

Denne rapport
tilhører



L&U DOK. SENTER

L. NR. 20088390018

KODE Well 31/2-3 nr 25

Returneres etter bruk

Reservoir Fluid Analysis
For
Norske Shell Exploration & Production
Well: 31/2-3
North Sea, Norway

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

Reservoir Fluid Analysis
For
Norske Shell Exploration & Production
Well: 31/2-3
North Sea, Norway

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

5th January, 1981

Norske Shell Exploration & Production,
Damsle Ferusuei 43,
P.O. Box 10,
40-33 Forus,
Stavanger,
Norway.

Attention: Mr. Dave Jolly

Subject: Reservoir Fluid Analysis
Well: 31/2-3
North Sea, Norway
Our File Number: RFLA 80167

Gentlemen,

On 8th July, 1980, samples of separator gas and condensate were collected during testing of the subject well and forwarded to our Aberdeen laboratory for analysis. The results of these analyses as requested by a representative of Norske Shell Exploration & Production are presented in the following report.

The hydrocarbon composition of the separator gas was determined by routine gas chromatography. The hydrocarbon composition of the condensate liquid was determined by low temperature fractional distillation.

After correcting the quoted producing gas-condensate ratio for the factors shown on page one a corrected gas-condensate ratio of 415567 SCF/BBL of separator condensate was calculated. Utilizing this gas-condensate ratio in conjunction with the experimentally determined hydrocarbon compositions of the separator products and the measured laboratory shrinkage of the condensate liquid, a wellstream composition was calculated. These compositions are to be found on page two. The laboratory shrinkage data may be found on page five.

The separator products were physically recombined at the above gas-condensate ratio and the resultant reservoir gas-condensate utilized for the remainder of the study.

A portion of the gas-condensate was placed in a high pressure visual cell and examined at the reservoir temperature of 154°F. At this temperature the system exhibited a retrograde dew point at 2067 psig. The pressure-volume relations are shown on page three.

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Norske Shell Exploration & Production

Continued/...

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The wellstream composition was used to calculate the cumulative stock tank liquid and sales gas recovery using normal two stage separation. Also calculated are the plant liquid products on the primary and secondary stage separator gases. The total plant products in the wellstream are also shown. All recoveries are based on one MMSCF of original reservoir fluid. It must be remembered in applying these data that all recoveries are based on 100 percent plant efficiency. These data may be found on page four.

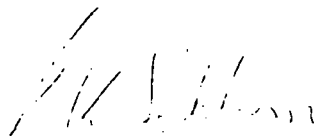
The extended hydrocarbon composition to eicosanes plus of the condensate fluid was determined by gas chromatography and this composition may be found on page six.

The extended composition to eicosanes plus of the reservoir fluid was calculated and this composition is presented on page seven.

In view of these results, the reservoir fluid would usually be considered a dry gas system, and consequently we would not normally perform a "step-wise" equilibrium (constant volume) depletion to simulate wellstream behaviour below the dew point. We will retain the samples in our laboratory pending further instructions from Norske Shell Exploration & Production.

It has been a pleasure to be of service to Norske Shell Exploration & Production. Should any questions arise concerning the data presented in this report, please do not hesitate to contact us.

Very truly yours,
Core Laboratories U.K. Ltd.,



LKS/HG
15 cc addressee

L. K. Sebborn,
Laboratory Manager - RFL

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 Well 31/2-3

Hydrocarbon Analyses of Separator Products and Calculated Well Stream

<u>Component</u>	<u>Separator Liquid *</u> Mol Per Cent	<u>Separator Gas +</u> Mol Per Cent	<u>GPM</u>	<u>Well Stream</u> Mol Per Cent
Hydrogen Sulfide	NIL	NIL		NIL
Carbon Dioxide	0.16	0.57		0.57
Nitrogen	0.06	1.61		1.61
Methane	8.40	93.26		93.08
Ethane	1.47	3.45		3.45
Propane	0.44	0.38	0.104	0.38
iso-Butane	0.64	0.29	0.095	0.29
n-Butane	0.14	0.04	0.013	0.04
iso-Pentane	0.59	0.04	0.015	0.04
n-Pentane	0.22	0.01	0.004	0.01
Hexanes	3.18	0.08	0.033	0.09
Heptanes plus	84.70	0.27	0.122	0.44
	<u>100.00</u>	<u>100.00</u>	<u>0.386</u>	<u>100.00</u>

Properties of Heptanes plus

API gravity @ 60° F.	44.0		
Specific gravity @ 60/60° F.	0.8063		0.7427
Molecular weight	130	103	114

Calculated separator gas gravity (air=1.000)=0.602
 Calculated gross heating value for separator gas=1044 BTU
 per cubic foot of dry gas @ 14.696 psia and 60° F.

Primary separator gas collected @ 325 psig and 100 °F.
 Primary separator liquid collected @ 325 psig and 100 °F.

Primary separator gas/separator liquid ratio 415567 SCF/Bbl @ 325 psig and 100 °F
 Primary separator liquid/stock tank liquid ratio 1.0872 Bbls @ 325 psig and 100 °F/Bbl at 60 °F

* Cylinder Number: 16251/69

+ Cylinder Number: A 7588

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Pressure-Volume Relations at154.... °F.

<u>Pressure PSIG</u>		<u>Relative Volume (1)</u>	<u>Compressibility Factor Z</u>
3000		0.6953	0.877
2500		0.8242	0.867
<u>2275</u>	Reservoir Pressure	0.9051	0.867
2200		0.9369	0.868
2100		0.9835	0.870
<u>2067</u>	Dew Point Pressure	1.0000	0.871
2000		1.0344	
1900		1.0913	
1800		1.1560	
1700		1.2277	
1600		1.3102	
1400		1.5102	
1200		1.7797	
1000		2.1600	
800		2.7309	
600		3.6782	

(1) Relative Volume : V/V_{sat} is barrels at indicated pressure per barrel at saturation pressure.

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Well 31/2-3

CALCULATED RECOVERY PER MSCF OF ORIGINAL FLUID

Wellstream MSCF 1000

Normal Temperature Separation*

Stock Tank Liquid - Barrels	5.27
Primary Separator Gas - MSCF	991.36
Second Stage Gas - MSCF	2.56
Stock Tank Gas - MSCF	1.60

Total Plant Products in
Primary Separator Gas - Gallons**

Propane	101
Butanes (Total)	100
Pentanes Plus	65

Total Plant Products in
Second Stage Gas - Gallons**

Propane	0.34
Butanes (Total)	0.30
Pentanes Plus	0.14

Total Plant Products in
Wellstream - Gallons**

Propane	105
Butanes (Total)	107
Pentanes Plus	280

* Recovery Bases: Primary separation at 1250 psig and 40^oF
Second Stage at 500 psig and 40^oF
Stock Tank at 0 psig and 27^oF

** Recovery assumes 100% plant efficiency

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SEPARATOR TESTS OF Separator Liquid SAMPLE

SEPARATOR PRESSURE PSI GAUGE	SEPARATOR TEMPERATURE °F	SEPARATOR GAS/OIL RATIO (1)	STOCK TANK GAS/OIL RATIO (1)	STOCK TANK GRAVITY API @ 60°F	SHRINKAGE FACTOR VR/VSAT (2)	FORMATION VOLUME FACTOR (3)	SPECIFIC GRAVITY OF FLASHED GAS
0	65		90	44.4	0.9198	1.0872	0.873

- (1) Separator and Stock Tank Gas/Oil Ratio in cubic feet of gas @ 60°F and 14.7 PSI absolute per barrel of stock tank oil @ 60°F.
- (2) Shrinkage Factor : Vr/Vsat. is barrels of stock tank oil @ 60°F per barrel of saturated oil @ 325 PSI gauge and 100 F.
- (3) Formation Volume Factor : Vsat/Vr is barrels of saturated oil @ 325 PSI gauge and 100 F per barrel of stock tank oil @ 60°F.

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HYDROCARBON ANALYSIS OF SEPARATOR LIQUID SAMPLE

<u>Component:</u>	<u>Mol Percent:</u>	<u>Weight Percent:</u>
Hydrogen Sulphide	NIL	NIL
Carbon Dioxide	0.16	0.06
Nitrogen	0.06	0.01
Methane	8.40	1.16
Ethane	1.47	0.38
Propane	0.44	0.17
Iso-Butane	0.64	0.32
N-Butane	0.14	0.07
Iso-Pentane	0.59	0.37
N-Pentane	0.22	0.14
Hexanes	3.18	2.35
Methyl Cyclopentane	2.74	1.93
Benzene	NIL	NIL
Cyclohexane	4.16	2.94
Heptanes	3.75	3.15
Methyl Cyclohexane	9.55	7.86
Toluene	0.80	0.62
Octanes	7.96	7.62
Ethylbenzene	1.20	1.07
Meta and Para Xylene	4.31	3.84
Orthoxylene	0.55	0.49
Nonanes	7.31	7.86
1, 2, 4 Trimethylbenzene	3.00	3.02
Decanes	10.31	12.31
Undecanes	10.86	13.42
Dodecanes	4.80	6.49
Tridecanes	4.65	6.84
Tetradecanes	3.44	5.49
Pentadecanes	2.57	4.45
Hexadecanes	1.02	1.90
Heptadecanes	0.80	1.59
Octadecanes	0.44	0.93
Nonadecanes	0.23	0.51
Eicosanes plus	0.25	0.64
	<u>100.00</u>	<u>100.00</u>

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HYDROCARBON ANALYSIS OF WELLSTREAM SAMPLE

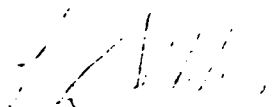
<u>Component:</u>	<u>Mol Percent:</u>
Hydrogen Sulphide	NIL
Carbon Dioxide	0.57
Nitrogen	1.61
Methane	93.08
Ethane	3.45
Propane	0.38
Iso-Butane	0.29
N-Butane	0.04
Iso-Pentane	0.04
N-Pentane	0.01
Hexanes	0.09
Methyl Cyclohexane	0.01
Benzene	NIL
Cyclohexane	0.02
Heptanes	0.02
Methyl Cyclohexane	0.06 C C 8
Toluene	TRACE
Octanes	0.05
Ethylbenzene	0.01 C C C
Meta and Para Xylene	0.02
Orthoxylene	TRACE
Nonanes	0.04 C C C
1, 2, 4 Trimethylbenzene	0.02
Decanes	0.06 C C C
Undecanes	0.08
Dodecanes	0.03
Tridecanes	0.01
Tetradecanes	0.01
Pentadecanes	TRACE
Hexadecanes	TRACE
Heptadecanes	TRACE
Octadecanes	TRACE
Nonadecanes	TRACE
Eicosanes plus	TRACE
	<u>100.00</u>

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