CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

SPECIAL STUDY

for

Statoil A/S

Well: 34/10-4 DST 1

North Sea, Norway.

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

28th February 1981

Statoil A/S
P.O. Box 300
4001 Stavanger
Norway

Subject: Special Study
Well: 34/10-4 DST 1
North Sea, Norway.
Our File Number:
RFLA 80201C

Attention: Per Thomassen.

Gentlemen,

The following report contains the details of a revaporization study performed on samples from the subject well as requested by a representative of Statoil A/S.

The hydrocarbon composition of both the initial reservoir fluid and the injection gas previously reported are given on pages two and three.

The measured deviation factor Z of the synthesised injection gas may be found on page four.

A portion of the reservoir fluid was placed in a high pressure visual cell and thermally expanded to the operating temperature of 73°C. During a constant composition expansion at this temperature, the fluid was observed to have a saturation pressure of 239.6 Bar G. The partial pressure-volume relations, and the associated compressibility data for the undersaturated fluid may be found on page six.

The revaporization study was then performed contacting the reservoir fluid with the injection gas at 330.9 Bar G and 73.0°C and after equilibration the excess gas was removed at constant pressure and analysed for hydrocarbon composition. This process was repeated for a series of nine injections, at which point the test was terminated. The factors and data derived from this test, and the hydrocarbon composition of each effluent may be found on pages seven and eight of the report.

The hydrocarbon composition of the residual fluid was determined by low temperature fractional distillation, and this composition in terms of both mol and weight percent is presented on page nine.

A single stage flash separation (zero shrinkage) was performed on a portion of the residual oil and the factors and data derived from this this test are persented on page ten.

Cont. Over/.....

It has been a pleasure to be of service to Statoil A/S. Should any questions arise concerning data presented in this report please do not hesitate to contact us.

Yours very truly

Core Laboratories UK Limited
Reservoir Fluid Analysis

L K Sebborn

LKS/STB
10CC/ADDRESSEE

Les K. Sebborn
Laboratory Manager

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

File RFLA 80201C

Company Statoil A/S | Date Sampled

Well 34/10 - 4 DST 1 | State North Sea

Field | Country Norway

FORMATION CHARACTERISTICS

Formation Name	
Date First Well Completed	, 19
Original Reservoir Pressure	PSIG @ Ft.
Original Produced Gas-Oil Ratio	SCF/Bbl
Production Ratio	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	Ft.
Tubing Size and Depth	In. to Ft.
Productivity Index	Bbl/D/PSI @ Bbl/Day
Last Reservoir Pressure	PSIG @ Ft.
Date	, 19
Reservoir Temperature	73 °C. @ 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	Ft.
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	FOLPETROL

REMARKS: Cylinder Numbers 2657-30 and 20475-62

Company Statoil A/S Formation

Well 34/10-4 DST 1 County North Sea

Field State Norway

HYDROCARBON ANALYSIS OF Reservoir Fluid SAMPLE

COMPONENT	MOL PERCENT	WEIGHT PERCENT	DENSITY	API	MOL WEIGHT
Hydrogen Sulfide	NIL	NIL			
Carbon Dioxide	1.07	0.39			
Nitrogen	0.25	0.06			
Methane	44.98	5.95			
Ethane	3.05	0.76			
Propane	0.99	0.36			
iso-Butane	0.54	0.26			
n-Butane	0.91	0.43			
iso-Pentane	0.63	0.37			
n-Pentane	0.49	0.29			
Hexanes	1.32	0.93			
Heptanes plus	45.77	90.20	0.8880	27.7	239
	100.00	100.00			

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Company Statoil A/S Formation

Well 34/10-4 DST 1 County North Sea

Field State Norway

HYDROCARBON ANALYSIS OF Synthesised Injection GAS SAMPLE

COMPONENT	MOL PERCENT	GPM
Hydrogen Sulfide	NIL	
Carbon Dioxide	1.79	
Nitrogen	1.17	
Methane	85.47	
Ethane	6.93	
Propane	2.15	0.590
iso-Butane	0.77	0.251
n-Butane	0.86	0.270
iso-Pentane	0.41	0.150
n-Pentane	0.17	0.062
Hexanes plus	0.28	0.119
	100.00	1.442

Calculated gas gravity (air = 1.000) = 0.673

Calculated gross heating value = 1131 BTU per cubic foot of dry gas at 14.696 psia and 60°F.

Collected at 0 psig and 65°F.

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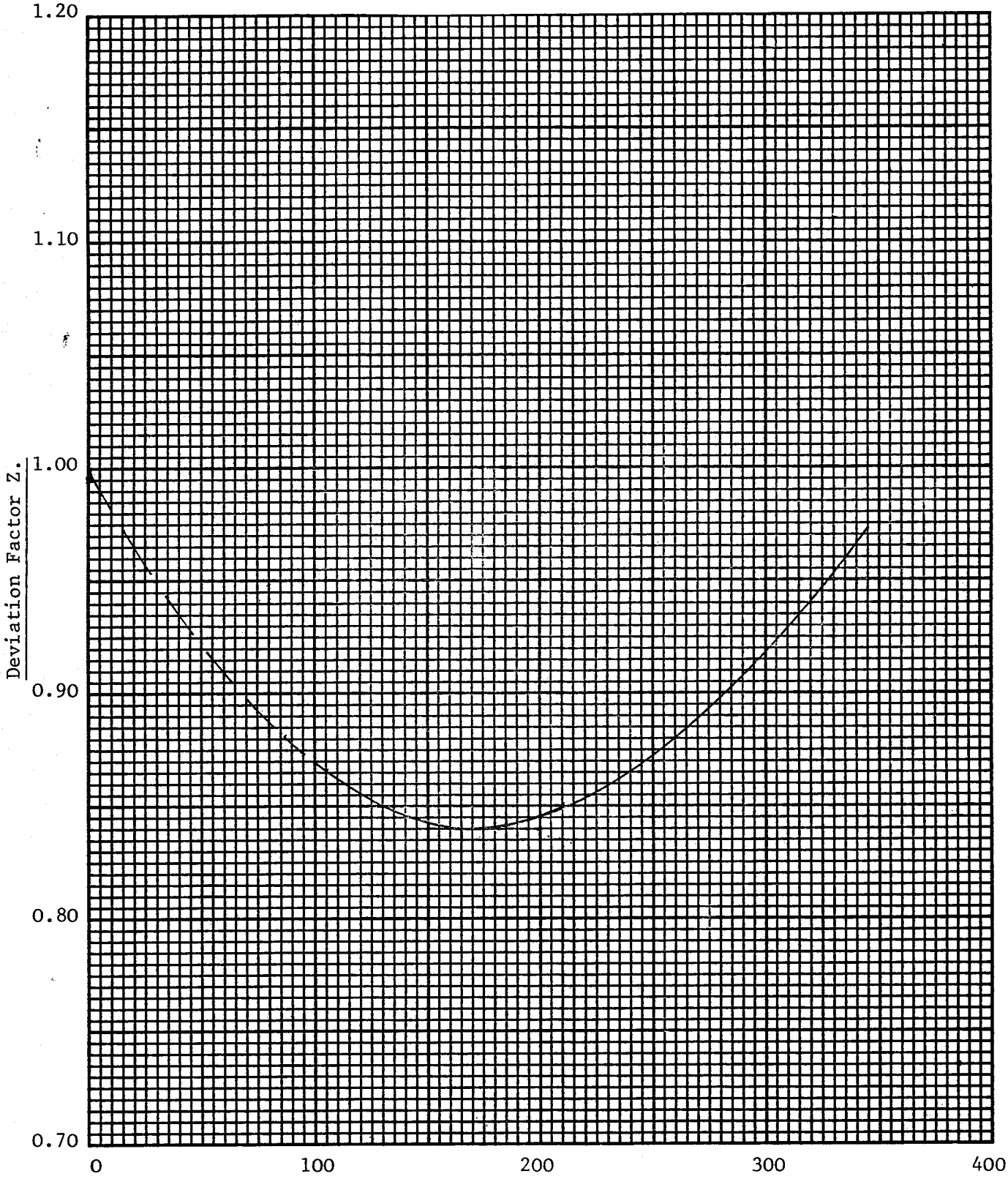
Well 34/10-4 DST 1

MEASURED GAS DEVIATION FACTOR Z OF SYNTHESISED INJECTION GAS AT 73.0°C.

Pressure Bar G	Deviation Factor Z
344.7	0.972
330.9	0.954
310.3	0.928
296.5	0.913
275.8	0.894
241.3	0.866
206.8	0.847
172.4	0.840
137.9	0.845
103.4	0.866

Deviation Factor Z of Synthesized Injection Gas at 73.0°C.

Company Statoil A/S **Formation**
Well 34/10 - 4 DST 1 **County** North Sea
Field **State** Norway



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VOLUMETRIC DATA OF Original Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 239.6 BAR G @ 73.0 °C.

2. Thermal expansion of saturated oil @ 344.7 BAR G = $\frac{V \text{ @ } 73.0 \text{ °C.}}{V \text{ @ } 17.8 \text{ °C.}}$ = 1.05059

3. Compressibility of saturated oil @ reservoir temperature: Vol/Vol/BAR G:

   From 344.7 BAR G to 310.3 BAR G = 11.07x10 -5

   From 310.3 BAR G to 275.8 BAR G = 12.07x10 -5

   From 275.8 BAR G to 239.6 BAR G = 12.58x10 -5

4. Pressure-Volume Relations:

Pressure Bar G		Relative Volume (1)
344.7		0.9875
310.3		0.9913
275.8		0.9954
262.0		0.9971
255.1		0.9980
248.2		0.9989
241.3		0.9998
239.6	Saturation Pressure	1.0000

(1) Relative Volume: V/Vsat is cubic metres at indicated pressure per cubic metre at saturation pressure.

REVAPORIZATION STUDY AT 330.9 BAR G AND 73.0°F.

Basis: 1 mol of original reservoir fluid.
Volume of original reservoir fluid at 330.9 Bar G and 73.0°F = One pore volume.

Injection Number	Gas Injected				Incremental Mols of Gas Produced	Mols of Liquid Phase Remaining	Relative Liquid Phase
	Pore Volumes		Mols				
	Incremental	Cumulative	Incremental	Cumulative			
0	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
1	0.5187	0.5187	0.9811	0.9811	0.8439	1.1372	1.0412
2	0.5187	1.0374	0.9811	1.9622	1.0711	1.0471	1.0193
3	0.5187	0.5561	0.9811	2.9433	1.0306	0.9976	0.9940
4	0.5187	2.0748	0.9811	3.9244	1.0203	0.9584	0.9655
5	0.5187	2.5935	0.9811	4.9055	1.0172	0.9222	0.9343
6	0.5187	3.1122	0.9811	5.8866	1.0140	0.8893	0.9040
7	0.5187	3.6309	0.9811	6.8677	1.0112	0.8591	0.8760
8	0.5187	4.1496	0.9811	7.8488	1.0088	0.8314	0.8510
9	0.5187	4.6683	0.9811	8.8299	1.0050	0.8074	0.8271

REVAPORIZATION STUDY AT 330.9 BAR G and 73.0°C.

Hydrocarbon Analyses of Produced Gases - Mol Per Cent

	Injection Number								
Component	1	2	3	4	5	6	7	8	9
Carbon Dioxide	1.39	1.50	1.57	1.62	1.66	1.69	1.71	1.73	1.74
Nitrogen	0.93	1.01	1.08	1.14	1.17	1.20	1.20	1.21	1.21
Methane	83.16	83.44	83.68	83.88	84.04	84.18	84.30	84.30	84.41
Ethane	5.62	6.04	6.38	6.60	6.80	6.91	6.98	7.00	7.02
Propane	1.39	1.63	1.85	1.98	2.07	2.14	2.20	2.25	2.28
iso-Butane	0.53	0.60	0.67	0.72	0.75	0.78	0.79	0.80	0.80
n-Butane	0.62	0.70	0.77	0.83	0.86	0.89	0.90	0.91	0.91
iso-Pentane	0.45	0.41	0.38	0.36	0.35	0.34	0.33	0.33	0.32
n-Pentane	0.23	0.20	0.18	0.17	0.16	0.15	0.15	0.14	0.14
Hexanes	0.43	0.33	0.28	0.24	0.22	0.20	0.19	0.18	0.18
Heptanes Plus	5.26	4.47	3.44	2.70	1.93	1.53	1.26	1.07	0.90
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular weight of heptanes plus	126	129	131	133	135	136	137	138	139
Specific gravity of heptanes plus	0.765	0.768	0.770	0.772	0.774	0.775	0.776	0.777	0.778

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Company Statoil A/S Formation

Well 34/10-4 DST 1 County North Sea

Field State Norway

HYDROCARBON ANALYSIS OF Residual Oil SAMPLE*

COMPONENT	MOL PERCENT	WEIGHT PERCENT	DENSITY	API	MOL WEIGHT
Hydrogen Sulfide	NIL	NIL			
Carbon Dioxide	2.73	1.09			
Nitrogen	0.46	0.12			
Methane	52.91	7.71			
Ethane	5.73	1.56			
Propane	2.56	1.03			
iso-Butane	1.06	0.56			
n-Butane	1.32	0.70			
iso-Pentane	1.22	0.80			
n-Pentane	0.59	0.38			
Hexanes	0.62	0.48			
Heptanes plus	30.80	85.57	0.9047	24.8	306
	100.00	100.00			

*From revaporization test at 330.9 BAR G.

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SEPARATOR TESTS OF Residual Oil SAMPLE

Separator Pressure, BAR Gauge	Separator Temperature °C.	Separator Gas/Oil Ratio(1)	Stock Tank Gas/Oil Ratio(1)	Stock Tank Density Kg/L @ 15°F.	Shrinkage Factor, Vr/Vsat(2)	Formation Volume Factor Vsat/Vr(3)	Specific Gravity of Flashed Gas
0	20	142		0.8898	0.7402	1.351	0.742

(1) Separator and Stock Tank Gas/Oil Ratio in cubic metres of gas @ 15°C and 1.0132 Bar absolute per cubic metre of stock tank oil at 15°C.
(2) Shrinkage Factor: Vr/Vsat is cubic metres of stock tank oil at 15°C. per cubic metre of saturated oil at 330.9 Bar gauge and 73.0°C.
(3) Formation Volume Factor: Vsat/Vr is cubic metres of saturated oil at 330.9 Bar gauge and 73.0°C per cubic metre of stock tank oil at 15°C.

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STATOIL A/S
Well: 34/10-4 DST 1

RFLA: 80201C

Core Laboratories UK Limited
Reservoir Fluid Analysis

L. K. Sebborn

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Laboratory Manager-RFL