

Denne rapport
tilhører

 **STATOIL**

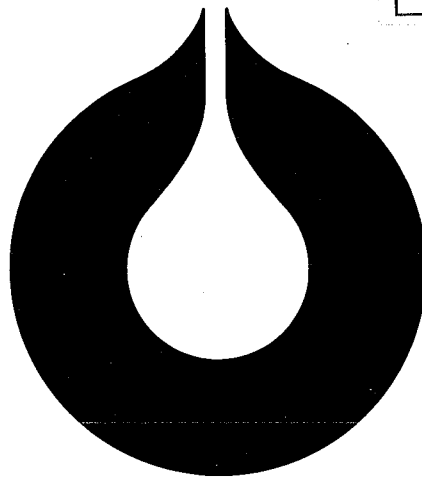
01.525.179-8

L&U DOK. SENTER

L. NR. 20084480028

KODE Well 31/6-5 nr.32

Returneres etter bruk



statoil

Well 31/6-5
Compositional Analysis
of
Separator Samples

**STATOIL
EXPLORATION & PRODUCTION
LABORATORY**

vember 1984

LAB 84.

Den norske stats oljeselskap a.s



Classification

Requested by

Arne Martinsen, LET-S

Subtitle

Co-workers

Bodil Fjæreide Sømme, Torbjørg Log Frantzen
Eivind Osjord, Liv Tau

Title

Well 31/6-5
Compositional Analysis
of
Separator Samples

STATOIL
EXPLORATION & PRODUCTION
LABORATORY

November 1984

LAB 84.246

Prepared

22/11-84

Otto Rogne
Otto Rogne

Approved

Per Thomassen

Per Thomassen

CONTENTS

	Page
INTRODUCTION	1
SAMPLES	2
NAUTILUS SAMPLES	
Bubble point of sep liquid	3
Composition of sep liquid	4
Composition of reservoir fluid	5
SEPARATOR SAMPLES	
Bubble point of sep liquid	6
Composition of sep liquid	7
Detailed composition of sep liquid	8
Composition of sep gas	9
Composition of reservoir fluid	10
Detailed composition of res fluid	11

INTRODUCTION

Compositional analysis of two sets of separator samples from well 31/6-5, DST 1, have been carried out as requested. One sample set was from the Nautilus mini lab., the other from the conventional test separator. Compositional analysis based on the Nautilus mini lab is also reported by Nautilus in report AMER.85.031.

No PVT analysis were attempted since the Nautilus samples did not appear to be representative, and for the separator samples no reliable GOR could be established.

The separator liquid from Nautilus had a too low bubble point compared to that expected from the separator conditions. This is consistent with the measured composition which is considerably heavier than that reported by Nautilus. It thus appears that the liquid has lost gas either during sampling or during storage. The composition of the Nautilus separator gas is also ritcher than that reported by Nautilus making their GOR unsuitable in the present case. A calculated reservoir composition, based on the GOR provided, is reported only for comparison.

The amount of nitrogen in the Nautilus gas sample is identical to that in the separator gas samples and consistent with other analysis from Troll, but lower than reported by Nautilus themselves. This could be due to failure on behalf of Nautilus to correct their gas sample analysis for the presence of air.

The liquid from the test separator had a bubble point consistent with the separator conditions and thus appeared to be representative. The liquid was flashed to standard conditions to determine its composition which was then recombined mathematically with the separator gas composition according to the GOR provided. The resulting reservoir gas composition is, however, uncertain for the following reasons.

First, the GOR is unreliable since no liquid rates could be measured on the separator due to the small liquid volumes, and the Flow Computer, which provided the rates, showed large variations during the whole test. The GOR is also inconsistent with that reported by Nautilus being lower in spite of a much higher separator temperature.

Secondly, the calculated composition seems to be too rich compared to Nautilus and most previous Troll compositions. This could be due to a too heavy separator gas resulting from equilibrium not being attained in the separator at the high flow rates used.

1)
SAMPLES

FIELD
WELL
DST

TROLL
31/6-5
1

1 NAUTILUS SAMPLES

Date	15-05-84
Separator temp	0 C
pressure	30 Bara
Gas-oil ratio	43000 Sm ³ /m ³ sep liquid
Gas rate	320000 Sm ³ /day
Oil bottle	83021410
Gas bottle	A-14806
	A-14812
Well head pressure	133 Bara
temp	10 C

2 SEPARATOR SAMPLES

Date	15-05-84
Separator temp	27 C
pressure	45.7 Bara
Gas oil ratio 2)	35800 Sm ³ /m ³ sep liquid
Gas rate	320000 Sm ³ /day
Oil bottle	8212704
Gas bottle	A-14844
	A-14842
Well head pressure	135 Bara
temp	12 C

- 1) Data from Nautilus report and OTIS well test report
2) Recombination GOR, supplied by Statoil LET/S

Nautilus samples

WELL : 31/6-5
DST : 1
BOTTLE: 83021410

BUBBLE POINT OF SEPARATOR LIQUID AT 20.3C

	PRESSURE BARG	REL VOL V/Vb
	154.0	0.9781
	135.3	0.9809
	113.3	0.9845
	94.2	0.9879
	74.8	0.9913
	54.8	0.9947
	44.5	0.9967
	36.4	0.9983
Pb =	27.0	1.0000
	26.7	1.0002
	20.2	1.3269
	16.5	1.6329
	13.8	1.9889
	11.8	2.3385

Nautilus samples

WELL : 31/6-5
 DST : 1
 BOTTLE: 83021410

COMPOSITION OF SEPARATOR LIQUID
 (Single flash to stock tank conditions)

	STOCK TANK OIL	EVOLVED GAS	RECOMBINED LIQUID		
	MOL%	MOL%	WEIGHT%	MOL WT	MOL%
NITROGEN	0.00	0.12	0.00	28.0	0.02
CARBONDIOXIDE	0.00	2.08	0.12	44.0	0.30
METHANE	0.00	65.51	1.37	16.0	9.35
ETHANE	0.05	15.69	0.63	30.1	2.28
PROPANE	0.29	6.12	0.45	44.1	1.12
i-BUTANE	0.99	5.14	0.84	58.1	1.58
n-BUTANE	0.45	1.32	0.31	58.1	0.58
i-PENTANE	1.34	1.13	0.86	72.1	1.31
n-PENTANE	0.70	0.40	0.43	72.2	0.65
Hexanes	5.44	1.11	3.66	83.3	4.82
Hepthanes	17.39	1.07	12.32	89.6	15.06
Octanes	21.99	0.29	18.12	105.1	18.90
Nonanes	12.65	0.01	11.81	119.3	10.85
DECANES PLUS	38.72	0.00	49.08	162.0	33.19
	-----	-----	-----		-----
	100.00	100.00	100.00		100.00
MOL WEIGHT	123.5	25.90			109.56

Gas oil ratio	=	25.2	Sm ³ /Sm ³ STO
Flash formation volume factor of bubble point liquid	=	1.146	m ³ /Sm ³ STO
Density at bubble point	=	0.713	g/cm ³
Density of STO	=	0.790	g/cm ³ at 15C
Gas gravity (air=1)	=	0.894	
Density of C10+	=	0.839	g/cm ³

Nautilus samples

WELL : 31/6-5

DST : 1

COMPOSITION OF RESERVOIR FLUID

	SEPARATOR	SEPARATOR	RECOMBINED		
	LIQUID	GAS	WEIGHT%	MOL WT	MOL%
	MOL%	MOL%			
NITROGEN	0.02	1.57	2.43	28.0	1.57
CARBONDIOXIDE	0.30	0.31	0.75	44.0	0.31
METHANE	9.35	92.24	81.47	16.0	91.95
ETHANE	2.28	3.90	6.47	30.1	3.89
PROPANE	1.12	0.73	1.79	44.1	0.74
i-BUTANE	1.58	0.47	1.51	58.1	0.47
n-BUTANE	0.58	0.12	0.39	58.1	0.12
i-PENTANE	1.31	0.11	0.46	72.2	0.12
n-PENTANE	0.65	0.04	0.18	72.2	0.05
HEXANES	4.82	0.16	0.79	82.5	0.17
HEPTHANES	15.06	0.22	1.34	88.6	0.27
OCTANES	18.90	0.11	0.98	103.0	0.17
NONANES	10.85	0.01	0.35	118.9	0.05
DECANES PLUS	33.19	0.00	1.10	161.1	0.12
	-----	-----	-----		-----
	100.00	100.00	100.00		100.00
MOL WEIGHT	109.6	17.78			18.10
MOL RATIO	0.36	99.64			100.00
MASS RATIO	2.16	97.84			100.00
GASS OIL RATIO	43000	Sm3 gas/m3 separator oil			

Separator gas sample :A-14806
Separator liquid sample:83021410

WELL : 31/6-5
DST : 1
BOTTLE: 8212704

BUBBLE POINT OF SEPARATOR LIQUID AT 27.0C

	PRESSURE BARG	REL VOL V/Vb
	201.2	0.9824
	155.1	0.9872
	135.8	0.9895
	116.7	0.9918
	97.0	0.9939
	77.4	0.9964
	56.2	0.9986
Pb =	45.7	1.0000
	45.5	1.0022
	44.8	1.0141
	32.9	1.2635
	24.6	1.6021
	19.0	2.0284
	16.3	2.3205
	14.0	2.6862

WELL : 31/6-5
 DST : 1
 BOTTLE: 8212704

COMPOSITION OF SEPARATOR LIQUID
 (Single flash to stock tank conditions)

	STOCK TANK OIL	EVOLVED GAS	RECOMBINED LIQUID		
	MOL%	MOL%	WEIGHT%	MOL WT	MOL%
NITROGEN	0.00	0.29	0.02	28.0	0.07
CARBONDIOXIDE	0.00	1.37	0.14	44.0	0.31
METHANE	0.00	70.40	2.54	16.0	15.91
ETHANE	0.07	12.96	0.89	30.1	2.98
PROPANE	0.29	4.98	0.59	44.1	1.35
i-BUTANE	0.89	4.08	0.93	58.1	1.61
n-BUTANE	0.40	1.11	0.33	58.1	0.56
i-PENTANE	1.14	0.99	0.80	72.1	1.11
n-PENTANE	0.59	0.37	0.39	72.1	0.54
Hexanes	4.66	1.13	3.21	83.6	3.86
Hepthanes	16.87	1.72	12.00	89.7	13.45
Octanes	24.80	0.56	20.23	105.2	19.33
Nonanes	15.24	0.03	14.20	120.9	11.80
DECANES PLUS	35.04	0.00	43.73	162.0	27.13
	-----	-----	-----		-----
	100.00	100.00	100.00		100.00
MOL WEIGHT	122.5	25.17			100.48

Gas oil ratio = 44.4 Sm³/Sm³ STO
 Flash formation volume factor
 of bubble point liquid = 1.156 m³/Sm³ STO
 Density at bubble point = 0.723 g/cm³
 Density of STO = 0.788 g/cm³ at 15C
 Gas gravity (air=1) = 0.869
 Density of C10+ = 0.830 g/cm³

WELL : 31/6-5
 DST : 1
 BOTTLE: 8212704

DETAILED COMPOSITION OF SEPARATOR LIQUID TO C10 PLUS
 (Single flash to stock tank conditions)

	RECOMBINED LIQUID			
	WEIGHT %	MOLECULAR WEIGHT	MOL %	DENSITY g/cm ³ 15C
NITROGEN	0.018	28.01	0.066	
CARBONDIOXIDE	0.135	44.01	0.309	
METHANE	2.539	16.04	15.908	
ETHANE	0.892	30.07	2.981	
PROPANE	0.593	44.09	1.353	
i-BUTANE	0.931	58.12	1.610	
n-BUTANE	0.327	58.12	0.565	
i-PENTANE	0.797	72.15	1.110	
n-PENTANE	0.385	72.15	0.536	
C6 Paraffines	2.775	86.18	3.235	0.662
C6 Naphtenes	0.438	70.13	0.627	0.750
C6 Total	3.212	83.57	3.862	0.674
C7 Paraffines	1.923	100.20	1.928	0.681
C7 Naphtenes	10.061	87.94	11.497	0.766
C7 Aromatics	0.016	78.11	0.021	0.884
C7 Total	12.001	89.68	13.446	0.753
C8 Paraffines	4.347	114.23	3.824	0.704
C8 Naphtenes	15.377	103.37	14.948	0.770
C8 Aromatics	0.507	92.14	0.553	0.871
C8 Total	20.231	105.19	19.325	0.758
C9 Paraffines	6.146	128.26	4.815	0.721
C9 Naphtenes	5.560	120.86	4.623	0.791
C9 Aromatics	2.499	106.17	2.365	0.870
C9 Total	14.205	120.94	11.802	0.775
DECANES PLUS	43.733	162.00	27.127	0.830
	-----		-----	
	100.000		100.000	
Benzene	0.016	78.11	0.021	0.884
Toluene	0.507	92.14	0.553	0.871
Xylenes	1.340	106.17	1.268	0.870
MeCyclopentan	2.796	84.16	3.338	0.753
Cyclohexane	4.243	84.16	5.067	0.783
MeCyclohexane	8.751	98.19	8.956	0.774

Well 31/6-5
DST 1

SEPARATOR GAS COMPOSITION

Compound	Weight %	Molwt	Mol %
NITROGEN	2.533	28.01	1.579
CARBONDIOXIDE	0.762	44.01	0.302
METHANE	85.390	16.04	92.949
ETHANE	6.426	30.07	3.731
PROPANE	1.558	44.10	0.617
i-BUTANE	1.183	58.12	0.355
n-BUTANE	0.291	58.12	0.087
i-PENTANE	0.302	72.15	0.073
n-PENTANE	0.114	72.15	0.028
C6 Paraffines	0.361	86.18	0.073
C6 Naphtenes	0.068	70.13	0.017
C7 Paraffines	0.080	100.21	0.014
C7 Naphtenes	0.556	86.95	0.112
C7 Aromates	0.001	78.11	.000
C8 Paraffines	0.032	114.13	0.005
C8 Naphtenes	0.275	100.31	0.048
C8 Aromates	0.010	92.14	0.002
C9 Paraffines	0.017	126.74	0.002
C9 Naphtenes	0.008	125.00	0.001
C9 Aromates	0.012	106.17	0.002
DECANES PLUS	0.021	140.00	0.003
Total	100.000		100.000
Benzene	0.001	78.11	.000
Toluene	0.010	92.14	0.002
Xylenes	0.010	106.17	0.002
MeCyclopentan	0.211	84.16	0.044
Cyclohexane	0.220	84.16	0.046
MeCyclohexane	0.209	98.19	0.037

WELL : 31/6-5
DST : 1

COMPOSITION OF RESERVOIR FLUID

	SEPARATOR	SEPARATOR	RECOMBINED		
	LIQUID	GAS	WEIGHT%	MOL WT	MOL%
	MOL%	MOL%			
NITROGEN	0.07	1.58	2.47	28.0	1.57
CARBONDIOXIDE	0.31	0.30	0.75	44.0	0.30
METHANE	15.91	92.95	83.18	16.0	92.58
ETHANE	2.98	3.73	6.28	30.1	3.73
PROPANE	1.35	0.62	1.53	44.1	0.62
i-BUTANE	1.61	0.36	1.18	58.1	0.36
n-BUTANE	0.56	0.09	0.29	58.1	0.09
i-PENTANE	1.11	0.07	0.32	72.2	0.08
n-PENTANE	0.54	0.03	0.12	72.2	0.03
HEXANES	3.86	0.09	0.50	83.2	0.11
HEPTANES	13.45	0.13	0.94	88.8	0.19
OCTANES	19.33	0.05	0.85	103.7	0.15
NONANES	11.80	0.01	0.41	120.8	0.06
DECANES PLUS	27.13	0.00	1.18	161.6	0.13
	-----	-----	-----		-----
	100.00	100.00	100.00		100.00
MOL WEIGHT	100.5	17.46			17.85
MOL RATIO	0.47	99.53			100.00
MASS RATIO	2.66	97.34			100.00

GASS OIL RATIO 35800 Sm3 gas/m3 separator oil

Separator gas sample :A-14842
Separator liquid sample:8212704

WELL : 31/6-5
DST : 1

DETAILED COMPOSITION OF RESERVOIR FLUID TO C10 PLUS

	WEIGHT %	MOLECULAR WEIGHT	MOL %	DENSITY g/cm ³ 15C
NITROGEN	2.466	28.01	1.572	
CARBONDIOXIDE	0.745	44.01	0.302	
METHANE	83.184	16.04	92.584	
ETHANE	6.279	30.07	3.728	
PROPANE	1.532	44.10	0.620	
i-BUTANE	1.176	58.12	0.361	
n-BUTANE	0.292	58.12	0.090	
i-PENTANE	0.315	72.15	0.078	
n-PENTANE	0.121	72.15	0.030	
C6 Paraffines	0.425	86.18	0.088	0.662
C6 Naphtenes	0.078	70.13	0.020	0.750
C6 Total	0.503	83.23	0.108	0.676
C7 Paraffines	0.129	100.21	0.023	0.681
C7 Naphtenes	0.809	87.27	0.165	0.766
C7 Aromates	0.001	78.11	0.000	0.884
C7 Total	0.939	88.83	0.189	0.755
C8 Paraffines	0.147	114.21	0.023	0.704
C8 Naphtenes	0.677	102.14	0.118	0.770
C8 Aromates	0.023	92.14	0.004	0.871
C8 Total	0.847	103.73	0.146	0.761
C9 Paraffines	0.180	128.12	0.025	0.721
C9 Naphtenes	0.156	121.06	0.023	0.791
C9 Aromates	0.078	106.17	0.013	0.870
C9 Total	0.414	120.76	0.061	0.775
DECANES PLUS	1.184	161.56	0.131	0.830
	-----		-----	
	100.000		100.000	
Benzene	0.001	78.11	0.000	0.884
Toluene	0.023	92.14	0.004	0.871
Xylenes	0.045	106.17	0.008	0.870
MeCyclopentan	0.280	84.16	0.059	0.753
Cyclohexane	0.327	84.16	0.069	0.783
MeCyclohexane	0.436	98.19	0.079	0.774