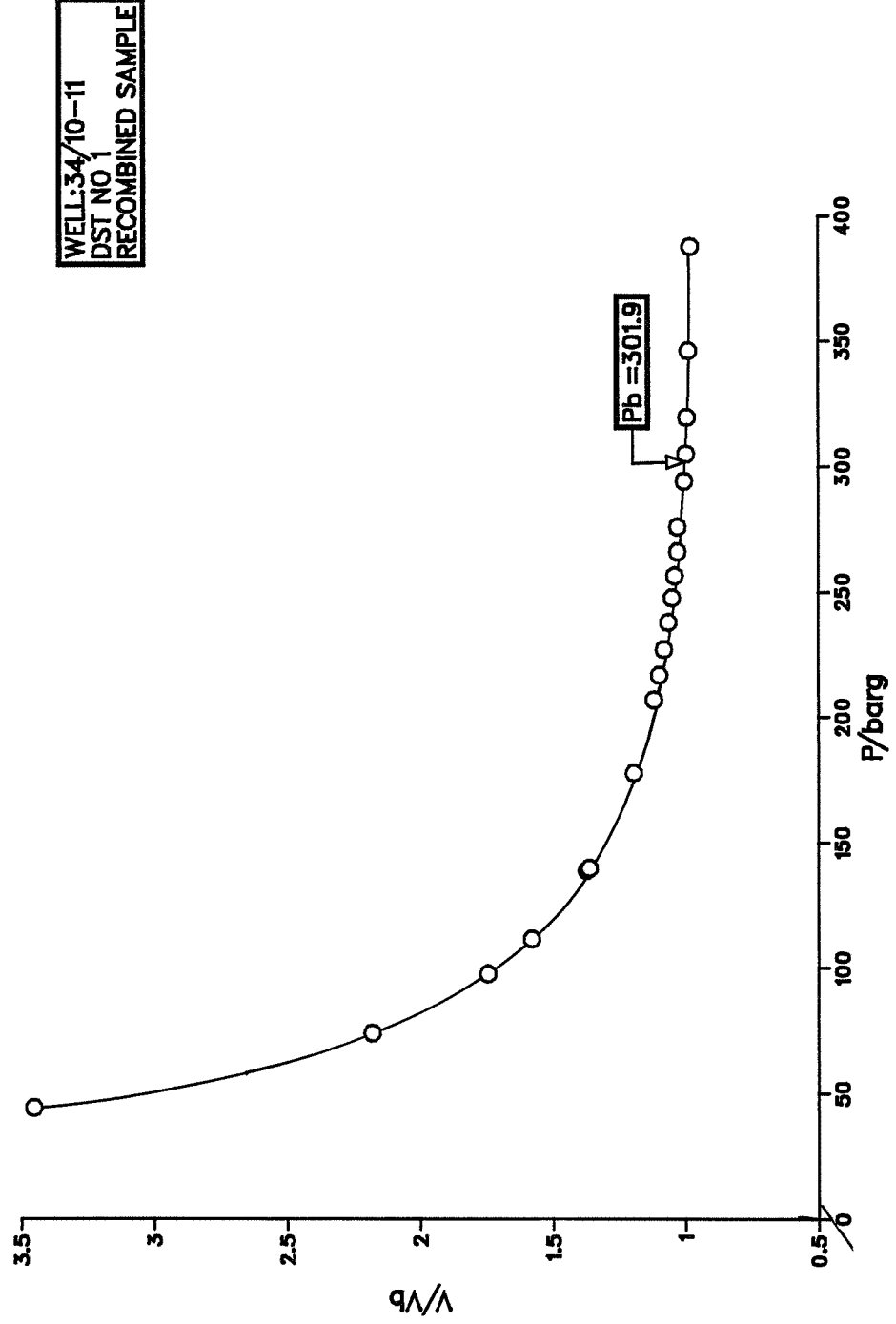
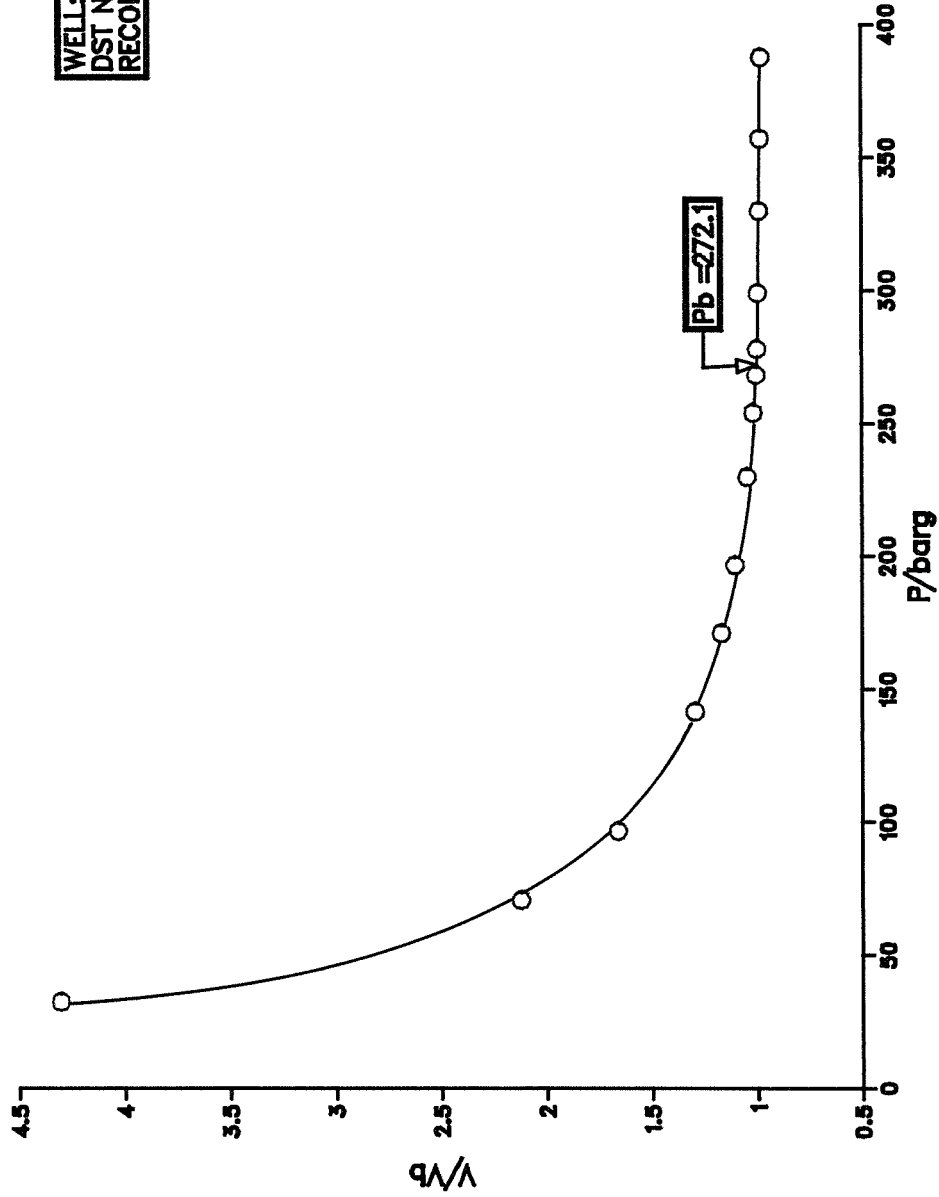


FIG.5

# CONSTANT MASS EXPANSION AT 75.6 °C



**A P P E N D I X**

FLOPETROL

Client : STATOIL

Section: ANNEX 4.1

Base : STAVANGER

Field : GULLBLOKKA

Page : 16

Well : 34/10-II

Report No: 81/2301/1

- BOTTOM HOLE SAMPLING -

Date of sampling : 20.02.81 Service order : \_\_\_\_\_ Sampling No : 2  
Sample nature : Liquid Sampling depth : 1970 m

A - RESERVOIR AND WELL CHARACTERISTICS -

Producing zone : STATEJORD Perforations : 2018-2028 m Sampling interval : Same

Depth origin : RKB Tubing Dia : 3 1/2" Casing Dia : 7"  
Surface elevation : 25 m Shoe : 2013.9 m Shoe : 2154 m

Bottom hole static conditions Initial pressure : 4775 psia at depth : 2006.4 m date : 19.02.81  
Latest pressure measured : 4774.5 psia at depth : 2006.4 m date : 19.02.81  
Temperature : 77 °C at depth : 2006.4 m date : 19.02.81

B - SAMPLING AND TRANSFER CHARACTERISTICS -

Sampler Type and No . FLOPETROL Capacity : 600 cc

Time at which sample was taken : 01.45 Test Running start : 14.30 - 18.02.81  
duration Pulling end : 10.15 - 20.02.81

Well shut in since : - Time elapsed since closing well : -  
 Well flowing through choke : 8 /64" Production duration through this choke : 0.37 hrs.

Production cond during sampling or before closing: Bottom hole pressure 4764.6 psia Well head pressure: 2755 psia Separator pressure: 80 psia  
2006.4 m ft. temp. : 79.5 °C temp. : \_\_\_\_\_ temp. : 40 °F  
Flow rates: 0.34 mm SCFD WLR. : - Specific Gravity Gas (air:1): 0.647  
333 BOPD Prod.GOR.: 1020 Oil : 0.831

Opening pressure of the first valve (if necessary) : 1390 psig

Estimated bubble point under bottom hole conditions :  
Temp. : 79.5 °C Pressure : 3200 psig

Transfer conditions.  By gravity  By pumping Hg collected at transferring end : -  
Temp : 45 °F Pressure : 5000 psig volume remaining in the shipping bottle : 25 cc

Final conditions of shipping bottle after decompression : Hg volume withdrawn for bottle decompression :  
Temp : 45 °F Pressure : 1450 psig 105 cc

C - IDENTIFICATION OF THE SAMPLE -

Shipping bottle No : 8088-28 sent on : \_\_\_\_\_ by : \_\_\_\_\_ Shipping order No. : \_\_\_\_\_  
Addressee : \_\_\_\_\_

Coupled with	LIQUID	GAS
Bottom hole samples No	_____	_____
Surface samples No	_____	_____

D - REMARKS -

As the sampler was dropped down the well (by accident) the sample might not be representative

Visa Chief operator

Terje Baustad

No. : DOP 128

# FLOPETROL

Client : STATOIL

Section : ANNEX

**42**Base : STAVANGERField : GULLBLOKKA  
Well : 34/10-11Page : 17  
Report N° : 81/2301/10

DST #1

SURFACE SAMPLINGDate of sampling : 19.02.81 Service order : \_\_\_\_\_ Sampling No. : 1  
Sample nature : Liquid Sampling point : Sep. oil-outletA - RESERVOIR AND WELL CHARACTERISTICS-Producing zone : STATFJORD Perforations : 2018-2028 m Sampling interval : SameDepth origin : RKB Tubing Dia. : 3 1/2" Casing Dia. : 7"  
Surface elevation : 25 m Shoe : 2013.9 m Shoe : 2154 mBottom hole static conditions  
Initial pressure : 4775 psia at depth : 2006.4 m date : 19.02.81  
Latest pressure measured : 4774.5 psia at depth : 2006.4 m date : 19.02.81  
Temperature : 77.5 °C at depth : 2006.4 m date : 19.02.81B - MEASUREMENT AND SAMPLING CONDITIONSTime at which sample was taken : 16.55 Time elapsed since stabilisation : 1.00 hourBottom hole dynamic conditions  
Choke size : 24/64" since : 13.27 Well head pressure : 2361 psia Well head temp. : 66 °F  
Bottom hole pressure : 4413 psia at depth : 2006.4 m date : 19.02.81  
Bottom hole temp. : 79.9 °C at depth : 2006.4 m date : 19.02.81Flow measurement of sampled gas - Gravity (air: 1) : 0.647 Factor  $F_{pv} = \frac{1}{\sqrt{Z}}$  : 1.0278  
Values used for calculations :Separator Pressure : 245 PSIG Rates - Gas : 2.15 mm SCFD GOR : 848  
Temp. : 39 °F Oil (separator cond.) : 2540 BOPD (separator cond.)Stock tank Atmosphere : - mmHg. - °F Oil at 60°F : 2273 BOPD  
Tank temperature : - °FBSW : 0 % WLR : - %Transferring fluid : mercury Transfer duration : 0.40 hoursFinal conditions of the shipping bottle :  
Pressure : 200 psig Temp. : 45 °FC - IDENTIFICATION OF THE SAMPLEShipping bottle No. : 9024.91 sent on : \_\_\_\_\_ by : \_\_\_\_\_ Shipping order No. : \_\_\_\_\_  
Addressee : \_\_\_\_\_

Coupled with	LIQUID	GAS
Bottom hole samples No.	_____	_____
Surface samples No.	_____	<u>A-10914</u>

Measurement conditions.

 Tank -                       Meter -                       Dump -  
 Corrected with shrinkage tester -                       Corrected with tank -
D - REMARKS -

13 cc of hg left in bottle

Visa Chief Operator

Terje Baustad

# FLOPETROL

Client : STATOIL

Section : ANNEX

**42**Base : STAVANGERField : GULLBLOKKAPage : 18Well : 34/10-11Report N° : 81/2301/10

DST#1

**SURFACE SAMPLING**

Date of sampling : 19.02.81 Service order : \_\_\_\_\_ Sampling No. : 1  
 Sample nature : Gas Sampling point : Sep. gas outlet

**A - RESERVOIR AND WELL CHARACTERISTICS-**

Producing zone : STATEJORD Perforations : 2018-2028 m Sampling interval : Same  
 Depth origin : RKB Tubing Dia. : 3 1/2" Casing Dia. : 7"  
 Surface elevation : 25 m Shoe : 2013.9 m Shoe : 2154 m

Bottom hole static conditions	Initial pressure	: <u>4775 psia</u>	at depth : <u>2006.4 m</u>	date : <u>19.02.81</u>
	Latest pressure measured	: <u>4774.5 psia</u>	at depth : <u>2006.4 m</u>	date : <u>19.02.81</u>
	Temperature	: <u>77 °C</u>	at depth : <u>2006.4 m</u>	date : <u>19.02.81</u>

**B - MEASUREMENT AND SAMPLING CONDITIONS**Time at which sample was taken : 16.55 Time elapsed since stabilisation : 1.00 hour

Bottom hole dynamic conditions	Choke size	: <u>24/64"</u>	since : <u>13.27</u>	Well head pressure : <u>2361 psia</u>	Well head temp. : <u>66 °F</u>
	Bottom hole pressure	: <u>4413 psia</u>	at depth : <u>2006.4 m</u>	date : <u>19.02.81</u>	
	Bottom hole temp.	: <u>79.9 °C</u>	at depth : <u>2006.4 m</u>	date : <u>19.02.81</u>	

Flow measurement of sampled gas - Gravity (air: 1) : 0.647 Factor Fpv =  $\frac{1}{VZ}$  : 1.0278  
 Values used for calculations :

Separator	Pressure	: <u>245 PSIG</u>	Rates - Gas	: <u>2.15 mm SCFD</u>	GOR : <u>848</u>
	Temp.	: <u>39 °F</u>	Oil (separator cond.)	: <u>2540 BOPD</u>	<input checked="" type="checkbox"/> (separator cond.)
Stock tank	Atmosphere	: <u>- mmHg.</u>	Oil at 60°F	: <u>2273 BOPD</u>	<input type="checkbox"/>
	Tank temperature	: <u>- °F</u>			<input type="checkbox"/>

BSW : 0 % WLR : - %Transferring fluid : EVACUATED CONTAINER Transfer duration : 0.40 hours

Final conditions of the shipping bottle :  
 Pressure : 250 psia Temp. : 45 °F

**C - IDENTIFICATION OF THE SAMPLE**Shipping bottle No. : A-10914 sent on : \_\_\_\_\_ by : \_\_\_\_\_ Shipping order No. : \_\_\_\_\_  
Addressee : \_\_\_\_\_

Coupled with	LIQUID	GAS
Bottom hole samples No.	_____	_____
Surface samples No.	<u>9024-91</u>	_____

Measurement conditions.

Tank -  Meter -  Dump -  
 Corrected with shrinkage tester -  Corrected with tank -

D - REMARKS -

Visa Chief Operator

Terje Baustad



# FLOPETROL

Client : STATOIL

Section : ANNEX

**42**

Base : STAVANGER

Field : GULLBLOKKA

Page : 21

Well : 34/10-11

Report N° : 81/2301/10

DST # 2

**SURFACE SAMPLING**

Date of sampling : 23.02.81 Service order : \_\_\_\_\_ Sampling No. : 2  
 Sample nature : oil Sampling point : sep. oil outlet

**A - RESERVOIR AND WELL CHARACTERISTICS-**

Producing zone : Brent Statfjord Perforations : 1891-1896 m Sampling interval : Same

Depth origin : RKB Tubing Dia. : 3 1/2" Casing Dia. : 7"  
 Surface elevation : 25 m Shoe : 1886 m Shoe : 2154 m

Bottom hole static conditions	Initial pressure : 4617 psia at depth : 1864.7 m date : 22.02.81
	Latest pressure measured : 4634 psig at depth : 1879.1 m date : 23.02.81
	Temperature : 168 °F at depth : 1864.7 m date : 23.02.81

**B - MEASUREMENT AND SAMPLING CONDITIONS**

Time at which sample was taken : 8.15 Time elapsed since stabilisation : 3 hours

Bottom hole dynamic conditions	Choke size : 20/64" since : 3.46 Well head pressure : 2728 psi Well head temp. : 76 °F
	Bottom hole pressure : 4591 psig at depth : 1879.1 m date : 23.02.81
	Bottom hole temp. : 168 °F at depth : 1864.7 m date : 23.02.81

Flow measurement of sampled gas - Gravity (air: 1) : 0.656 Factor Fpv =  $\frac{1}{\sqrt{Z}}$  : 1.0156  
 Values used for calculations :

Separator	Pressure : 150 PSIG	Rates - Gas : 1.9000 mm SCFD	GOR : 855 scf/bbl (separator cond.)
	Temp. : 56 °F	Oil (separator cond.) : 2222 BOPD	

Stock tank	Atmosphere : 760 mmHg. 40 °F	Oil at 60°F : 2043 BOPD
	Tank temperature : 56 °F	

BSW : 0 % WLR : - %

Transferring fluid : mercury

Transfer duration : 0.35 hours

Final conditions of the shipping bottle :  
 Pressure : 110 psig Temp. : 40 °F

**C - IDENTIFICATION OF THE SAMPLE**Shipping bottle No. : 20438 - 46 sent on : \_\_\_\_\_ by : \_\_\_\_\_ Shipping order No. : \_\_\_\_\_  
Addressee : \_\_\_\_\_

Coupled with

Bottom hole samples No.

Surface samples No.

LIQUID

GAS

1) 20584-13

3) 8088-33

1)A-10932

2)A-10996

3)A-10938

Measurement conditions.

 Tank - Meter - Dump - Corrected with shrinkage tester - Corrected with tank -**D - REMARKS -**

10cc hg. left in bottle

Visa Chief Operator

Terje Baustad

Client : STAVOLL

Section : ANNEX

42

Base : STAVANGER

Field : GULLBLOKKA

Page : 22

Well : 34/10-11

Report N° : 81/2301/10

DST# 2

### SURFACE SAMPLING

 Date of sampling : 23.02.81 Service order : \_\_\_\_\_ Sampling No. : 2  
 Sample nature : Gas Sampling point : Sep. gas outlet

### A - RESERVOIR AND WELL CHARACTERISTICS--

 Producing zone : Brent Statfjord Perforations : 1891-1896 m Sampling interval : Same  
 Depth origin : RKB Tubing Dia. : 3 1/2" Casing Dia. : 7"  
 Surface elevation : 25 m Shoe : 1886 m Shoe : 2154 m

Bottom hole static conditions	Initial pressure	: <u>4617 psia</u>	at depth : <u>1864.7 m</u>	date : <u>22.02.81</u>
	Latest pressure measured	: <u>4634 psig</u>	at depth : <u>1879.1 m</u>	date : <u>23.02.81</u>
	Temperature	: <u>168 °F</u>	at depth : <u>1864.7 m</u>	date : <u>23.02.81</u>

### B - MEASUREMENT AND SAMPLING CONDITIONS

 Time at which sample was taken : 8.15 Time elapsed since stabilisation : 3 hours

Bottom hole dynamic conditions	Choke size : <u>20/64"</u> since : <u>3.46</u>	Well head pressure : <u>2728 PSI</u>	Well head temp. : <u>76 °F</u>
	Bottom hole pressure : <u>4591 psig</u>	at depth : <u>1879.1 m</u>	date : <u>23.02.81</u>
	Bottom hole temp. : <u>168 °F</u>	at depth : <u>1864.7 m</u>	date : <u>23.02.81</u>

 Flow measurement of sampled gas - Gravity (air: 1) : 0.656 Factor Fpv =  $\frac{1}{\sqrt{Z}}$  : 1.0156  
 Values used for calculations :

Separator	Pressure : <u>150</u> PSIG	Rates - Gas : <u>1.9000</u> mm SCFD	GOR : <u>855</u> scf/bbl
	Temp. : <u>56</u> °F	Oil (separator cond.) : <u>2222</u> BOPD	(separator cond.)
Stock tank	Atmosphere : <u>760</u> mmHg.	<u>40</u> °F	Oil at 60°F : <u>2043</u> BOPD
	Tank temperature : _____	<u>56</u> °F	<input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> E <input checked="" type="checkbox"/> b

 BSW : 0 % WLR : - %

 Transferring fluid : Vacuumed bottle Transfer duration : 0.35 hours

 Final conditions of the shipping bottle :  
 Pressure : 165 psig Temp. : 40 °F

### C - IDENTIFICATION OF THE SAMPLE

 Shipping bottle No. : A-10996 sent on : \_\_\_\_\_ by : \_\_\_\_\_ Shipping order No. : \_\_\_\_\_  
 Addressee : \_\_\_\_\_

Coupled with	LIQUID	GAS
Bottom hole samples No.	_____	_____
Surface samples No.	1) <u>20584-13</u> 2) <u>20438-46</u> 3) <u>8088-33</u>	1) <u>A-10932</u> 3) <u>A-10938</u>

Measurement conditions.

 Tank -  Meter -  Dump -  
 Corrected with shrinkage tester -  Corrected with tank -

D - REMARKS -

Visa Chief Operator

Terje Baustad