CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

SPECIAL FLUID STUDY

for

B.P. Petroleum Development (Norway)

Well: 7/12-6 DST 2

North Sea, Norway.

CORE LABORATORIES UK LTD.
Petroleum Reservoir Engineering
ABERDEEN, SCOTLAND

6th January 1982

B.P. Petroleum Development Limited (Norway)
Sorflateveien 11
P.O. Box 3077
Mariero
4001 Stavanger
Norway

Subject: Special Fluid Study
Well: 7/12-6 DST 2
Field: Ula
North Sea, Norway.
Our File: RFLA 81169A

Attention: Mr. T. N. D. Hares.

Gentlemen,

On the 12th October 1981 a report (our file number RFLA 81169) containing the results of a reservoir fluid study conducted on reservoir fluid sample from the subject well was issued from our Aberdeen laboratory. We were subsequently requested, by a representative of B.P. Petroleum Development Limited (Norway), to conduct a number of further tests, the results of which are presented in the following report.

Utilising large volumes of reservoir fluid, two multi-stage flash separation tests were conducted in the laboratory. The conditions for these tests being 520 psig at 255°F to 140 psig at 215°F to 30 psig at 195°F for test one, and 520 psig at 255°F to 125 psig at 160°F for test two. These tests were terminated prior to the stock tank stage to create separator oil sample one at 30 psig and 195°F and separator oil sample two at 125 psig and 160°F.

A portion of separator oil sample one was placed in a high pressure visual cell and the pressure-volume relations measured at the specified pressures and temperatures. These data, along with the associated compressibility data, may be found on pages two, four and six.

The viscosity of the separator oil was determined at the specified temperatures in a rolling ball viscosimeter. These data may be found on pages three, five and seven.

A portion of separator oil sample two was placed in a high pressure visual cell and the pressure-volume relations measured at the specified pressures and temperatures. These data, along with the associated compressibility data, may be found on pages eight, ten and twelve.

The viscosity of the separator oil was determined at the specified temperatures in a rolling ball viscosimeter. These data may be found on pages nine, eleven and thirteen.

We were subsequently requested to measure the density of each separator oil sample. However, as the above tests utilised all available separator liquid, a theoretical density was calculated for each separator oil sample from compositions calculated using N.G.P.A. equilibrium constants applied to the previously reported reservoir fluid composition. These data, along with volume reduction factors calculated from measured volumetric data, which showed good agreement with published data, may be found with the viscosity data for each sample.

Continued Over/.....

It has been a pleasure to be of service to B.P. Petroleum Development Limited. Should any questions arise concerning data presented in this report, please do not hesitate to contact us.

Very truly yours

Core Laboratories UK Limited
Reservoir Fluid Analysis

L. K. Sebborn

LKS/DT/stb
10cc/Addressee

Les. K. Sebborn
Laboratory Manager

CORE LABORATORIES UK LTD.

Petroleum Reservoir Engineering

ABERDEEN, SCOTLAND

File RFLA 81169A

Company BP Pet. Development Ltd (Norway) Date Sampled 16th July 1981

Well 7/12-6 DST 2 State North Sea

Field Ula Country Norway

FORMATION CHARACTERISTICS

Formation Name	Ula
Date First Well Completed	, 19
Original Reservoir Pressure	7009 PSIG @ 3425 M BRT
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	3434-3511 M.
Tubing Size and Depth	In. to Ft.
Productivity Index	Bbl/D/PSI @ Bbl/Day
Last Reservoir Pressure	6874 PSIG @ 3425 M.
Date	, 19
Reservoir Temperature	290 °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	Choke
Status of Well	
Gas-Oil Ratio	339 SCF/Bbl
Separator Pressure and Temperature	620 PSIG, 152 °F.
Tubing Pressure	3216 PSIG
Casing Pressure	PSIG
Sampled by	FLOPETROL
Type Sampler	

REMARKS:

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Well 7/12-6 DST 2

Separator Oil Sample One Collected At 30 PSIG and 195°F.

PRESSURE-VOLUME RELATIONS @ 62°F.

Pressure PSIG	Relative Volume (1)
140	1.0000
125	1.0001
110	1.0002
95	1.0003
80	1.0004
65	1.0005
50	1.0006
35	1.0008
20	1.0010
5	1.0015

Compressibility of fluid @ 62°F (2):

From 140 PSI to 125 PSI = 5.62 x 10-6 Vol/Vol/PSI:

From 125 PSI to 110 PSI = 5.63 x 10-6 Vol/Vol/PSI:

From 110 PSI to 95 PSI = 5.64 x 10-6 Vol/Vol/PSI:

From 95 PSI to 80 PSI = 5.65 x 10-6 Vol/Vol/PSI:

From 80 PSI to 65 PSI = 5.67 x 10-6 Vol/Vol/PSI:

From 65 PSI to 50 PSI = 5.69 x 10-6 Vol/Vol/PSI:

From 50 PSI to 35 PSI = 5.71 x 10-6 Vol/Vol/PSI:

From 35 PSI to 20 PSI = 5.77 x 10-6 Vol/Vol/PSI:

(1) Relative Volume : V/V is barrels at indicated pressure per barrel at 140 psig and 62°F.

(2) Compressibility: $Co = (-1/V1)\ ([V_1-V_2]/[P_1-P_2])$

Separator Oil Sample One Collected At 30 PSIG and 195°F.

VISCOSITY DATA AT 62°F.

Pressure PSIG	Oil Viscosity Centipoise
140	5.14
125	5.13
110	5.13
95	5.12
80	5.12
65	5.11
50	5.10
35	5.10
20	5.09
5	5.09

Density of separator liquid sample at 140 psig and 62°F = 0.8088 g/ml (1)

(1) Density calculated from composition of separator oil derived from applying N.G.P.A. equilibrium constants to reservoir fluid composition.

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Separator Oil Sample One Collected At 30 PSIG and 195°F.

PRESSURE-VOLUME RELATIONS @ 120°F.

Pressure PSIG	Relative Volume (1)
140	1.0000
125	1.0001
110	1.0002
95	1.0003
80	1.0005
65	1.0006
50	1.0008
35	1.0010
20	1.0013
5	1.0017

Compressibility of fluid @ 120°F (2):

From 140 PSI to 125 PSI = 6.33 x 10-6 Vol/Vol/PSI:

From 125 PSI to 110 PSI = 6.34 x 10-6 Vol/Vol/PSI:

From 110 PSI to 95 PSI = 6.36 x 10-6 Vol/Vol/PSI:

From 95 PSI to 80 PSI = 6.39 x 10-6 Vol/Vol/PSI:

From 80 PSI to 65 PSI = 6.43 x 10-6 Vol/Vol/PSI:

From 65 PSI to 50 PSI = 6.47 x 10-6 Vol/Vol/PSI:

From 50 PSI to 35 PSI = 6.52 x 10-6 Vol/Vol/PSI:

From 35 PSI to 20 PSI = 6.67 x 10-6 Vol/Vol/PSI:

(1) Relative Volume : V/V is barrels at indicated pressure per barrel at 140 psig and 120°F.

(2) Compressibility: $Co = (-1/Vl)\ ([V_1-V_2]/[P_1-P_2])$

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Separator Oil Sample One Collected At 30 PSIG and 195°F.

VISCOSITY DATA AT 120°F.

Pressure PSIG	Oil Viscosity Centipoise
140	2.22
125	2.22
110	2.21
95	2.21
80	2.20
65	2.20
50	2.20
35	2.19
20	2.19

Density of separator liquid sample at 140 psig and 120°F = 0.7846 g/ml (1)

Volume reduction factor from 140 psig at 120°F to 140 psig at 62°F = 0.9701 (2)

(1) Density = density at 140 psig and 62°F x Volume Reduction Factor.
(2) Volume Reduction Factor: = Volume at 140 psig and 62°F/Volume at 140 psig and 120°F.

Separator Oil Sample One Collected At 30 PSIG and 195°F.

PRESSURE-VOLUME RELATIONS @ 195°F.

Pressure PSIG	Relative Volume (1)
140	1.0000
125	1.0001
110	1.0003
95	1.0005
80	1.0007
65	1.0009
50	1.0012
35	1.0015
29	1.0018

Compressibility of fluid @ 195°F (2):

From 140 PSI to 125 PSI = 7.34 x 10-6 Vol/Vol/PSI:

From 125 PSI to 110 PSI = 7.37 x 10-6 Vol/Vol/PSI:

From 110 PSI to 95 PSI = 7.40 x 10-6 Vol/Vol/PSI:

From 95 PSI to 80 PSI = 7.44 x 10-6 Vol/Vol/PSI:

From 80 PSI to 65 PSI = 7.49 x 10-6 Vol/Vol/PSI:

From 65 PSI to 50 PSI = 7.55 x 10-6 Vol/Vol/PSI:

From 50 PSI to 35 PSI = 7.61 x 10-6 Vol/Vol/PSI:

(1) Relative Volume : V/V is barrels at indicated pressure per barrel at 140 psig and 195°F.

(2) Compressibility: $Co = (-1/V1)\ ([V_1-V_2]/[P_1-P_2])$

Separator Oil Sample One Collected At 30 PSIG and 195°F.

VISCOSITY DATA AT 195°F.

Pressure PSIG	Oil Viscosity * Centipoise
140	1.187
125	1.185
110	1.184
95	1.183
80	1.181
65	1.178
50	1.176
35	1.171

Density of separator liquid sample at 140 psig and 195°F = 0.7536 g/ml (1)

Volume reduction factor from 140 psig at 195°F to 140 psig at 62°F = 0.9317 (2)

*Third decimal place from interpolation.

(1) Density = density at 140 psig and 62°F x Volume Reduction Factor.
(2) Volume Reduction Factor: = Volume at 140 psig and 62°F/Volume at 140 psig and 195°F.

Separator Oil Sample Two Collected At 125 PSIG and 160°F.

PRESSURE-VOLUME RELATIONS @ 62°F.

Pressure PSIG	Relative Volume (1)
400	1.0000
360	1.0003
320	1.0005
280	1.0008
240	1.0010
200	1.0012
160	1.0015
120	1.0018
80	1.0021
40	1.5523

Compressibility of fluid @ 62°F (2):

From 400 PSI to 360 PSI = 6.25 x 10-6 Vol/Vol/PSI:

From 360 PSI to 320 PSI = 6.41 x 10-6 Vol/Vol/PSI:

From 320 PSI to 280 PSI = 6.57 x 10-6 Vol/Vol/PSI:

From 280 PSI to 240 PSI = 6.75 x 10-6 Vol/Vol/PSI:

From 240 PSI to 200 PSI = 6.92 x 10-6 Vol/Vol/PSI:

From 200 PSI to 160 PSI = 7.11 x 10-6 Vol/Vol/PSI:

From 160 PSI to 120 PSI = 7.29 x 10-6 Vol/Vol/PSI:

From 120 PSI to 80 PSI = 7.50 x 10-6 Vol/Vol/PSI:

(1) Relative Volume : V/V is barrels at indicated pressure per barrel at 400 psig and 62°F.

(2) Compressibility: $Co = (-1/V1)\ ([V_1-V_2]/[P_1-P_2])$

Separator Oil Sample Two Collected At 125 PSIG and 160°F.

VISCOSITY DATA AT 62°F.

Pressure PSIG	Oil Viscosity Centipoise
400	3.89
360	3.88
320	3.86
280	3.85
240	3.83
200	3.81
160	3.80
120	3.78
80	3.76

Density of separator liquid sample at 400 psig and 62°F = 0.7964 g/ml (1)

(1) Density calculated from composition of separator oil derived from applying N.G.P.A. equilibrium constants to reservoir fluid composition.

Separator Oil Sample Two Collected At 125 PSIG and 160°F.

PRESSURE-VOLUME RELATIONS @ 100°F.

Pressure PSIG	Relative Volume (1)
400	1.0000
360	1.0003
320	1.0005
280	1.0008
240	1.0011
200	1.0013
160	1.0016
120	1.0019
80	1.1186
40	2.0127

Compressibility of fluid @ 100°F (2):

From 400 PSI to 360 PSI = 6.50 x 10-6 Vol/Vol/PSI:

From 360 PSI to 320 PSI = 6.61 x 10-6 Vol/Vol/PSI:

From 320 PSI to 280 PSI = 6.72 x 10-6 Vol/Vol/PSI:

From 280 PSI to 240 PSI = 6.84 x 10-6 Vol/Vol/PSI:

From 240 PSI to 200 PSI = 6.97 x 10-6 Vol/Vol/PSI:

From 200 PSI to 160 PSI = 7.13 x 10-6 Vol/Vol/PSI:

From 160 PSI to 120 PSI = 7.35 x 10-6 Vol/Vol/PSI:

(1) Relative Volume : V/V is barrels at indicated pressure per barrel at 400 psig and 100°F.

(2) Compressibility: $Co = (-1/V1)([V_1-V_2]/[P_1-P_2])$

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Separator Oil Sample Two Collected At 125 PSIG and 160°F.

VISCOSITY DATA AT 100°F.

Pressure PSIG	Oil Viscosity Centipoise
400	2.41
360	2.40
320	2.39
280	2.38
240	2.36
200	2.35
160	2.34
120	2.33

Density of separator liquid sample at 400 psig and 100°F = 0.7806 g/ml (1)

Volume reduction factor from 400 psig at 100°F to 400 psig at 62°F = 0.9801 (2)

(1) Density = density at 400 psig and 62°F x Volume Reduction Factor.
(2) Volume Reduction Factor: = Volume at 400 psig and 62°F/Volume at 400 psig and 100°F.

Separator Oil Sample Two Collected At 125 PSIG and 160°F.

PRESSURE-VOLUME RELATIONS @ 160°F.

Pressure PSIG	Relative Volume (1)
400	1.0000
360	1.0003
320	1.0006
280	1.0010
240	1.0013
200	1.0017
160	1.0020
120	1.0321
80	1.6048
59	2.4513

Compressibility of fluid @ 160°F (2):

From 400 PSI to 360 PSI = 7.91 x 10-6 Vol/Vol/PSI:

From 360 PSI to 320 PSI = 8.09 x 10-6 Vol/Vol/PSI:

From 320 PSI to 280 PSI = 8.23 x 10-6 Vol/Vol/PSI:

From 280 PSI to 240 PSI = 8.32 x 10-6 Vol/Vol/PSI:

From 240 PSI to 200 PSI = 8.69 x 10-6 Vol/Vol/PSI:

From 200 PSI to 160 PSI = 9.08 x 10-6 Vol/Vol/PSI:

(1) Relative Volume : V/V is barrels at indicated pressure per barrel at 400 psig and 160°F.

(2) Compressibility: $Co = (-1/V1)([V_1-V_2]/[P_1-P_2])$

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Separator Oil Sample Two Collected At 125 PSIG and 160°F.

VISCOSITY DATA AT 160°F.

Pressure PSIG	Oil Viscosity Centipoise
400	1.32
360	1.31
320	1.31
280	1.30
240	1.30
200	1.29
160	1.28

Density of separator liquid sample at 400 psig and 160°F = 0.7543 g/ml (1)

Volume reduction factor from 400 psig at 62°F to 400 psig at 160°F = 0.9471 (2)

(1) Density = density at 400 psig and 62°F x Volume Reduction Factor.
(2) Volume Reduction Factor: = Volume at 400 psig and 62°F/Volume at 400 psig and 160°F.

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Reservoir Fluid Analysis

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