

**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

RESERVOIR FLUID STUDY

D-28

for

CONOCO NORWAY INC.

WELL: 7/8-3 DST No. 2

— CONOCO NORWAY INC. —  
— CENTRAL FILES —  
— LIBRARY —

**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

March 14th. 1984

Conoco Norway Inc.  
P.O.Box 488

4001 STAVANGER

Attention: Mr. Kurt O. Thomas

Subject: Reservoir Fluid Study  
Well: 7/8-3 DST No. 2  
Block 7/8  
North Sea, Norway  
Our File Number: RFLN 830010

Gentlemen,

Duplicate subsurface samples were collected from the subject well and forwarded to our Ågotnes laboratory for use in a reservoir fluid study. Presented in the following report are the results of this study as requested by Conoco Norway Inc.

As a quality check the room temperature saturation pressure of each sample was determined. At 63°F, subsurface fluid sample in cylinder numbers 20112 106 and 9214/182 were found to have bubble point pressures of 955 PSIG and 514 PSIG, respectively. The upper valve on cylinder number 9214/182 was found to be damaged upon receipt and the cylinder showed evidence of having leaked during transportation. The reservoir fluid study was performed on fluid from cylinder number 20112 106.

The hydrocarbon composition of the reservoir fluid was determined by low temperature fractional distillation. The results of this distillation in terms of both mol percent and weight percent are presented on page two.

A small quantity of the reservoir fluid was charged to a high pressure windowed cell and thermally expanded to the reservoir temperature of 310°F. During a constant composition expansion at this temperature, the fluid was found to have a bubble point pressure of 1399 PSIG. The results of the pressure-volume measurements at reservoir temperature may be found on page four.

When subjected to differential pressure depletion at the reservoir temperature, the fluid evolved a total of 396 cubic feet of gas at 14.696 psia and 60°F per barrel of residual oil at 60°F. The resulting relative oil volume factor was 1.456 barrels of saturated fluid per barrel of residual oil. The oil density and the properties of the evolved gases were measured at each point during the differential pressure depletion and these data are included in the summary of the differential depletion data on page five.

Conoco Norway Inc.  
Well: 7/8-3 DST No. 2

The viscosity of the reservoir fluid was measured over a wide range of pressures at 310°F. in a rolling ball viscosimeter. The viscosity of the fluid was found to vary from a minimum of 0.541 centipoise at the saturation pressure to a maximum of 1.096 centipoises at atmospheric pressure. The results of the viscosity measurements are tabulated on page six.

Thank you for the opportunity to be of service to Conoco Norway Inc. If you have any questions or if we may be of further assistance in any way, please feel free to call upon us.

Very truly yours

Core Laboratories Norsk

*Duncan Thow*

Duncan Thow  
Operations supervisor  
Reservoir Fluid Laboratory

**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

Page 1 of 9

File RFLN 830010

Company Conoco Norway Inc Date Sampled December 2nd 1983  
 Well 7/8-3.DST.No. 2 County North Sea  
 Field Block 7/8 State Norway

**FORMATION CHARACTERISTICS**

Formation Name .....  
 Date First Well Completed ..... 19.....  
 Original Reservoir Pressure ..... 8586 ..... PSIG @ 12262 ..... Ft.  
 Original Produced Gas-Liquid Ratio ..... SCF/Bbl  
     Production Rate ..... 418 ..... Bbl/Day  
     Separator Pressure and Temperature ..... PSIG ..... ° F.  
     Oil Gravity at 60°F. .... ° API  
 Datum ..... Ft. Subsea  
 Original Gas Cap .....

**WELL CHARACTERISTICS**

Elevation ..... 82 ..... Ft. RKB  
 Total Depth ..... 14174 ..... Ft.  
 Producing Interval ..... 12252 - 12272 ..... Ft.  
 Tubing Size and Depth ..... 5 ..... In. to 12248 ..... Ft.  
 Productivity Index ..... Bbl/D/PSI @ ..... Bbl/Day  
 Last Reservoir Pressure ..... 8586 ..... PSIG @ 12262 ..... Ft.  
     Date ..... December 5th ..... 1983...  
     Reservoir Temperature ..... 310 ..... ° F. @ 12262 ..... 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 ..... 12157 ..... Ft.  
 Status of Well .....  
     Gas-Oil Ratio ..... 175 (Estimated) ..... SCF/Bbl  
     Separator Pressure and Temperature ..... PSIG ..... ° F.  
     Tubing Pressure ..... PSIG  
     Casing Pressure ..... PSIG  
 Sampled by ..... Flopetrol  
 Type Sampler .....

REMARKS :

**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

Page ....2..... of ....9.....

File ....REIN...830010.....

Company ..... Conoco Norway Inc. .... Date Sampled ..... December 5th. 1983 .....  
 Well ..... 7/8-3 DST No. 2 ..... County ..... North Sea .....  
 Field ..... Block 7/8 ..... State ..... Norway .....

**HYDROCARBON ANALYSIS OF ... Reservoir Fluid ... SAMPLE**

COMPONENT	MOL PERCENT	WEIGHT PERCENT	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Hydrogen Sulfide	NIL	NIL			
Carbon Dioxide	1.09	0.30			
Nitrogen	1.85	0.32			
Methane	14.74	1.47			
Ethane	7.05	1.32			
Propane	6.82	1.87			
iso-Butane	1.04	0.38			
n-Butane	4.07	1.47			
iso-Pentane	1.75	0.78			
n-Pentane	2.85	1.28			
Hexanes	5.27	2.81			
Heptanes plus	<u>53.47</u>	<u>88.00</u>	0.8762	29.8	265
	100.00	100.00			

VOLUMETRIC DATA OF ..RESERVOIR FLUID.... SAMPLE

1. Saturation pressure (bubble-point pressure) .....1399... PSIG @ ..310.... °F.

2. Specific volume at saturation pressure : ft<sup>3</sup>/lb .....0.02277..... @ ..310.... °F.

3. Thermal expansion of saturated oil @ ...2000..... PSI =  $\frac{V @ 310}{V @ 59.5} \frac{°F}{°F} = 1.14765$

4. Compressibility of saturated oil @ reservoir temperature : Vol/Vol/PSI :

From...8586...PSI to...7000...PSI = .....7.69 x 10<sup>-6</sup>...  
From...7000...PSI to...5000...PSI = .....9.00 x 10<sup>-6</sup>...  
From...5000...PSI to...3000...PSI = .....10.95 x 10<sup>-6</sup>...  
From...3000...PSI to...2000...PSI = .....13.13 x 10<sup>-6</sup>...  
From...2000...PSI to...1399...PSI = .....15.51 x 10<sup>-6</sup>...

**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

Page .....4..... of .....9.....

File .....RFLN.830010.....

Well .....7/8-3 DST No. 2.....

Pressure-Volume Relations at ...31.0... °F.

<u>Pressure PSIG</u>	<u>Relative Volume (1)</u>	<u>Y Function (2)</u>
8586	0.9276	
8000	0.9314	
7500	0.9352	
7000	0.9390	
6500	0.9430	
6000	0.9472	
5500	0.9516	
5000	0.9563	
4500	0.9611	
4000	0.9663	
3500	0.9718	
3000	0.9777	
2500	0.9838	
2000	0.9907	
1900	0.9922	
1800	0.9937	
1700	0.9953	
1600	0.9968	
1500	0.9984	
1399 Saturation Pressure	1.0000	
1388	1.0028	2.815
1383	1.0041	2.806
1355	1.0115	2.784
1289	1.0309	2.726
1180	1.0701	2.614
1055	1.1278	2.516
933	1.2064	2.382
805	1.3221	2.249
688	1.4793	2.111
589	1.6728	1.993
463	2.0687	1.832
358	2.6539	1.687
262	3.6322	1.559

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

$$(2) Y \text{ Function} = \frac{(P_{sat}-P)}{(P_{abs})(V/V_{sat}-1)}$$

**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

Differential Vaporization at 310 °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
1399	396	1.456	1.456	0.7034			
1250	368	1.442	1.522	0.7060	0.934	0.01607	0.974
1100	343	1.429	1.602	0.7088	0.938	0.01831	0.962
900	309	1.409	1.757	0.7131	0.945	0.02248	0.996
700	271	1.388	2.034	0.7179	0.953	0.02902	1.059
500	229	1.362	2.572	0.7237	0.962	0.04067	1.152
300	177	1.327	3.954	0.7316	0.974	0.06735	1.331
200	146	1.301	5.733	0.7384	0.982	0.09953	1.464
129	123	1.276	8.543	0.7460	0.987	0.14947	1.624
0	0	1.117		0.7885			2.657

Gravity of residual oil = .....29.0.....° API @ 60°F.

- (1) Cubic feet of gas at 14.696 psia and 60 °F. per barrel of 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 14.696 psia and 60°F.



**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

Page .....6..... of .....9.....

File ....RFLN.830010.....

Well ....7/8-3.DST.No.2....

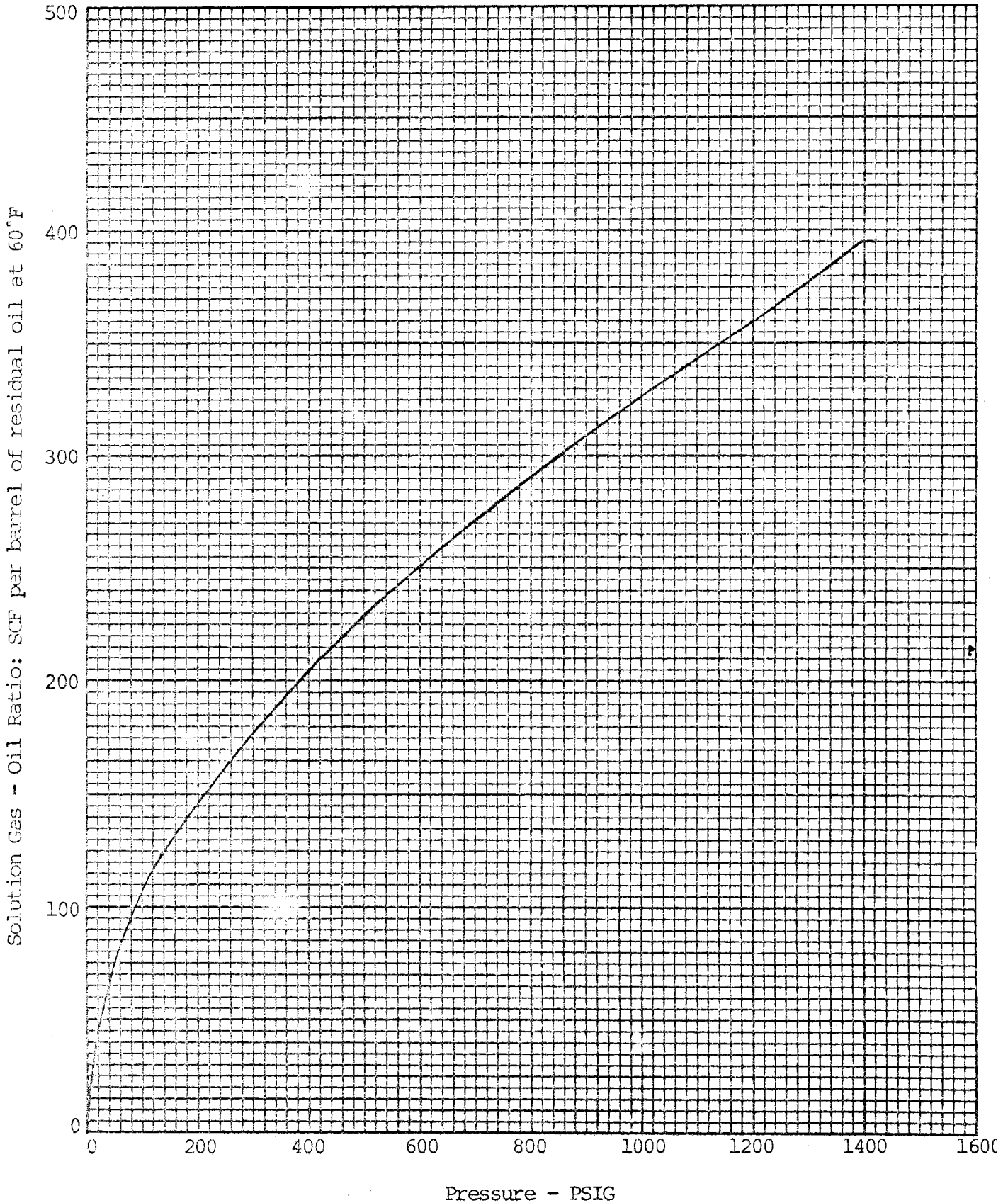
Viscosity Data at 310 °F.

Pressure PSIG	Oil Viscosity Centipoise	Calculated Gas Viscosity Centipoise	Oil/Gas Viscosity Ratio
8586	0.962		
8000	0.927		
7500	0.898		
7000	0.869		
6500	0.840		
6000	0.811		
5500	0.781		
5000	0.752		
4500	0.723		
4000	0.693		
3500	0.664		
3000	0.635		
2500	0.606		
2000	0.577		
1399	0.541		
Saturation Pressure			
1250	0.545	0.0157	34.7
1100	0.552	0.0151	36.6
900	0.568	0.0145	39.2
700	0.597	0.0137	43.6
500	0.652	0.0132	49.4
300	0.721	0.0126	58.0
200	0.766	0.0121	63.3
129	0.862	0.0117	73.7
0	1.096		

BERGEN, NORWAY

Differential Vapourization at 310°F

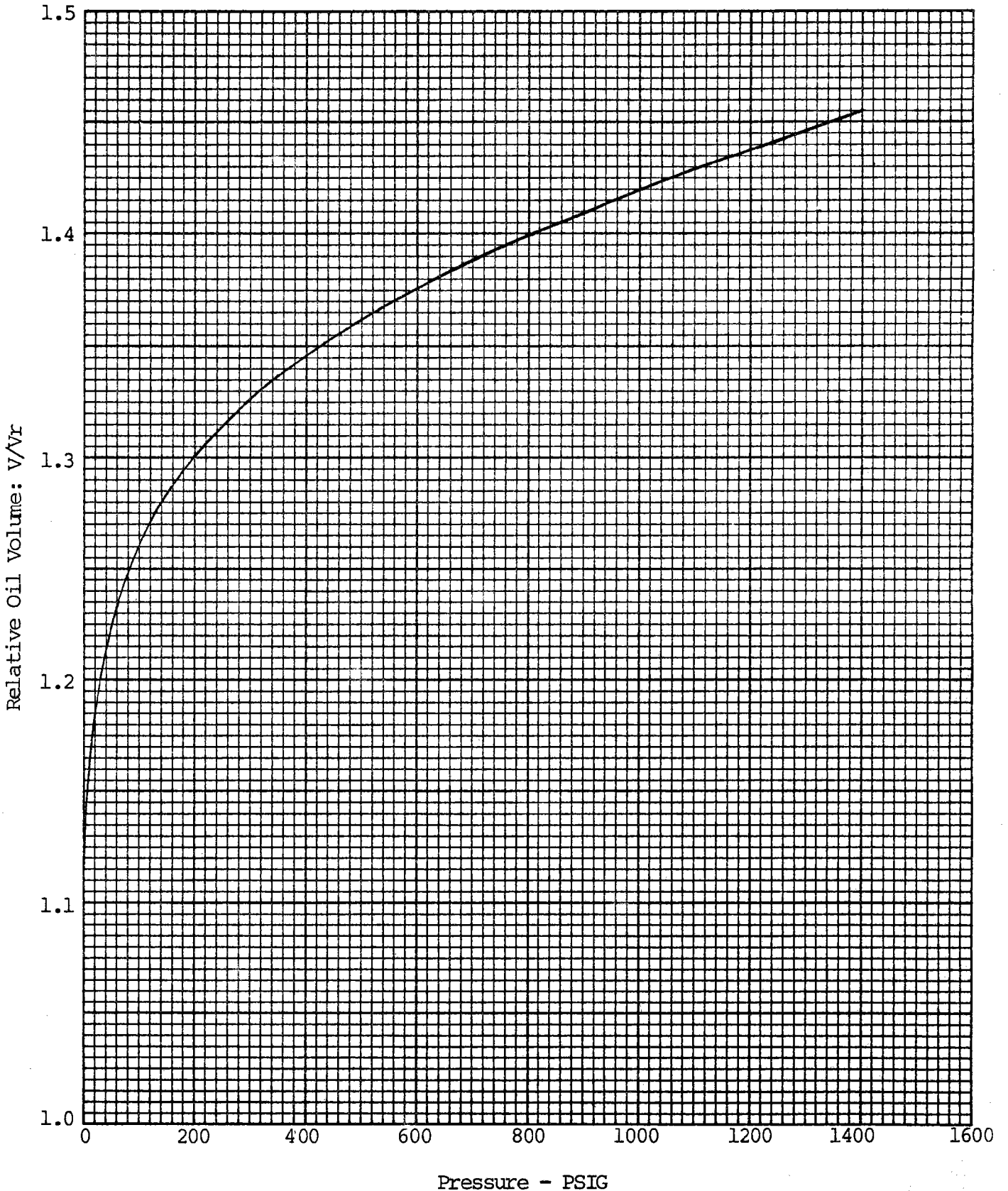
Company	Conoco Norway Inc.	Formation	
Well	7/8-3 DST No. 2	Province	North Sea
Field	Block 7/8	Country	Norway



BERGEN, NORWAY

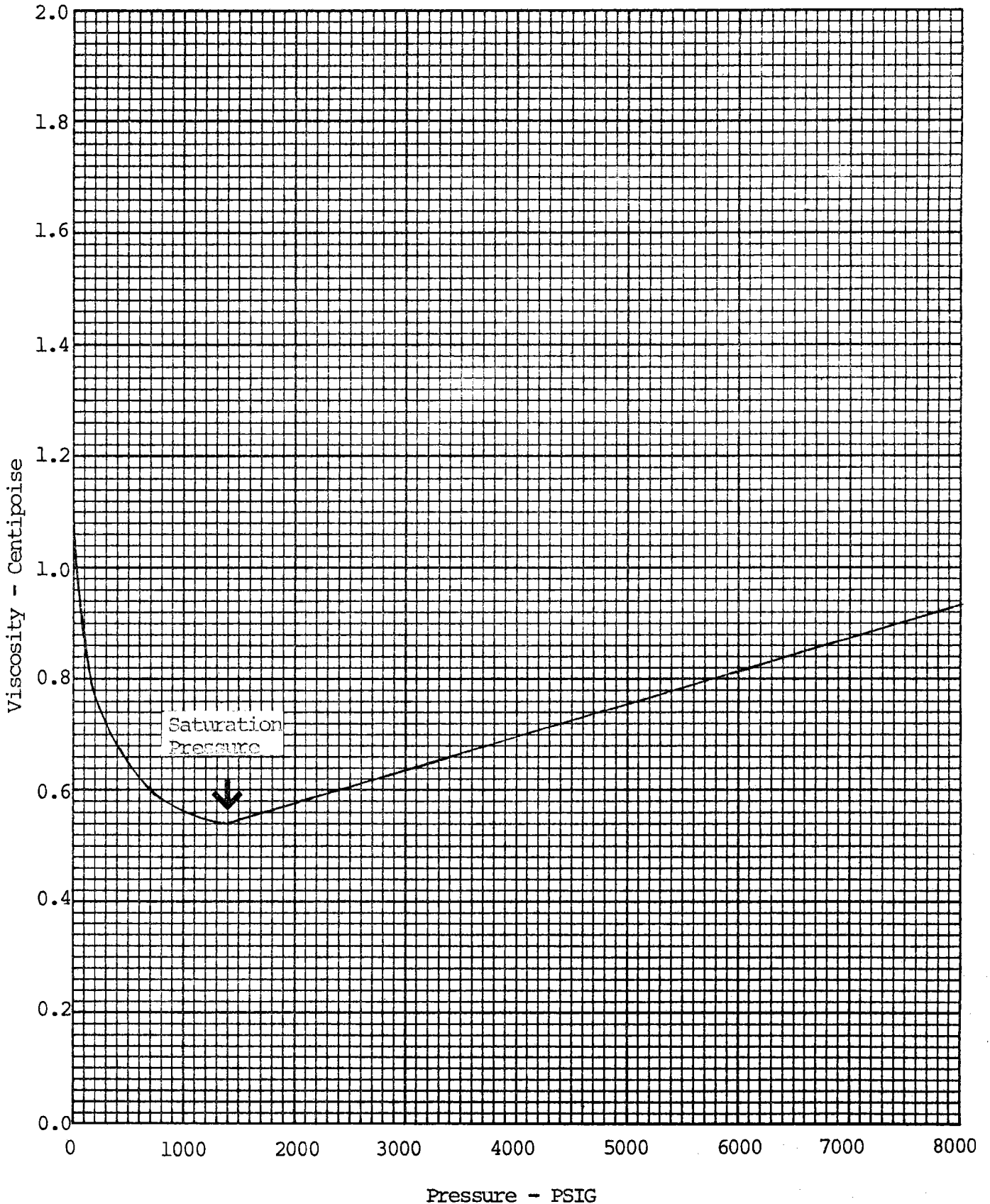
Differential Vapourization at 310°F

Company	Conoco Norway Inc.	Formation	
Well	7/8-3 DST No. 2	Province	North Sea
Field	Block 7/8	Country	Norway



Viscosity Of Reservoir Fluid


Company	Conoco Norway Inc	Formation	
Well	7/8-3 DST No. 2	Province	North Sea
Field	Block 7/8	Country	Norway



**CORE LABORATORIES**  
*Petroleum Reservoir Engineering*  
**CCB, ÅGOTNES**

Conoco Norway Inc.  
Well: 7/8-3 DST No. 2

RFLN 830010

Core Laboratories Norsk  
Reservoir Fluid Laboratory  
  
DUNCAN THOW  
Operations Supervisor