CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

Reservoir Fluid Study

for

STATOIL

Well: 34/10-1 DST 2
Flow 2
North Sea
Norway

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

4 th December, 1978.

Statoil,
Lagardsveien 78,
P.O. Box 300,
4001, Stavanger,
Norway.

Attention: Mr. Per Thomassan.

Subject: Reservoir Fluid Analysis
Well: 34/10-1 DST No. 2
Flow 2.
North Sea, Norway.
Our File Number: RFLA-78059

Gentlemen:

on August 24th 1978, a subsurface sample was collected from the subject well and forwarded to our Aberdeen laboratory. This report presents the results of analyses performed on this sample

A portion of the reservoir fluid was placed in a high pressure visual cell and thermally expanded to the reservoir temperature of 161°F. At this temperature a constant composition expansion was conducted during which a bubble point pressure of 3644 psig was observed. The fluid was then subjected to a differential vaporization, which resulted in the total liberation of 567 cubic feet of gas at 14.73 psia and 60°F. per barrel of residual oil at 60°F., with an associated relative oil volume of 1.256 barrels of saturated oil per barrel of residual oil. In addition at several pressure levels below the observed saturation pressure, oil densities, gas deviation factors, and gas gravities were measured. These data are tabulated on pages two through four and graphically represented on pages five and six.

The viscosity of the reservoir fluid was measured over a wide range of pressures at 161°F., in a rolling ball viscosimeter. The viscosity of the fluid was found to vary from a minimum of 1.08 centipoise at the saturation pressure to a maximum of 3.71 centipoise at atmospheric pressure. The results of the viscosity measurements are tabulated on page seven.

A two-stage flash separation was conducted in the laboratory at the following conditions: 460 psia at 72°F., 15 psia at 60°F. The ratios and factors derived from this test are presented on page nine. Also, gas samples evolved at each stage of separation were collected in the laboratory and analyzed for hydrocarbon composition. These compositions are listed on page ten. In addition, the stock tank oil was collected and analyzed for hydrocarbon composition, using low temperature fractional distillation apparatus. The results of this test are presented on page eleven.

Using the experimentally determined compositions of the separator gas and stock tank oil, in conjunction with the factors and ratios derived from the flash separation, we were able to calculate a well stream composition. The resulting calculated well stream composition is given on page twelve.

Thank you for the opportunity to perform this fluid study. It is always a pleasure to be of service to Statoil, and should you have any questions or if we may be of further assistance, please do not hesitate to contact us.

Very truly yours
Core Laboratories U.K. Limited.

John D. Owen

JDO/rmb:
7cc/Addressee:

John D. Owen.
Supervisor.

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ABERDEEN, SCOTLAND

File RFLA- 78059

Company	STATOIL	Date Sampled	24th August, 1978.
Well	34/10-1 DST 2 Flow 2	County	NORTH SEA
Field		State	NORWAY.

FORMATION CHARACTERISTICS

Formation Name	
Date First Well Completed	, 19
Original Reservoir Pressure	PSIG @ Ft.
Original Produced Gas-Liquid Ratio	SCF/Bbl
Production Rate	Bbl/Day
Separator Pressure and Temperature	PSIG ° F.
Oil Gravity at 60°F.	° API
Datum	Ft. Subsea
Original Gas Cap	

WELL CHARACTERISTICS

Elevation	Ft.
Total Depth	Ft.
Producing Interval	1839-1844 M
Tubing Size and Depth	3½ In. to 1835 M
Productivity Index	Bbl/D/PSI @ Bbl/Day
Last Reservoir Pressure	PSIG @ Ft.
Date	, 19
Reservoir Temperature	° F. @ Ft.
Status of Well	
Pressure Gauge	
Normal Production Rate	Bbl/Day
Gas-Oil Ratio	SCF/Bbl
Separator Pressure and Temperature	PSIG ° F.
Base Pressure	PSIA
Well Making Water	% Cut

SAMPLING CONDITIONS

Sampled at	1530 M
Status of Well	
Gas-Oil Ratio	SCF/Bbl
Separator Pressure and Temperature	PSIG ° F.
Tubing Pressure	PSIG
Casing Pressure	PSIG
Sampled by	FLOPETROL
Type Sampler	

REMARKS :

Received cylinder 20475-99

Ambient bubble point is 3268 psig at 66°F.

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Well 34/10-1 DST 2
Flow 2

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 3644 PSIG @ 161 °F.
2. Specific volume at saturation pressure : ft ^{3}/lb 0.02082 @ 161 °F.
3. Thermal expansion of saturated oil @ 5000 PSI = $\frac{V\ @\ 161\ °F}{V\ @\ 67\ °F}$ = 1.03837
4. Compressibility of saturated oil @ reservoir temperature : Vol/Vol/PSI :

   From 5000 PSI to 4600 PSI = 7.87×10^{-6}

   From 4600 PSI to 4200 PSI = 7.90×10^{-6}

   From 4200 PSI to 3644 PSI = 8.15×10^{-6}

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Well ....34/10-1 DST 2 Flow 2

Pressure-Volume Relations at ....161.... °F.

Pressure PSIG		Relative Volume (1)	Y Function (2)
5000	344.73	0.9892	
4800	330.94	0.9907	
4600	317.16	0.9923	
4400	303.37	0.9939	
4200	289.58	0.9955	
4100	282.69	0.9963	
4000	275.79	0.9971	
3900	268.89	0.9979	
3800		0.9987	
3700	255.11	0.9996	
3644		1.0000	
3620		1.0012	5.595
3561		1.0041	5.661
3448		1.0107	5.295
3290		1.0208	5.142
3019		1.0413	4.983
2713		1.0723	4.723
2412		1.1141	4.450
2092		1.1771	4.160
1795		1.2615	3.906
1496		1.3887	3.658
1235		1.5587	3.450
1019		1.7716	3.290
760		2.2010	3.098
552		2.8412	2.962
395		3.9115	2.722

(1) Relative Volume : V/Vsat is barrels at indicated pressure per barrel at saturation pressure.

(2) Y Function $= \frac{(Psat-P)}{(Pabs)\,(V/Vsat-1)}$

Differential Vaporization at 161 °F.

Pressure PSIG	Solution Gas/Oil Ratio (1)	Relative Oil Volume (2)	Relative Total Volume (3)	Oil Density gm/cc	Deviation Factor Z	Gas Formation Volume Factor (4)	Incremental Gas Gravity
3644 (251.2)	567 (100.8)	1.256	1.256	0.7694			
3300 (227.53)	514 (91.38)	1.235	1.281	0.7762	0.906	0.00481	0.631
2900 (199.95)	453 (80.53)	1.213	1.321	0.7839	0.882	0.00532	0.629
2500 (172.37)	393 (69.87)	1.190	1.379	0.7922	0.874	0.00611	0.628
2100 (144.79)	332 (59.02)	1.168	1.473	0.8000	0.877	0.00729	0.628
1700 (117.21)	274 (48.71)	1.147	1.623	0.8075	0.890	0.00913	0.629
1300 (89.63)	212 (37.69)	1.123	1.891	0.8171	0.908	0.01215	0.630
900 (62.05)	152 (27.02)	1.101	2.424	0.8254	0.931	0.01790	0.641
500 (34.47)	92 (16.36)	1.079	3.850	0.8336	0.959	0.03276	0.662
153 (10.55)	33 (5.87)	1.058	10.887	0.8421	0.987	0.10335	0.738
0	0	1.044		0.8463			1.009

At 60 °F = 1.000

over kokrekt. $B_{od} = B_{oid} \cdot \frac{V}{V_{sat}}$.
p[bar]

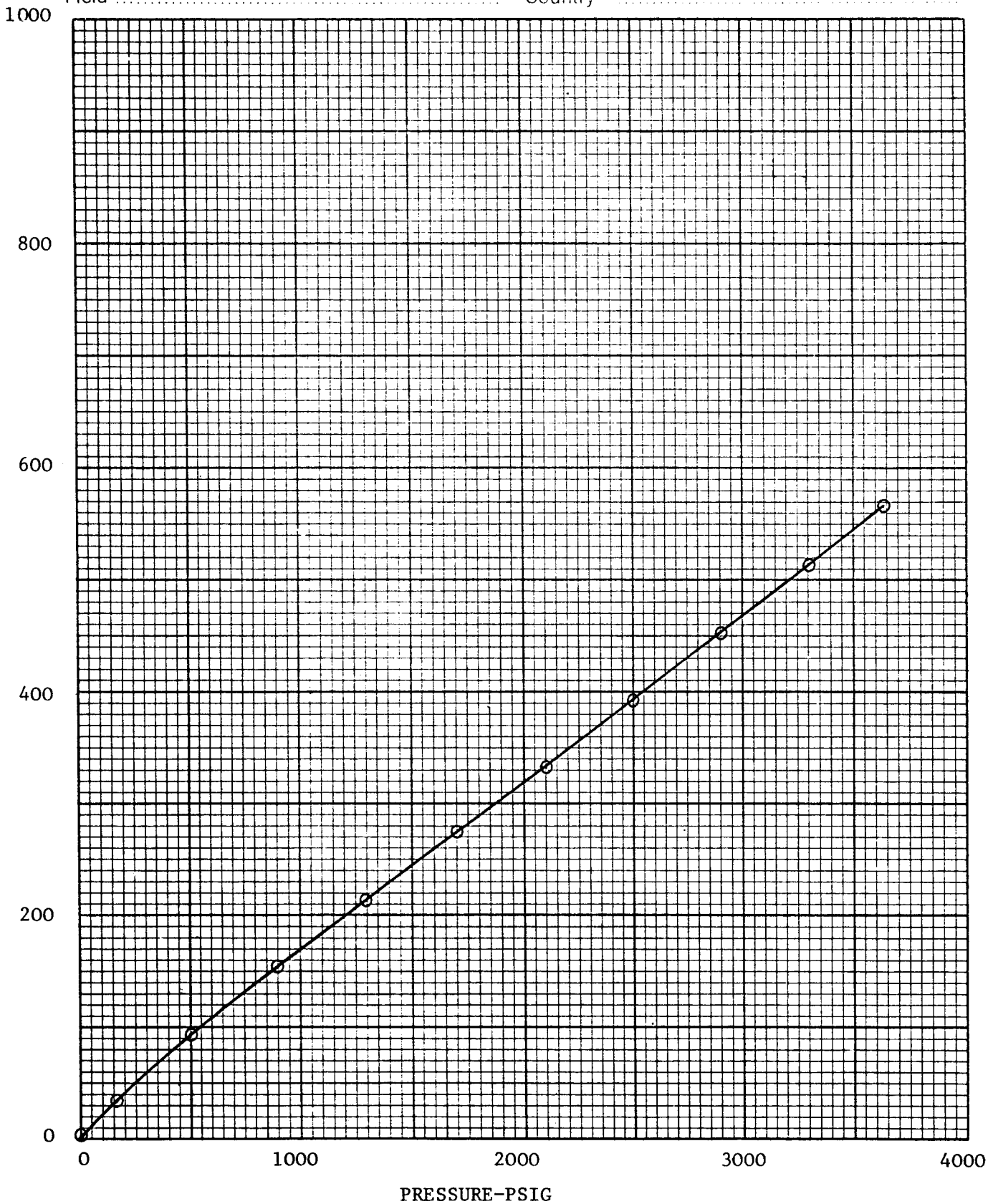
Gravity of residual oil = 28.5 ° API @ 60°F.

(1) Cubic feet of gas at 14.73 psia and 60 °F. per barrel or residual oil at 60°F.
(2) Barrels of oil at indicated pressure and temperature per barrel of residual oil at 60°F.
(3) Barrels of oil plus liberated gas at indicated pressure and temperature per barrel of residual oil at 60°F.
(4) Cubic feet of gas at indicated pressure and temperature per cubic foot at 14.73 psia and 60°F.

Differential Vaporization of Reservoir Fluid at 161°F.

Company STATOIL
Well 34/10-1 DST 2 Flow 2
Field

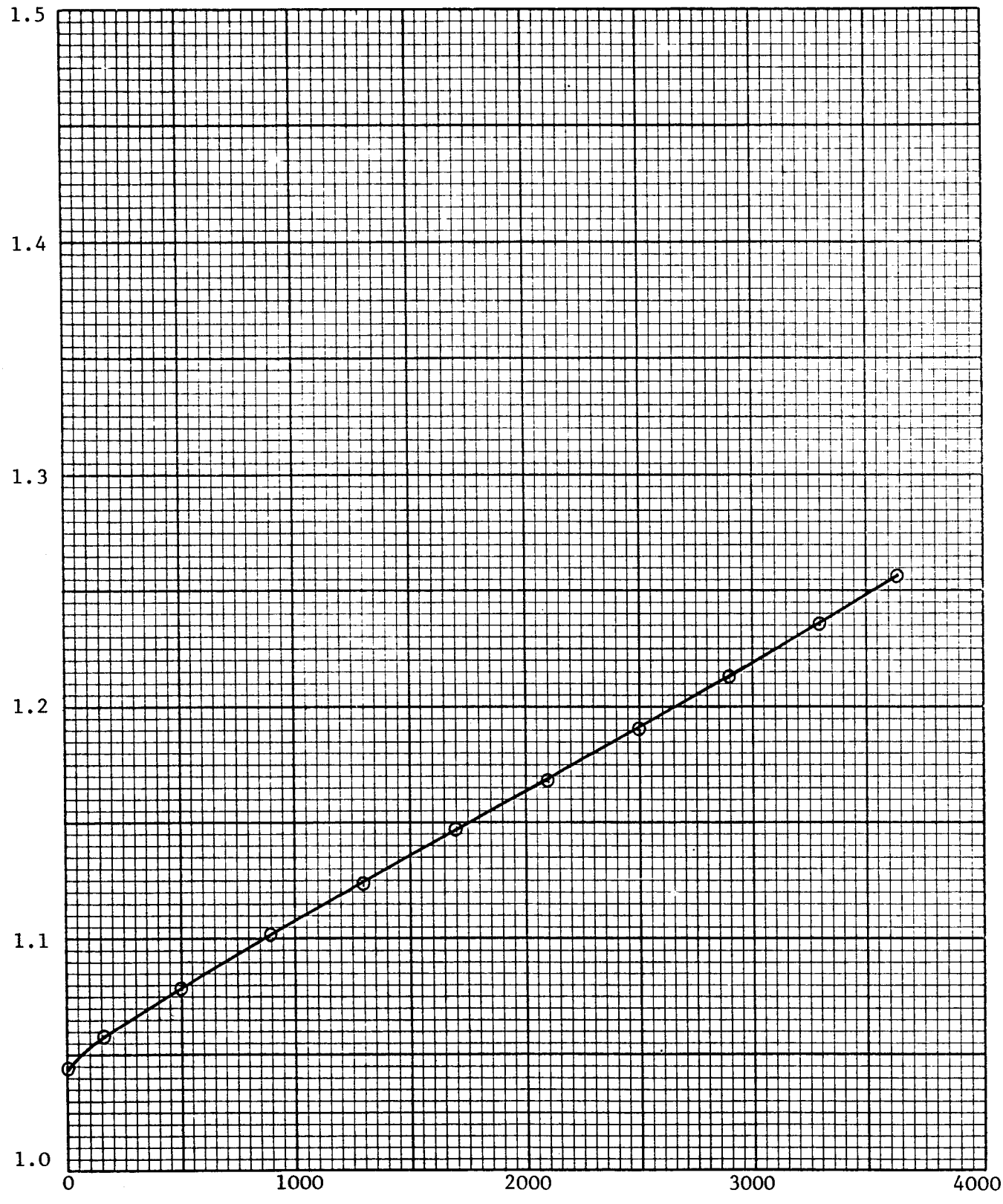
Formation
Province NORTH SEA
Country NORWAY



Differential Vaporization of Reservoir Fluid at 161°F.

Company STATOIL
Well 34/10-1 DST 2 Flow 2
Field

Formation
Province NORTH SEA
Country NORWAY



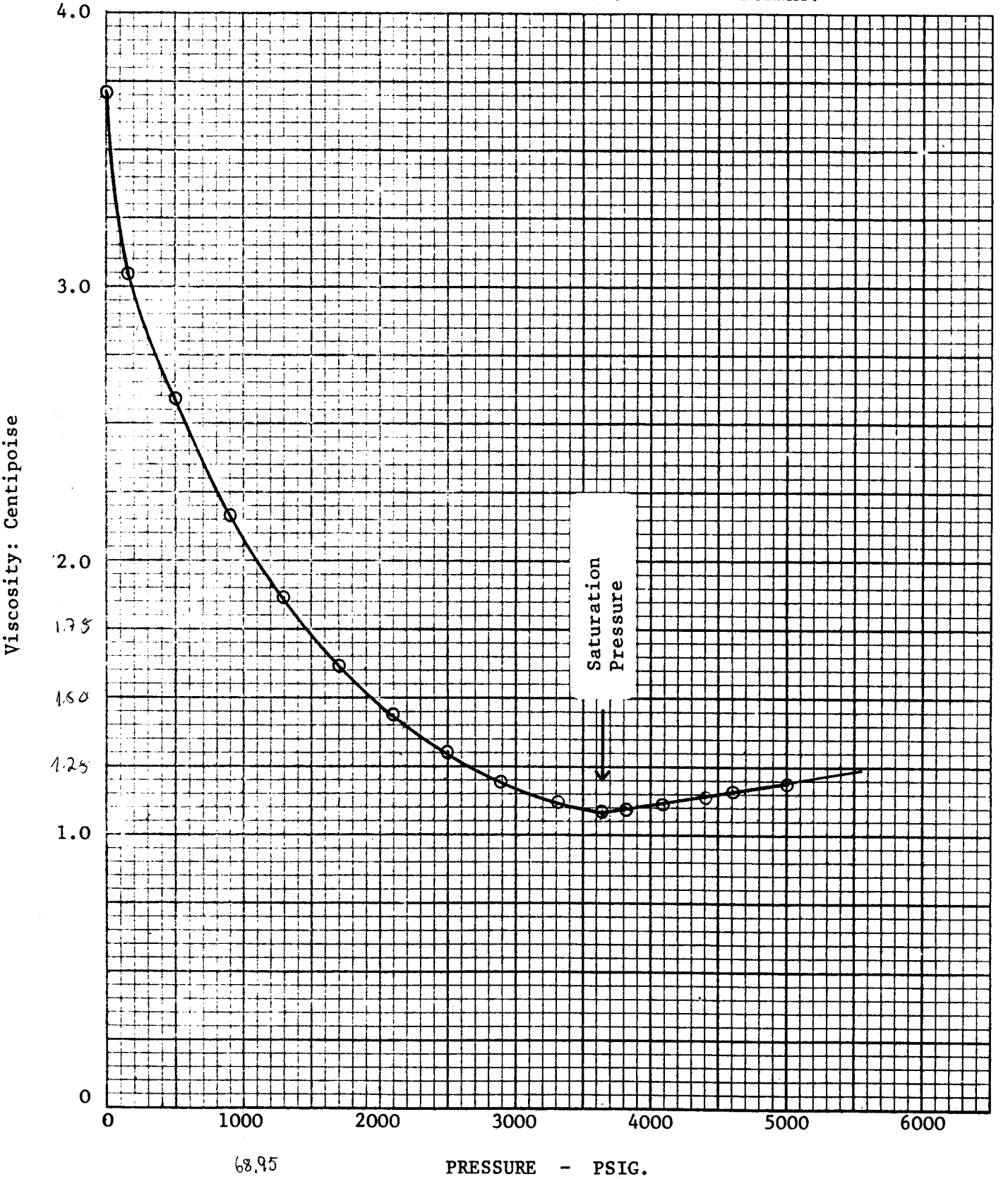
Viscosity Data at 161 °F.

Pressure PSIG		Oil Viscosity Centipoise	Calculated Gas Viscosity Centipoise	Oil/Gas Viscosity Ratio
5000	344.74	1.19		
4600	317.16	1.16		
4400	303.37	1.14		
4100	282.68	1.11		
3800	262.00	1.09		
3644	251.24	1.08		
3300	227.53	1.11	0.0208	53.37
2900	199.95	1.19	0.0196	60.71
2500	172.37	1.30	0.0182	71.43
2100	144.79	1.44	0.0169	85.21
1700	117.21	1.62	0.0157	103.18
1300	89.63	1.86	0.0147	126.53
900	62.05	2.16	0.0138	156.52
500	34.47	2.59	0.0131	197.71
160	11.03	3.05	0.0123	247.97
0		3.71		

Viscosity of Reservoir Fluid at 161°F.

Company STATOIL
Well 34/10-1 DST 2 Flow 2
Field

Formation
Province NORTH SEA
Country NORWAY.



68.95

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Well ...34/10-1 DST 2 Flow 2

SEPARATOR TESTS OF ...Reservoir Fluid..... **SAMPLE** *

SEPARATOR PRESSURE PSIA	SEPARATOR TEMPERATURE ° F.	GAS/OIL RATIO (1)	GAS/OIL RATIO (2)	STOCK TANK GRAVITY ° API @ 60° F.	FORMATION VOLUME FACTOR (3)	SEPARATOR VOLUME FACTOR (4)	SPECIFIC GRAVITY OF FLASHED GAS
460	72	415	443			1.067	0.626 +
to							
0	60	115 530	115	29.2	1.248	1.000	0.824 +

* Flow 2 (cylinder 20475-99)

\+ Collected and analyzed for hydrocarbons.

(1) Gas/Oil Ratio in cubic feet of gas @ 60° F. and .....14.73..... PSI absolute per barrel of oil @ indicated pressure and temperature.

(2) Gas/Oil Ratio in cubic feet of gas @ 60° F. and .....14.73..... PSI absolute per barrel of stock tank oil @ 60° F.

(3) Formation Volume Factor is barrels of saturated oil @ ...3644.. PSI gauge and ....161.... ° F. per barrel of stock tank oil @ 60° F.

(4) Separator Volume Factor is barrels of oil @ indicated pressure and temperature per barrel of stock tank oil @ 60° F.

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Well 34/10-1 DST 2 Flow 2

HYDROCARBON ANALYSIS OF MULTI-STAGE SEPARATOR GASES

	460 PSIA @ 72 °F		0 PSIA @ 60 °F	
Components:	Mol Percent	GPM	Mol Percent	GPM
Hydrogen Sulfide	NIL		NIL	
Carbon Dioxide	1.58		2.88	
Nitrogen	0.77		0.53	
Methane	91.06		68.13	
Ethane	4.67		17.62	
Propane	0.62	0.171	4.44	1.222
iso-Butane	0.19	0.062	1.93	0.631
n-Butane	0.36	0.114	1.77	0.558
iso-Pentane	0.17	0.062	1.09	0.399
n-Pentane	0.24	0.087	0.71	0.257
Hexanes	0.20	0.082	0.60	0.245
Heptanes plus	0.14	0.064	0.30	0.136
	100.00	0.642	100.00	3.448

Calculated gas gravity(air=1.000)	0.626	0.824
Calculated gross heating value =	1072 BTU	1353 BTU
per cubic foot of dry gas at	14.73 psia at 60°F.	14.73 psia at 60°F.

Collected in the laboratory.

Company STATOIL — Date Sampled 24th August 1978
Well 34/10-1 DST 2 Flow 2 — County NORTH SEA
Field — State NORWAY

HYDROCARBON ANALYSIS OF Stock Tank Oil SAMPLE

COMPONENT	MOL PERCENT	WEIGHT PERCENT	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Hydrogen Sulfide	NIL	NIL			
Carbon Dioxide	0.04	0.01			
Nitrogen	NIL	NIL			
Methane	0.40	0.03			
Ethane	0.65	0.08			
Propane	0.63	0.12			
iso-Butane	0.74	0.18			
n-Butane	0.69	0.17			
iso-Pentane	0.78	0.24			
n-Pentane	0.77	0.24			
Hexanes	1.80	0.66			
Heptanes plus	93.50	98.27	0.8856	28.1	245
	100.00	100.00			

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Well 34/10-1 DST 2 Flow 2

Company STATOIL Formation

Field State NORTH SEA- NORWAY

HYDROCARBON ANALYSIS OF Calculated Wellstream

Component	Mol Per Cent
Hydrogen Sulfide	NIL
Carbon Dioxide	0.99
Nitrogen	0.38
Methane	45.57
Ethane	4.18
Propane	0.98
iso-Butane	0.55
n-Butane	0.66
iso-Pentane	0.55
n-Pentane	0.53
Hexanes	1.00
Heptanes plus	44.61
	100.00

Properties of Heptanes Plus:

API gravity at 60°F.	28.2
Specific gravity at 60/60°F.	0.8862
Molecular Weight	243

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STATOIL:
Well: 34/10-1 DST 2 Flow 2.

Core Laboratories U.K. Limited

Reservoir Fluid Analysis

John D. Owen

John D. Owen.
Supervisor