CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

Reservoir Fluid Analysis

for WELLFILE

STATOIL

Well: 34/10-1
DST No.3 Flow 2
North Sea, Norway.

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

9th November, 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. 3
Flow 2.
North Sea, Norway.
Our File Number: RFLA-78060

Gentlemen:

On August 29th 1978, a subsurface sample was collected form the subject well and forwarded to our Aberdeen laboratories. 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 156°F. At this temperature a constant composition expansion was conducted during which a bubble point pressure of 3684 psig was observed. The fluid was then subjected to a differential vaporization, which resulted in the total liberation of 579 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 1.264 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.

A two-stage flash separation was conducted in the laboratory at the following conditions: 380 psia at 68°F., 15 psia at 60°F. The ratios and factors derived from this test are presented on page seven. 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 eight. In addition, the stock tank oil was collected and analyzed for hydrocarbon composition, using low temperature fractional distillation apparatus.

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 ten.

At this writing, the viscosity of the reservoir fluid has not been determined. However, upon completion of these test procedures, a supplementary report will be issued.

It has indeed been a pleasure to be of service to Statoil. Should you have any questions concerning the data presented in this report, please do not hesitate to contact us.

Very truly yours
Core Laboratories U.K. Limited

John D. Owen

JDO/rmb:
15cc/Addressee:

John D. Owen.
Supervising Engineer.

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File RFLA - 78060

Company STATOIL — Date Sampled 29th August, 1978.
Well 34/10-1 DST 3 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	1788 - 1792 M
Tubing Size and Depth	3½ In. to 1784 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	1467 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 22478 - 20.

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Well 34/10-1 DST 3 Flow 2

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 3684 PSIG @ 156 °F.
2. Specific volume at saturation pressure : ft³/lb 0.02094 @ 156 °F.
3. Thermal expansion of saturated oil @ 5000 PSI = $\frac{V\ @\ 156\ °F}{V\ @\ 67\ °F}$ = 1.04352
4. Compressibility of saturated oil @ reservoir temperature : Vol/Vol/PSI :

From 5000 PSI to 4600 PSI = 7.68×10^{-6}
From 4600 PSI to 4200 PSI = 7.97×10^{-6}
From 4200 PSI to 3800 PSI = 8.13×10^{-6}
From 3800 PSI to 3684 PSI = 8.26×10^{-6}

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Pressure-Volume Relations at 156 °F.

Pressure PSIG	Relative Volume (1)	Y Function (2)
5000	0.9896	
4800	0.9911	
4600	0.9926	
4400	0.9942	
4200	0.9958	
4100	0.9966	
4000	0.9974	
3900	0.9982	
3800	0.9990	
3700	0.9999	
3684	1.0000	
3644	1.0020	5.439
3624	1.0030	5.496
3604	1.0040	5.554
3367	1.0175	5.356
3088	1.0374	5.136
2765	1.0681	4.855
2451	1.1089	4.591
2122	1.1705	4.287
1823	1.2531	4.000
1521	1.3775	3.730
1257	1.5438	3.508
1037	1.7521	3.345
913	1.9190	3.249
704	2.3411	3.090
529	2.9675	2.948
377	4.0167	2.797

(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 156 °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
3684	579	1.264	1.264	0.7649			
3300	519	1.241	1.291	0.7722	0.896	0.00472	0.626
2900	459	1.219	1.331	0.7793	0.873	0.00523	0.622
2500	399	1.198	1.391	0.7866	0.868	0.00602	0.621
2100	339	1.176	1.483	0.7942	0.872	0.00719	0.622
1700	276	1.153	1.638	0.8026	0.884	0.00899	0.624
1300	215	1.131	1.908	0.8111	0.903	0.01198	0.626
900	154	1.108	2.446	0.8198	0.926	0.01766	0.633
500	92	1.085	3.895	0.8294	0.956	0.03239	0.658
159	33	1.062	10.668	0.8384	0.985	0.09878	0.739
0	0	1.042		0.8471			1.068

At 60°F. = 1.000

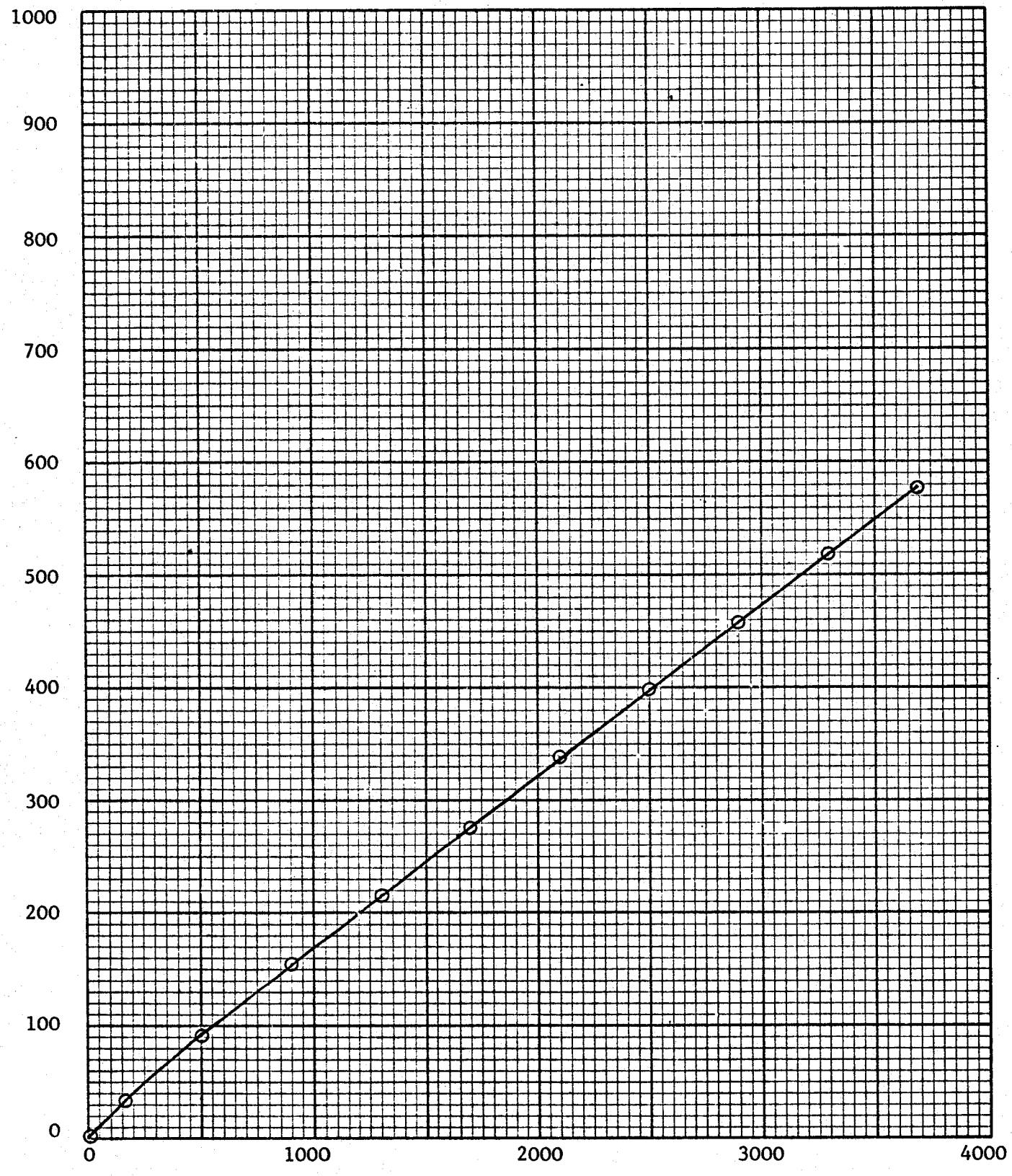
Gravity of residual oil = 28.7 ° API @ 60°F.

(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 156°F.

Company STATOIL
Well 34/10-1 DST 3 Flow 2
Field

Formation
Province NORTH SEA
Country NORWAY.



Differential Vaporization of Reservoir Fluid at 156°F.

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Well 34/10-1 DST 3 Flow 2
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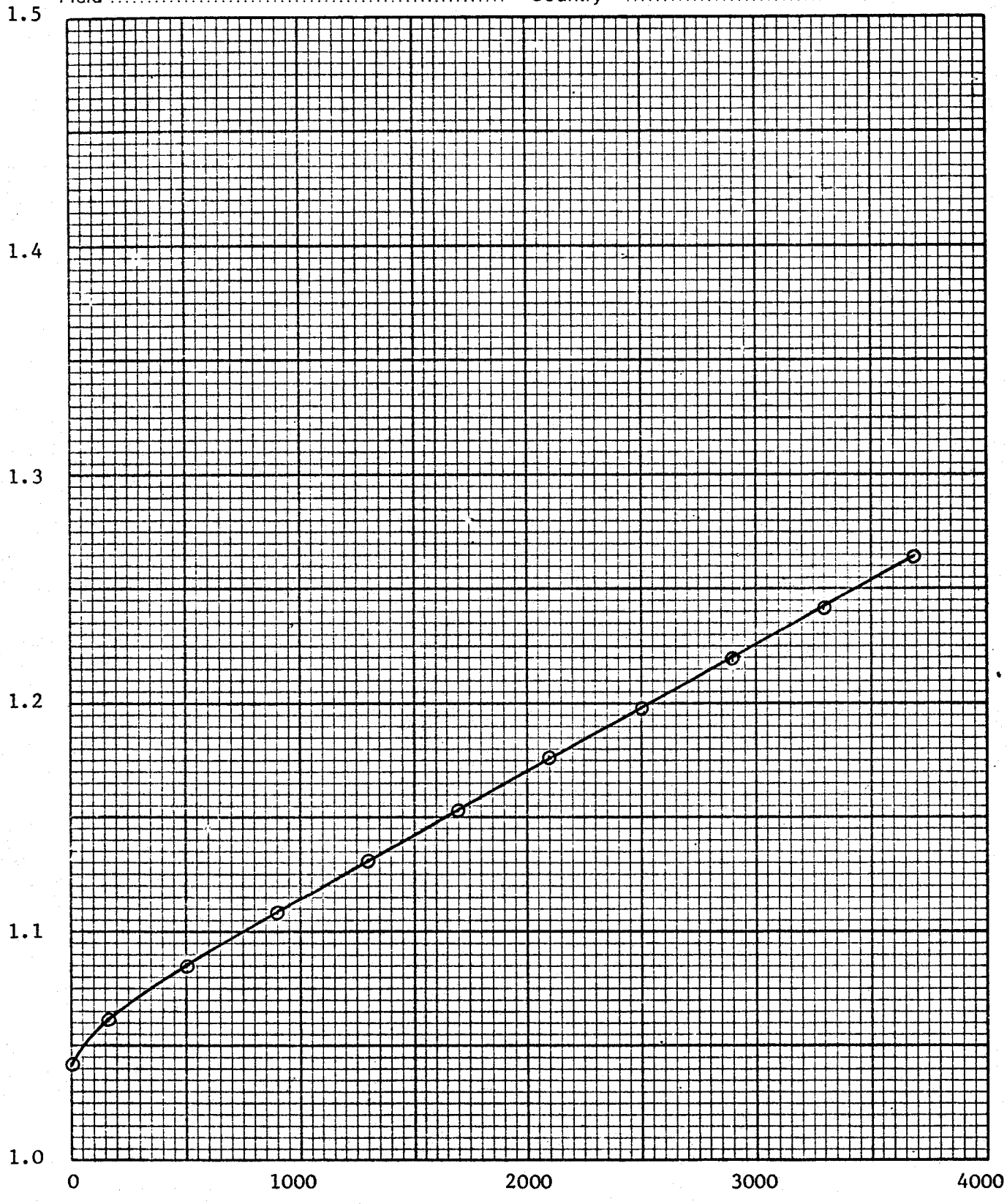

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Well 34/10 - 1 DST 3

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	
380	68	447	473			1.059	0.622	*
to								
15	60	92	92	29.1	1.258	1.000	0.827	**

* Collected and analyzed for hydrocarbons.

* * Stock tank liquid and gas 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 @ 3684 PSI gauge and 156 ° 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 3

Hydrocarbon Analysis of Multi-Stage Separator Gases.

Separator Conditions:	380 PSIA @ 68°F.		15 PSIA @ 60°F.	
Components:	Mol Per Cent	GPM	Mol Per Cent	GPM.
Hydrogen Sulphide	NIL		NIL	
Carbon Dioxide	1.83		3.31	
Nitrogen	0.75		0.45	
Methane	90.97		67.72	
Ethane	4.88		17.83	
Propane	0.63	0.173	4.47	1.230
iso-Butane	0.20	0.065	1.88	0.615
n-Butane	0.25	0.079	1.72	0.542
iso-Pentane	0.13	0.048	1.05	0.384
n-Pentane	0.14	0.051	0.67	0.243
Hexanes	0.12	0.049	0.56	0.228
Heptanes Plus.	0.10	0.045	0.34	0.154
	100.00	0.510	100.00	3.396
Calculated gas gravity (Air=1.000):	0.622		0.827	
Calculated gross heating value (BTU per cubic foot of dry gas at 14.73 PSI absolute and 60°F.):	1060		1347	

Collected in the laboratory.

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Well 34/10-1 DST 3 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	0.05	0.01			
Nitrogen	NIL	NIL			
Methane	0.41	0.03			
Ethane	0.58	0.07			
Propane	0.39	0.07			
iso-Butane	0.34	0.08			
n-Butane	0.32	0.08			
iso-Pentane	0.24	0.07			
n-Pentane	0.20	0.06			
Hexanes	0.72	0.26			
Heptanes plus	96.75	99.27	0.8889	27.5	245.
	100.00	100.00			

* Collected in the laboratory at 0 Psig and 60°F. from two-stage separator test.

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Well 34/10-1 DST 3 Flow 2

Company STATOIL Formation

Field State NORTH SEA - NORWAY.

HYDROCARBON ANALYSIS OF Calculated Wellstream *

Component	Mol Per Cent
Hydrogen Sulfide	NIL
Carbon Dioxide	1.13
Nitrogen	0.37
Methane	46.40
Ethane	4.01
Propane	0.86
iso-Butane	0.42
n-Butane	0.41
iso-Pentane	0.26
n-Pentane	0.21
Hexanes	0.44
Heptanes Plus.	45.49
	100.00

Properties of Heptanes plus	
API gravity at 60°F.	27.6
Specific gravity at 60/60°F.	0.8894
Molecular Weight	245

* Calculated from two-stage separator test data.

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