

Denne rapport  
tilhører

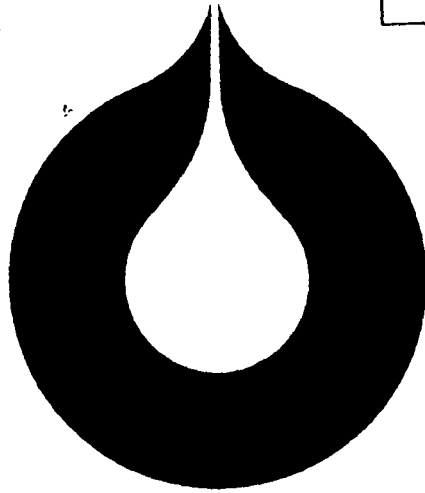
 **STATOIL**

**L&U DOK. SENTER**

L. NR. 12483220117

KODE Well 31/2-3 nr 42

Returneres etter bruk



**statoil**

RESERVOIR FLUID STUDY

FOR

SHELL WELL 31/2-3

A.M. Martinsen

STATOIL PRODUCTION LABORATORY

FEB. 1981

LAB 81.13

**Den norske stats oljeselskap a.s**

Requested by: Shell Exploration and Production Norway.

Subtitle: Reservoir fluid analysis on a bottom hole  
sample from 31/2-3 oil zone.

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## SUMMARY

This report presents results from a short PVT program on a bottom hole sample from well 31/2-3.

The bubble point of the reservoir fluid is lower than the reservoir pressure, but we think that the sample is representative for what was present in the tubing at the sampling depth

## INTRODUCTION

1. Medio september 1980 Statoil received PVT samples from the 31/2 block for internal evaluation. In a telex from Shell 1/1280 (FOR 021204/2) we were asked to do PVT analysis on bottom hole sample no.2 from well 31/2-3.

We were also asked to do further analysis by adjusting the bubblepoint to reservoir pressure by adding gas from 31/2-3 recombined gas sample used in the condensate study.

The results from that analysis will be subjected to a seperate report. In this report we will present the results obtained on the sample, as received.

## 2. SAMPLE DESCRIPTION

2-1 Flopetrol bottle no. 20475/90. Sampling depth 1437m

For sampling sheet see appendix.

Opening pressure of the bottle at ambient conditions was measured to approx. 80 bar. Bubble point determination at ambient conditions gave approx 115 bar.

Based on this information it was descided that the sample was suitable for further analysis. Approx. 100 cm<sup>3</sup> of reservoir fluid was transfered to a visual PVT cell at a pressure of 200 bar while the cell was kept at reservoir temp. (71.1<sup>0</sup>C).

## 3. METHODS AND EQUIPMENT

Determination of bubble point was done in a Ruska visual PVT cell. Single flash to sandartd conditions (15<sup>0</sup>C and latm), and measurement of GOR was done by using Ruska Flash seperator. Reservoir fluid composition was calculated from the flash experiment.

The gas was analysed both on a Hewlet Packard 5880 GC with packed column and TCD, and another of same fabrication using glas capillary column and FID. Oil analysis was run on the latter instrument using internal standard. Molweight of oil was measured using the principle of freezing point depression.

## 4. RESULTS

Results of PVT analysis is found in table 1 in the appendix.

## 5. DISCUSSION

5-1 PVT analysis

The bubble point is lower than the res. pressure, which could be due to the sampling method.

The reservoir composition seems reasonable. A flash computer run using this composition reproduced the measured GOR, oil density, Bo factor, and gas gravity, giving 51.5, 0.908, 1.158, 0.71 respectively.(1)

The uncertainty in a normal PVT analysis as experienced by our laboratory is stated in table 2.

## 6. CONCLUSION

Even though the bubble point is lower than the reservoir pressure we assume that the results obtained is representative for the fluid present in the tubing at the depth where the sample was taken.

## REFERENCES

(1) Standing

JPT FORUM xxx1 sep 79 P1193. "A set of eqn. for computing equilibrium Ratios of a crude oil/natural gas system at pressures below 1000 psia."

Table 1

Compsition of reservoir fluid  
from single flash of BHS from 31/2-3

<u>Components</u>	<u>Oil</u>		<u>Gas</u> <u>mole%</u>	<u>Res.fluid</u> <u>mole%</u>
	<u>wt%</u>	<u>mole%</u>		
Nitrogen	0	0	0.62	0.25
Carbondioxid	0	0	0.59	0.24
Methane	0	0	83.59	33.17
Etane	0.01	0.09	9.07	3.65
Propane	0.03	0.18	2.37	1.05
iso-butane	0.09	0.42	1.88	1.00
n-butane	0.04	0.21	0.53	0.33
iso-pentane	0.11	0.43	0.39	0.42
n-pentane	0.07	0.27	0.21	0.24
Hexanes	0.53	1.72	0.46	1.22
Heptanes +	<u>99.12</u>	<u>96.68</u>	<u>0.29</u>	<u>58.43</u>
	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>

C <sub>7+</sub> mol wt.		281
C <sub>7+</sub> density (g/cc)		0.9132
$\rho_{rf}$ density res. fluid (g/cm <sup>3</sup> ) (1)		0.8230
Bubble pt., (Bar)		133.8
C <sub>o</sub> , (vol/vol/bar x 10 <sup>5</sup> ) (3)		12.1
G <sub>o</sub> , (SM <sup>3</sup> /M <sup>3</sup> ) (1)		51.6
B <sub>o</sub> , (M <sup>3</sup> /M <sup>3</sup> ) (2)		1.159
$\rho_o$ , density of oil, (g/cm <sup>3</sup> )		0.9096
$\gamma_g$ , gravity of gas (1)		0.70
Mol weight stock tank oil		274
Bottle No.	Flopetrol	20475/90

Table 2

- (1)  $\gamma_g$ , GOR,  $B_o$ ,  $\rho$  res. fluid from singleflash of oil from reservoir condition to 1 atm., 15°C.
- (2)  $B_o$  is  $M^3$  of reservoir fluid pr.  $M^3$  of stock fluid at 1 atm., 15°C.
- (3) Average compressibility to oil between saturation pressure and initial reservoir pressure.

Error limits on reported values:

Bubble point :  $\pm$  0.5 BAR

GOR :  $\pm$  0.3  $SM^3/M^3$ , 1.7 SCF/BBL

$B_o$  :  $\pm$   $3 \times 10^{-3} M^3/M^3$

$\rho$  res. fluid :  $\pm$   $2 \times 10^{-3} g/cm^3$

$\rho$  oil :  $\pm$   $2 \times 10^{-4} g/cm^3$

$\gamma$  gas :  $\pm$   $1 \times 10^{-2}$

M :  $\pm$  10 g/g mole

Composition :  $C_1, C_2 \pm$  1% decreasing to about  $\pm$  7%

for components having reported values

less than 1 mole%



# FLOPETROL

Client : Norske Shell

Section : ANNEX 4

Base : Stavanger

Field : Wildcat  
Well : 31/2-3

Page : \_\_\_\_\_  
Report N° : \_\_\_\_\_

## - BOTTOM HOLE SAMPLING -

Date of sampling : 6/6-80 Service order : \_\_\_\_\_ Sampling No. : \_\_\_\_\_  
Sample nature : Oil Sampling depth : 4716' 1437'

## A - RESERVOIR AND WELL CHARACTERISTICS -

Producing zone : \_\_\_\_\_ Perforations : 1577.5m - 1582.5m Sampling interval : 5m  
Depth origin : RKB Tubing Dia. : 4 1/2" and 3 1/2" Casing Dia. : 9 5/8"  
Surface elevation : \_\_\_\_\_ Shoe : 1565.58m Shoe : 1582.5m  
P.B.T.D.

Bottom hole static conditions	Initial pressure : _____ at depth : _____ date : _____
	Latest pressure measured : _____ at depth : _____ date : _____
	Temperature : _____ at depth : _____ date : _____

## B - SAMPLING AND TRANSFER CHARACTERISTICS -

Sampler : Type and No. FLOPETROL Capacity : 600cc

Time at which sample was taken : 1944 Test duration : \_\_\_\_\_  
Running start : 15 32  
Pulling end : 20 17

Well shut in since : \_\_\_\_\_ Time elapsed since closing well : \_\_\_\_\_  
 Well flowing through choke : 8/24" Production duration through this choke : 3 1/2 hrs 14 mins

Production cond. during sampling or before closing	Bottom hole pressure : <u>2054 PSIG</u> Well head pressure : <u>69 PSIG</u> Separator pressure : _____
	5705' ft. temp. : <u>147°F</u> x 63.9°C temp. : <u>66°F</u> temp. : _____
Flow rates : <u>4700</u> SCFD W.L.R. : _____ Specific Gravity (Gas (air:1) : <u>.680</u> <u>1.93</u> <u>53.16</u> BOPD Prod. C.O.R. : _____ Oil : <u>.19</u> <u>RATES</u>	

Opening pressure of the first valve (if necessary) : 1240 PSIG

Estimated bubble point under bottom hole conditions :  
Temp : 140°F Pressure : 1700 PSIG

Transfer conditions :  By gravity  By pumping  
Temp. : 65°F Pressure : 4500 PSIG Hg volume collected at transferring end : 68cc  
remaining in the shipping bottle : 8cc

Final conditions of shipping bottle after decompression :  
Temp. : 65°F Pressure : 2040 PSIG Hg volume withdrawn for bottle decompression : 58cc

## C - IDENTIFICATION OF THE SAMPLE -

Shipping bottle No. : 20475-90 sent on : \_\_\_\_\_ by : \_\_\_\_\_ Shipping order No. : \_\_\_\_\_  
Addressee : A/S NORSE SHELL E&P 4056 TAVANGER  
616 NORSCO Base

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

## D - REMARKS -

*Flow is not being passed through separator due to poor flow.*

Visa Chief operator

*AP.H.*

