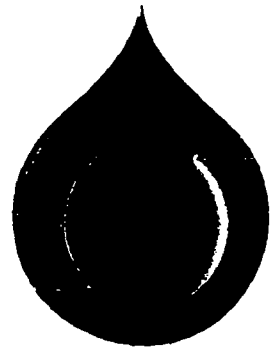
RESERVOIR FLUID



FOR

A/S NORSKE SHELL EXPLORATION & PRODUCTION

CONDENSATE

WELL NO 31/2 - 3

SINTEF

DIVISION OF PETROLEUM TECHNOLOGY
N-7034 TRONDHEIM-NTH, NORWAY
TELEPHONE: (075) 92 854*
TELEX. 55186 NTHB N, SINTEF

SINTEF REPORT

THE FOUNDATION OF SCIENTIFIC AND INDUSTRIAL RESEARCH AT THE NORWEGIAN INSTITUTE OF TECHNOLOGY

N-7034 TRONDHEIM – NTH

TELEPHONE: (47) (075) 93000
TELEX: 55620 sintf n

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AUTHORS: Helge Skirstad	PROJECT SUPERVISOR
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EXTRACT

This report presents the results from fluid analysis on a re-combined sample from 31/2-3.

Adr. 2000 - 12.79. 2515

SINTEF RESERVOIR FLUID STUDY

WELL : 31/2-3
COMPANY : Norske Shell A/S

INTRODUCTION

This report presents the results of laboratory studies performed on reservoir fluid recombined from separator liquid and vapor collected by a representative of FLOPETROL.

The producing gas-liquid ratio was measured to be 1010.4 M standard cubic feet of primary gas per barrel of primary separator liquid. This ratio has been corrected for the factors shown in Table 1.

The separator products were recombined to give a gas-liquid ratio of 1130.9 M standard cubic feet of gas per barrel of stock tank oil.

This ratio was used in conjuction with the measured composition of the separator products to calculate the composition of the well stream. The data are reported in Table 2. and 3.

During constant composition expansion of the reservoir fluid at 154^{o}F, a retrograde dew point was not observed. The results of the pressure-volume measurements at reservoir temperature are presented in Table 4.

A three-stage computer separator test was performed on the reservoir fluid at 1250, 500 and 0 psig and 40, 40 and 27^{o}F. The results are shown in Table 5.

SINTEF RESERVOIR FLUID STUDY

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Table 1. Reservoir and Sample Data

Well and Formation Data

Producing zone	Micaceous
Perforation intervals	1520 - 1535 m
Initial pressure	_____ psig at _____
Reservoir temperature	_____ °F at _____
Last static pressure	_____ psig at _____
Date	_____
Flowing pressure	_____ psig at _____
Rate (oil, water)	_____ B/D
(gas)	_____ MCF/D
Date	_____
Tubing size and depth	5" VAM, 1491 m

Sample Data

Data sampled	June, 16. 1980	
Type of sample(s)	Surface	
Separator pressure	390	psig
Separator temperature	72	°F
Average flow during sampling		
First stage separator gas	5041	MCF/D
Other separator gases		MCF/D
Stocktank oil	4.99	B/D
Water		B/D

Compressibility Factor (Field)	0.930
Compressibility Factor (Lab.)	0.929
Gas Gravity (Field)	0.618
Gas Gravity (Lab.)	0.604

The oil sample bottle and the gas sample bottle for recombination to reservoir fluid were marked FLO 9337 and A10033, respectively.

SINTEF RESERVOIR FLUID STUDY

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Table 2. Analysis of Separator Streams and Calculated Reservoir Fluid Composition

Component	*Mole Fraction*		
	Separator Gas	*Separator Liquid*	*Reservoir Fluid*
Carbon dioxide	0.0070	0.0014	0.00698
Nitrogen	0.0210	0.0013	0.02098
Methane	0.9223	0.1001	0.92159
Ethane	0.0315	0.0203	0.03148
Propane	0.0033	0.0062	0.00330
iso-Butane	0.0036	0.0131	0.00361
n-Butane	0.0006	0.0023	0.00060
iso-Pentane	0.0007	0.0086	0.00071
n-Pentane	0.0003	0.0029	0.00030
Hexanes	0.0034	0.0382	0.00343
Heptanes plus	0.0063	0.8056	0.00702
	1.0000	1.0000	1.00000

Properties of Heptanes plus

Molecular weight	115.2
Specific gravity	0.782

Separator Gas Properties

Gas gravity (air=1)	0.605
Pseudo-critical pressure, psia	672
Pseudo-critical temperature, ^{o}R	360

Separator Conditions

Two-stage. Primary separator operating at 390 psig and 72 ^{o}F.
Stocktank operating at 0 psig and 60^{o}F.

Primary separator gas/stocktank oil ratio = 1130.9 M SCF/Bbl

Stocktank vapor/stocktank oil ratio = 149.0 SCF/Bbl

Primary separator oil/stocktank oil ratio = 1.106 Bbl/Bbl

SINTEF RESERVOIR FLUID STUDY

WELL : 31/2-3

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Table 3. Analysis of Separator Streams and Calculated Reservoir Fluid Composition

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Ethane	0.0315	0.0203	0.03148
Propane	0.0033	0.0062	0.00330
iso-Butane	0.0036	0.0131	0.00361
n-Butane	0.0006	0.0023	0.00060
iso-Pentane	0.0007	0.0086	0.00071
n-Pentane	0.0003	0.0029	0.00030
Hexanes	0.0034	0.0382	0.00343
Heptanes	0.0063	0.1691	0.00644
Octanes		0.2545	0.00022
Nonanes		0.1734	0.00015
Decanes		0.1046	0.00009
Undecanes		0.0424	0.00004
Dodecanes		0.0369	0.00004
Tridecanes		0.0176	0.00002
Tetradecanes		0.0010	0.00001
Pentadecanes		0.0061	0.00001
Hexadecanes		0.0000	0.00000
	1.0000	1.0000	1.00000

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Gas gravity (air=1)	0.605
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Primary separator oil/stocktank oil ratio = 1.106 Bbl/Bbl

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WELL : 31/2-3
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Table 4. Experimental Constant-Composition Pressure-Volume Data at 154°F.

Pressure psig	*Relative Vol.Fact.* V_R	*Compressibility Factor, Z*
4355.6	0.5511	0.873
4071.2	0.5812	0.861
3730.0	0.6291	0.854
3346.0	0.6969	0.849
2606.5	0.8870	0.842
2275.0	1.0000	0.846
2189.9	1.0551	0.849
1827.3	1.2844	0.857
1528.7	1.5426	0.863
1312.5	1.8321	0.879
1141.9	2.1076	0.882
402.4	6.2751	0.947

Notes:

1. Relative volume factor is volume of reservoir fluid at pressure p per volume of fluid at reservoir pressure.

2. Reservoir pressure is 2275 psig at 154°F.

SINTEF RESERVOIR FLUID STUDY

WELL : 31/2-3
COMPANY : Norkse Shell A/S

Table 5.

FLASH CALCULATIONS - NORSKE SHELL AS

STAGE 1 P = 1265.0 PSIA T = 40.0 DEG F

L = .01314 V = .98686 GGR = .6013

COMPONENT	K	FEED MOL FRACT	LIQUID MOL FRACT	VAPOR MOL FRACT
C1	3.237	.92160	.28732	.93004
C2	.673	.03150	.04650	.03130
C3	.227	.00330	.01390	.00316
IC4	.115	.00360	.02833	.00327
NC4	.090	.00060	.00586	.00053
IC5	.048	.00070	.01159	.00056
NC5	.039	.00030	.00579	.00023
C6	.018	.00340	.10940	.00199
C7+	.001	.00700	.48437	.00065
CO2	1.512	.00690	.00459	.00693
N2	9.837	.02090	.00215	.02115
H2S	.421	.00000	.00000	.00000
		.99980	.99980	.99980

STAGE 2 P = 500.0 PSIA T = 40.0 DEG F

L = .01067 V = .00247 GGR = .6004

COMPONENT	K	FEED MOL FRACT	LIQUID MOL FRACT	VAPOR MOL FRACT
C1	6.698	.28732	.13877	.92951
C2	.888	.04650	.04750	.04218
C3	.220	.01390	.01629	.00358
IC4	.092	.02833	.03416	.00314
NC4	.067	.00586	.00711	.00048
IC5	.030	.01159	.01418	.00042
NC5	.023	.00579	.00709	.00016
C6	.009	.10940	.13445	.00115
C7+	.001	.48437	.59634	.00030
CO2	2.515	.00459	.00357	.00898
N2	27.995	.00215	.00035	.00991
H2S	.486	.00000	.00000	.00000
		.99980	.99980	.99980

SINTEF RESERVOIR FLUID STUDY

WELL : 31/2-3
COMPANY : Norkse Shell A/S

Table 5.

STAGE 3 P = 14.7 PSIA T = 27.0 DEG F

L = .00848 V = .00218 GGR = .8485

COMPONENT	K	FEED MOL FRACT	LIQUID MOL FRACT	VAPOR MOL FRACT
C1	210.870	.13877	.00316	.66556
C2	20.224	.04750	.00962	.19461
C3	3.948	.01629	.01013	.04020
IC4	1.443	.03416	.03120	.04566
NC4	1.017	.00711	.00709	.00721
IC5	.400	.01418	.01616	.00646
NC5	.296	.00709	.00828	.00245
C6	.095	.13445	.16501	.01572
C7+	.005	.59634	.74890	.00371
CO2	68.084	.00357	.00024	.01649
N2	1019.259	.00035	.00000	.00172
H2S	10.341	.00000	.00000	.00000
		.99980	.99980	.99980

GAS PROPERTIES
****

OIL PROPERTIES
****

BASIS FOR CALC-1 BBL STO

	TANK GAS	SEC.SEP. GAS	H.P. GAS	STO
LBS :	15.817	12.625	5055.124	263.153
MOLES:	.643	.727	290.719	2.500
SCF	244.129	275.844	110298.765	

SPECIFIC GRAVITY OF OIL= .7519
API GRAVITY OF OIL= 56.70

GOR= 110818.74 SCF/BBL STO

TOTAL SURFACE GAS GRAVITY= .60180

SPECIFIC GRAVITY OF C7+: .78400
MOLECULAR WEIGHT OF C7+: 115.200

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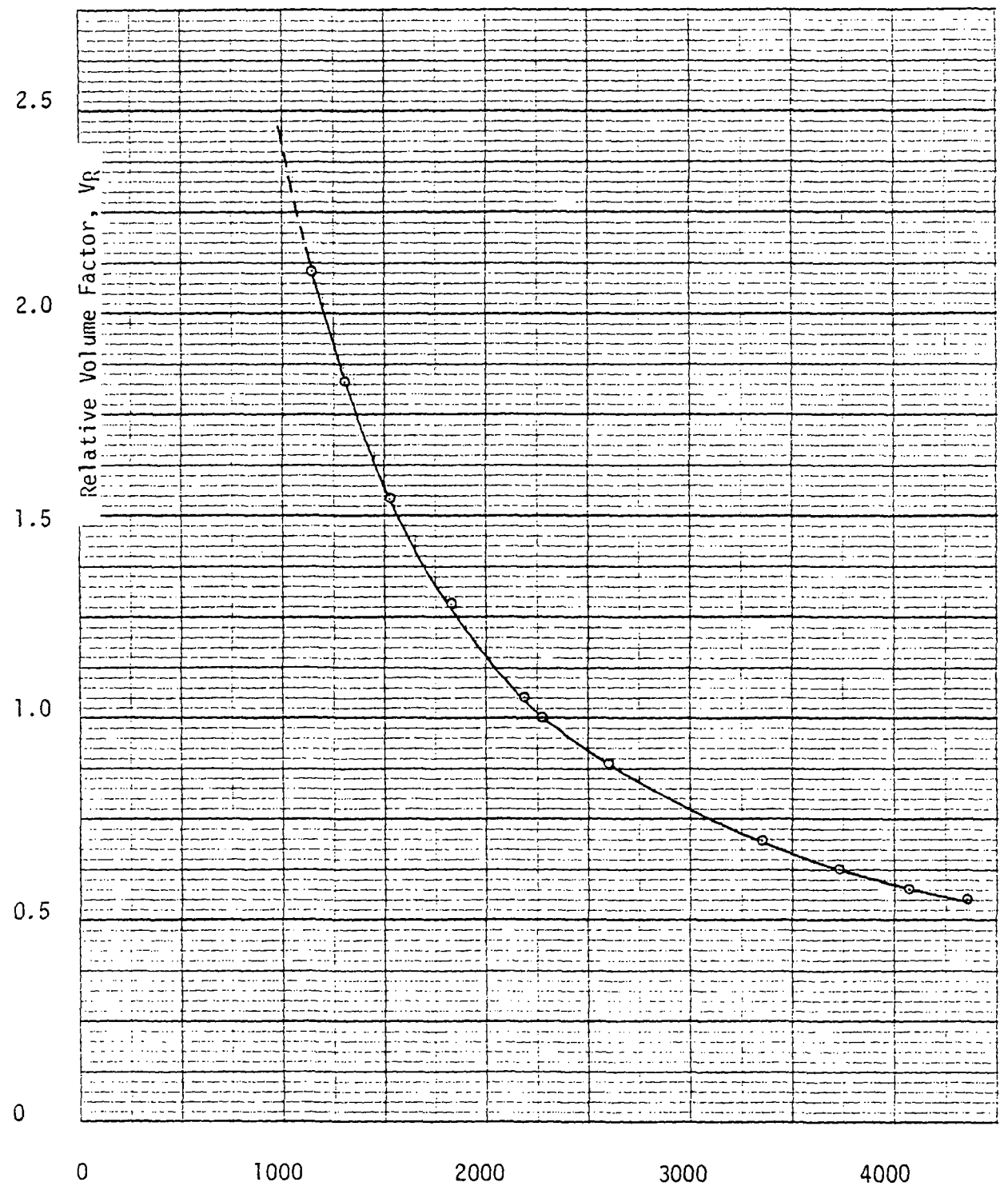

Figure 1. Experimental constant-composition pressure-volume relations. Temperature 154°F.

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WELL : 31/2-3
COMPANY : Norske Shell A/S

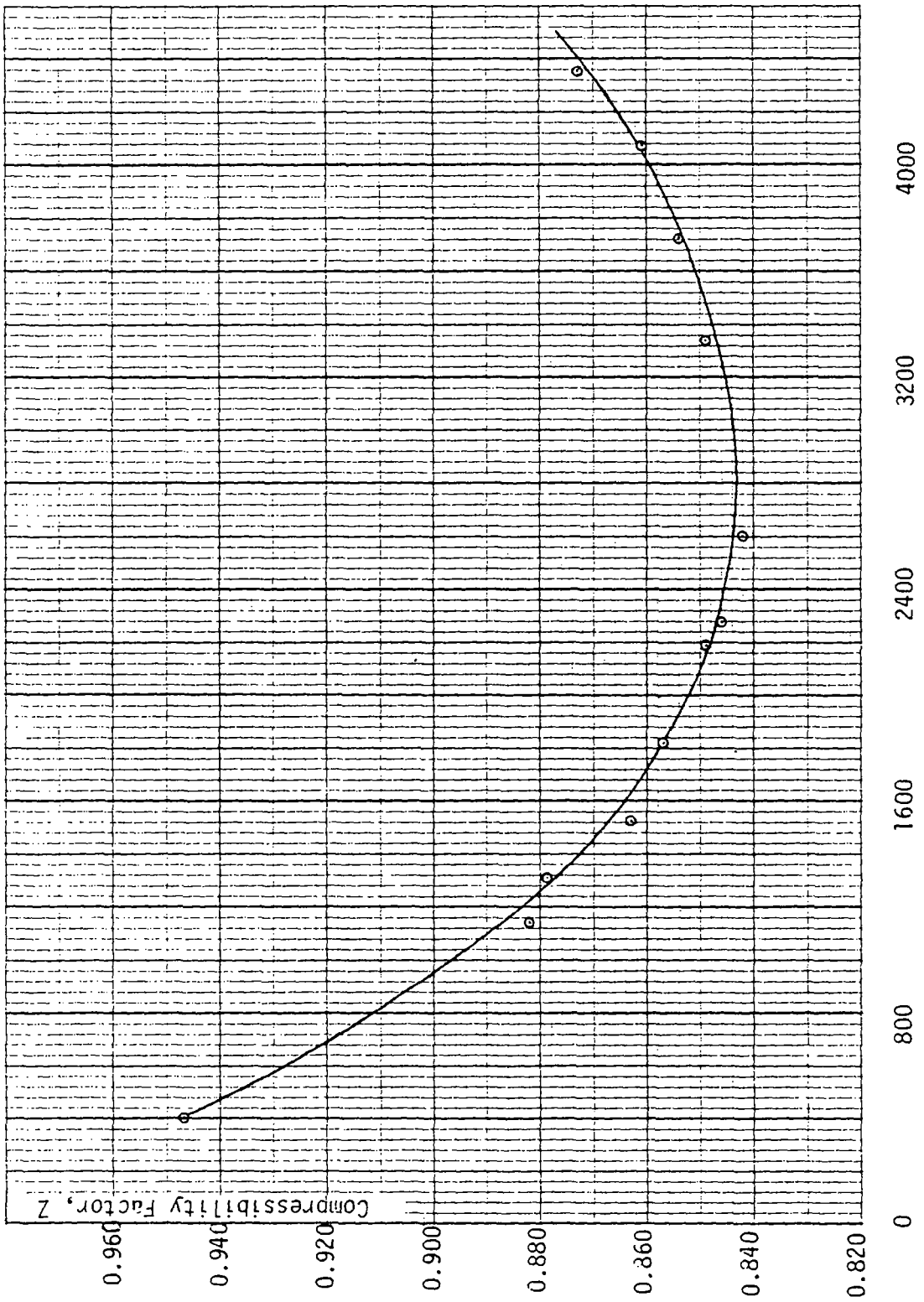

Figure 2. Experimental compressibiliy factor vs. pressure. Temperature 154°F.