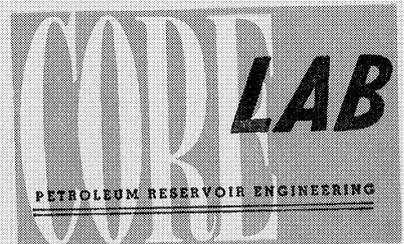


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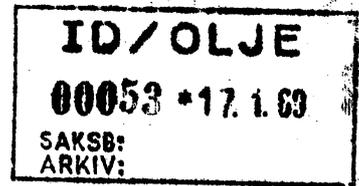
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**RESERVOIR FLUID STUDY
FOR
PHILLIPS PETROLEUM COMPANY**

7/11-2X WELL
BLOCK 7/11 FIELD
NORTH SEA, NORWAY



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207
January 2, 1969



RESERVOIR FLUID ANALYSIS

Phillips Petroleum Company
P. O. Box 72
Stavanger, Norway

Attention: Mr. Jerry Fetters

Subject: Reservoir Fluid Study
7/11-2X Well
Block 7/11 Field
North Sea, Norway
Our File Number: RFL 5114

Gentlemen:

Samples of primary separator liquid and vapor were collected from the subject well and submitted to our Dallas laboratory for use in a reservoir fluid study. Presented on the following pages are the results of this study as requested by Phillips Petroleum Company.

After correction for the factors shown on page one, the producing gas-liquid ratio was 16,912 cubic feet of primary separator gas at 14.696 psia and 60°F. per barrel of stock tank liquid at 60°F. In our laboratory it was found that this ratio is equivalent to 13,519 standard cubic feet of primary separator gas per barrel of primary separator liquid at 915 psig and 60°F. This ratio was then used in conjunction with the measured compositions of the separator products to calculate the composition of the well stream material, and these data are reported on page two.

The separator liquid and vapor products were then physically recombined to their producing gas-liquid ratio and the resultant fluid was examined in a visual cell at the reservoir temperature of 253°F. During a constant composition expansion at this temperature a retrograde dew point was observed at a pressure of 5503 psig. The last reservoir pressure was reported to be 5550 psig at a depth of 10,135 feet. Comparison of the dew point pressure

to the last reservoir pressure gives an indication that the fluid probably exists in the reservoir as a saturated gas phase. The results of the pressure-volume measurements, along with the measured deviation factor at the dew point pressure and above, are presented on page three.

In order to simulate pressure depletion of the reservoir, a constant volume depletion study was performed on a sample of the reservoir fluid. This depletion consisted of a series of expansions and constant pressure displacements, with each displacement terminating at the original cell volume. The gas displaced at each pressure level was charged to low temperature, fractional distillation equipment for analysis and volume measurements. Two deviation factors were calculated from the results of this depletion study. The first is a deviation factor of the produced equilibrium gas phase. The second is the two-phase deviation factor, and it is defined as the volume of gas plus liquid in the reservoir divided by the volume that would be occupied at reservoir conditions by an equal number of mols of an ideal gas. A graph of cumulative volume of gas produced versus the absolute pressure divided by the two-phase deviation factor is a straight line which may be extrapolated to yield total gas recovery. Presented on page four are the results obtained during this constant volume depletion study.

Smoothed compositions and equilibrium ratios from the literature were used to calculate the surface recoveries that may be expected as reservoir pressure declines. These recoveries are based upon one MMSCF of fluid in place at the dew point pressure, and they are presented on page five. Also tabulated on page five are the total plant products available in the primary separator gas and the second-stage gas, as well as the total plant products produced in the well stream. A plant efficiency of 100 per cent has been assumed for these recoveries.

The data concerning the amounts of retrograde liquid condensation in the reservoir, as reservoir pressure declines, are shown on page six of this report. At the first depletion level of 4500 psig the amount of retrograde liquid was only 0.46 per cent of the hydrocarbon pore space. The maximum retrograde liquid condensation will occur at a reservoir pressure of about 1000 psig, and the retrograde liquid will be about 4.3 per cent of the hydrocarbon pore space.

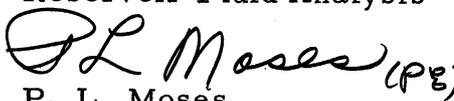
Phillips Petroleum Company
7/11-2X Well

Page Three

It has been our pleasure to perform this study for Phillips Petroleum Company. If you have any questions or if we may assist you further in any manner, please do not hesitate to contact us.

Very truly yours,

Core Laboratories, Inc.
Reservoir Fluid Analysis

 (P.L.)

P. L. Moses
Manager

PLM:HS:dr
15 cc - Addressee

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

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File RFL 5114

Company Phillips Petroleum Company Date Sampled October 4, 1968
 Well 7/11-2X Province _____
 Field Block 7/11 Country North Sea, Norway

FORMATION CHARACTERISTICS

Formation Name _____
 Date First Well Completed _____, 19____
 Original Reservoir Pressure 5328 PSIG @ -9439 Ft.
 Original Produced Gas-Liquid Ratio 11050 SCF/Bbl
 Production Rate 400 Bbls/Day
 Separator Pressure and Temperature 450 PSIG 53 ° F.
 Liquid Gravity at 60° F. 55 ° API
 Datum 9439 Ft. Subsea

WELL CHARACTERISTICS

Elevation 87 Ft.
 Total Depth 11245 Ft.
 Producing Interval 9932-10190 Ft.
 Tubing Size and Depth 3-1/2 In. to 10147 Ft.
 Open Flow Potential 60 MMSCF/Day
 Last Reservoir Pressure 5550 PSIG @ 10135 Ft.
 Date October 4, 19 68
 Reservoir Temperature 253 ° F. @ 10061 Ft.
 Status of Well _____
 Pressure Gauge _____

SAMPLING CONDITIONS

Flowing Tubing Pressure 2254 PSIG
 Flowing Bottom Hole Pressure 4259 PSIG
 Primary Separator Pressure 915 PSIG
 Primary Separator Temperature 138 ° F.
 Secondary Separator Pressure _____ PSIG
 Secondary Separator Temperature _____ ° F.
 Field Stock Tank Liquid Gravity 51 ° API @ 60° F.
 Primary Separator Gas Production Rate _____ MSCF/Day
 Pressure Base 14.696 PSIA
 Temperature Base 60 ° F.
 Compressibility Factor (F_{pv}) 1.062
 Gas Gravity (Laboratory) 0.692
 Gas Gravity Factor (F_g) 1.2021
 _____ Liquid Production Rate @ 60° F. _____ Bbls/Day
 Primary Separator Gas/ Stock Tank Liquid Ratio 16912 SCF/Bbl
 or 59.13 Bbls/MMSCF

Core Laboratories, Inc., Engineer

REMARKS:

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

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File RFL 5114

Well 7/11-2X

Hydrocarbon Analyses of Separator Products and Calculated Well Stream

Component	Separator Liquid		Separator Gas		Well Stream	
	Mol Per Cent		Mol Per Cent	GPM	Mol Per Cent	GPM
Hydrogen			0.02		0.02	
Helium			0.01		0.01	
Hydrogen Sulfide	Nil		Nil		Nil	
Carbon Dioxide	0.78		2.21		2.11	
Nitrogen	0.07		0.92		0.86	
Methane	18.14		83.30		78.79	
Ethane	6.48		7.67		7.59	
Propane	6.75		3.37	0.925	3.60	0.990
iso-Butane	1.74		0.58	0.189	0.66	0.216
n-Butane	5.79		1.02	0.321	1.35	0.425
iso-Pentane	3.15		0.28	0.102	0.48	0.175
n-Pentane	3.68		0.27	0.098	0.51	0.184
Hexanes	8.16		0.18	0.073	0.73	0.299
Heptanes plus	45.26		0.17	0.077	3.29	1.998
	<u>100.00</u>		<u>100.00</u>	<u>1.785</u>	<u>100.00</u>	<u>4.287</u>

Properties of Heptanes plus

API gravity @ 60° F.	<u>46.9</u>	
Specific gravity @ 60/60° F.	<u>0.7932</u>	<u>0.791</u>
Molecular weight	<u>154</u>	<u>103</u>

Calculated separator gas gravity (air = 1.000) = 0.692
 Calculated gross heating value for separator gas = 1154 BTU
 per cubic foot of dry gas @ 14.696 psia and 60° F.

Primary separator gas collected @ 900 psig and 136 °F.
 Primary separator liquid collected @ 900 psig and 132 °F.

Primary separator gas/separator liquid ratio 13519 SCF/Bbl @ 60° F.
 Primary separator liquid/stock tank liquid ratio 1.251 Bbls @ 60° F./Bbl
 Primary separator gas/well stream ratio 930.91 MMSCF/MMSCF
 Stock tank liquid/well stream ratio 55.04 Bbls/MMSCF

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

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File RFL 5114

Well 7/11-2X

Pressure-Volume Relations of Reservoir Fluid at 253° F.
(Constant Composition Expansion)

<u>Pressure</u> <u>PSIG</u>	<u>Relative</u> <u>Volume</u>	<u>Deviation Factor</u> <u>Z</u>
7000	0.8900	1.191
6500	0.9202	1.144
6000	0.9566	1.098
5700	0.9815	1.070
5637	0.9875	1.065
5587	0.9923	1.061
5567	0.9941	1.059
5550 Reservoir Pressure	0.9954	1.057*
5529	0.9973	1.055
<u>5503 Dew Point Pressure</u>	<u>1.0000</u>	<u>1.053**</u>
5493	1.0006	
5477	1.0023	
5451	1.0049	
5372	1.0130	
5260	1.0252	
4980	1.0591	
4591	1.1148	
4208	1.1838	
3812	1.2738	
3417	1.3927	
3019	1.5533	
2619	1.7730	
2222	2.0848	
1869	2.4883	
1571	2.9755	
1357	3.4642	
1191	3.9629	

* Gas formation volume factor = 1.467 MSCF/Bbl.

** Gas formation volume factor = 1.460 MSCF/Bbl.

These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitability of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

Depletion Study at 253 °F.

Hydrocarbon Analyses of Produced Well Stream- Mol Per Cent

Component	Reservoir Pressure - PSIG							
	5503	4500	3400	2300	1400	760	380*	0
Carbon dioxide	2.19	2.18	2.30	2.24	2.27	2.28	2.31	
Nitrogen	0.81	0.83	0.87	0.90	0.87	0.85	0.81	
Methane	78.73	79.14	79.71	80.33	80.75	80.01	78.65	
Ethane	7.70	7.70	7.95	7.54	7.86	7.93	7.74	
Propane	3.34	3.50	3.31	3.66	3.35	3.64	3.63	
iso-Butane	0.76	0.66	0.72	0.67	0.72	0.70	0.80	
n-Butane	1.41	1.43	1.22	1.35	1.30	1.40	1.66	
iso-Pentane	0.43	0.41	0.32	0.39	0.45	0.45	0.67	
n-Pentane	0.61	0.52	0.66	0.49	0.46	0.63	0.66	
Hexanes	0.68	0.76	0.74	0.64	0.61	0.66	0.92	
Heptanes plus	3.34	2.87	2.20	1.79	1.36	1.45	2.15	
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Molecular weight of heptanes plus	152	141	130	120	114	112	113	
Specific gravity of heptanes plus	0.791	0.782	0.770	0.760	0.754	0.752	0.753	
<u>Deviation Factor - Z</u>								
Equilibrium gas	1.053	0.979	0.922	0.906	0.921	0.948		
Two-phase	1.053	0.974	0.914	0.887	0.890	0.870		
Well stream produced-								
Cumulative per cent of initial	0.000	11.596	28.790	50.323	69.765	83.058		98.634
<u>GPM from Smooth Compositions</u>								
Propane plus	4.208	3.842	3.379	3.024	2.857	2.941	3.655	
Butanes plus	3.288	2.928	2.470	2.115	1.937	1.986	2.659	
Pentanes plus	2.623	2.266	1.817	1.472	1.284	1.318	1.876	

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Calculated Cumulative Recovery During Depletion

Cumulative Recovery per MMSCF of Original Fluid	Initial in Place	Reservoir Pressure—PSIG						
		5503	4500	3400	2300	1400	760	0
<u>Well Stream—MSCF</u>	1000	0	115.96	287.90	503.23	697.65	830.58	986.34
<u>Normal Temperature Separation *</u>								
Stock tank liquid—barrels	52.04	0	5.02	10.49	15.41	18.89		
Primary separator gas—MSCF	938.88	0	109.75	274.54	483.07	672.49		
Second stage gas—MSCF	15.07	0	1.53	3.30	4.98	6.22		
Stock tank gas—MSCF	5.11	0	0.52	1.13	1.71	2.15		
<u>Total "Plant Products" in</u>								
<u>Primary Separator Gas - Gallons**</u>								
Propane	814	0	96	240	424	594		
Butanes (total)	527	0	62	157	279	393		
Pentanes plus	521	0	62	157	280	395		
<u>Total "Plant Products" in</u>								
<u>Second Stage Gas - Gallons**</u>								
Propane	30	0	3.0	6.5	9.9	12.4		
Butanes (total)	16	0	1.7	3.7	5.6	7.0		
Pentanes plus	10	0	1.0	2.2	3.4	4.3		
<u>Total "Plant Products" in</u>								
<u>Well Stream—Gallons **</u>								
Propane	920	0	106	262	458	637	764	919
Butanes (total)	665	0	77	189	328	455	543	665
Pentanes plus	2623	0	263	575	892	1142	1317	1609

* Primary separator at 900 psig and 135°F., second stage separator at 100 psig and 80°F., stock tank at atmospheric pressure and 60°F.

** Recovery assumes 100 per cent plant efficiency.

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

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File RFL 5114

Well 7/11-2X

Retrograde Condensation During Gas Depletion at 253° F.

<u>Pressure PSIG</u>	<u>Retrograde Liquid Volume Per Cent of Hydrocarbon Pore Space</u>
5503 Dew Point Pressure	0.00
5493	Trace
5477	Trace
5451	0.01
5372	0.01
5260	0.05
4980	0.15
4500 First Depletion Level	0.46
3400	2.11
2300	3.53
1400	4.17
760	4.28
0	3.88

Properties of Zero PSIG Residual Liquid

Gravity : 43.0 °API @ 60° F.
Density : 0.8111 gms/cc @ 60° F.
Molecular weight: 190

Core Laboratories, Inc.
Reservoir Fluid Analysis

P. L. Moses (P.E.)

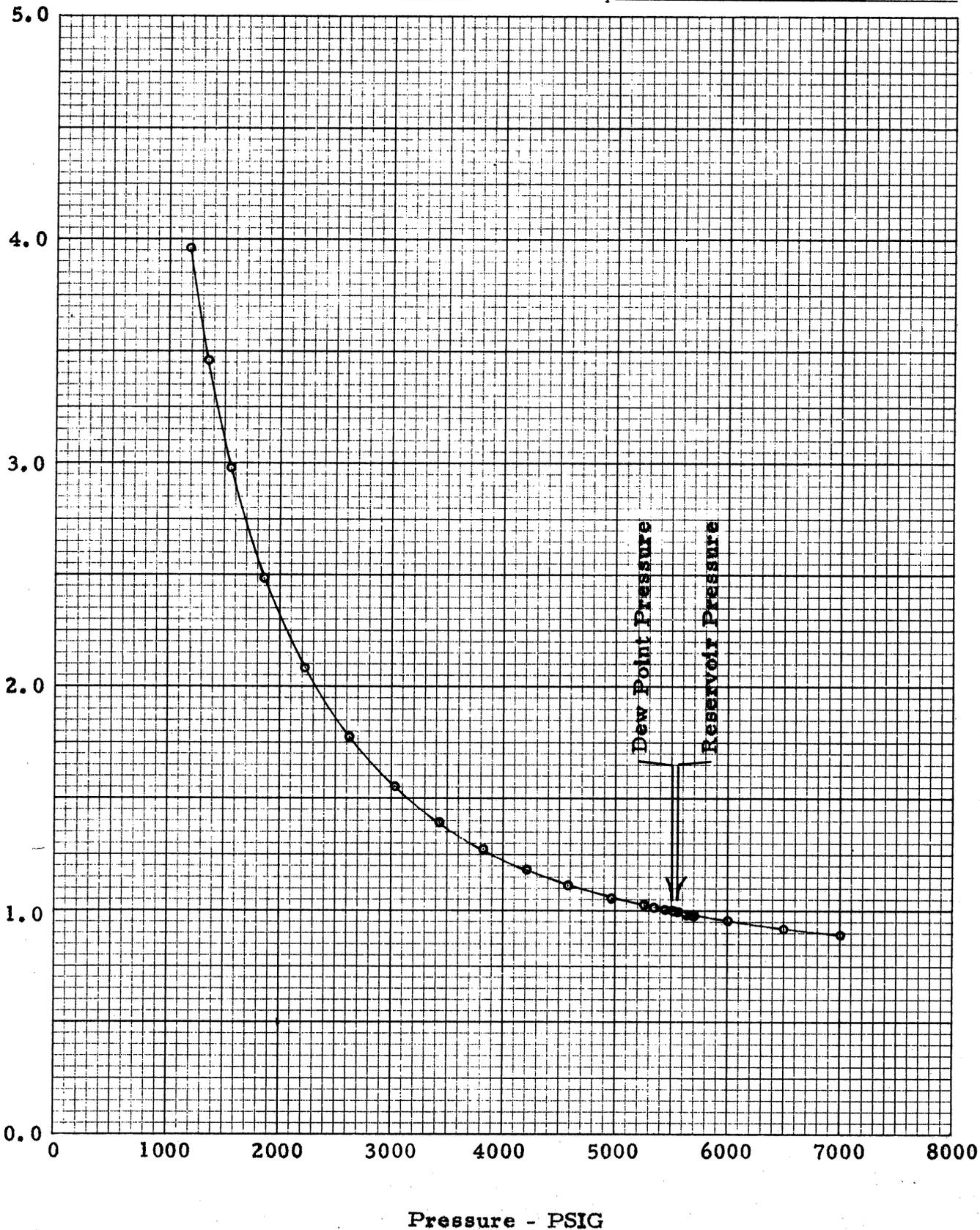
P. L. Moses
Manager

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Pressure-Volume Relations of Reservoir Fluid at 253°F.

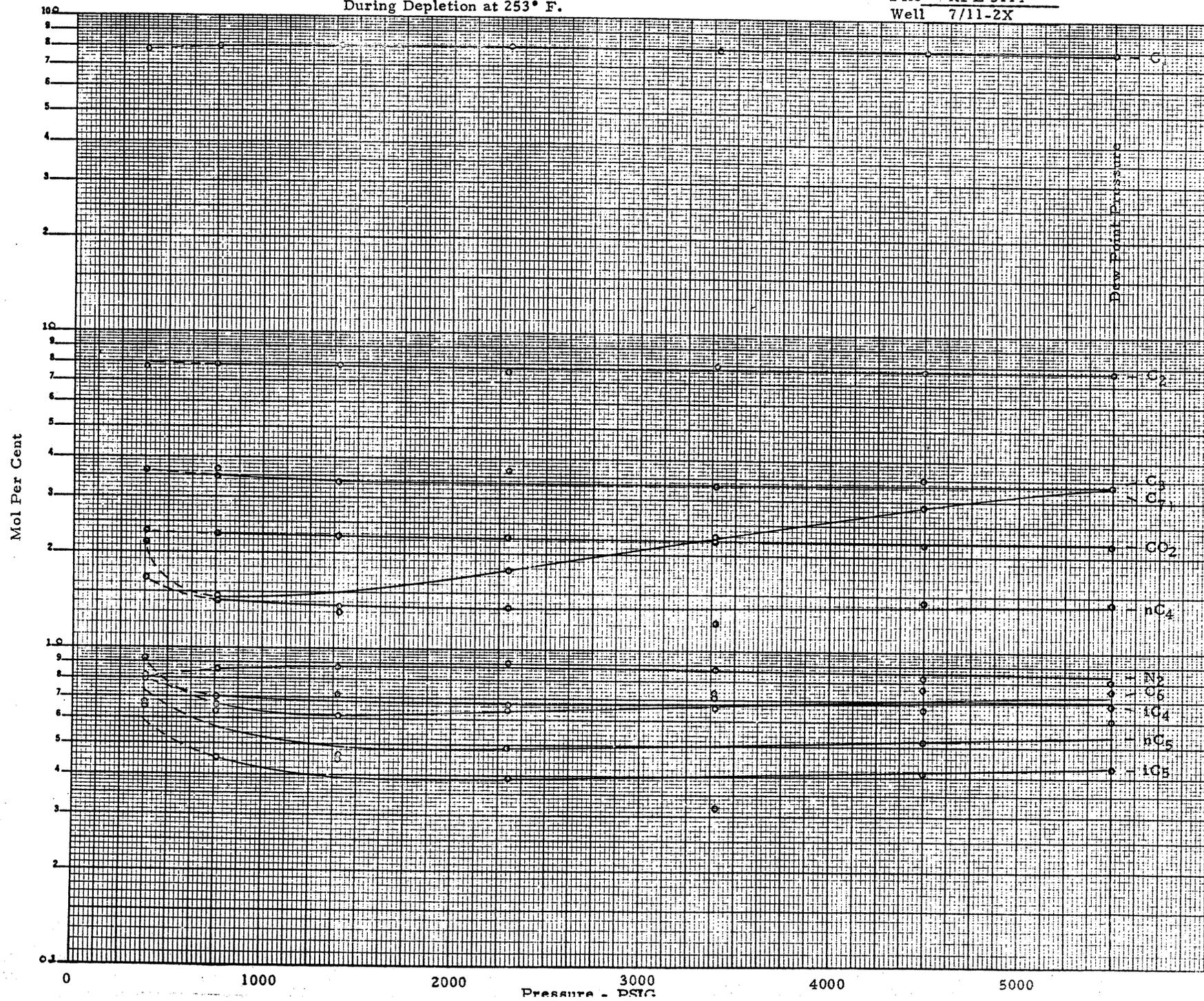
Company Phillips Petroleum Company Formation _____
Well 7/11-2X Province _____
Field Block 7/11 Country North Sea, Norway

Relative Volume - V/V_s



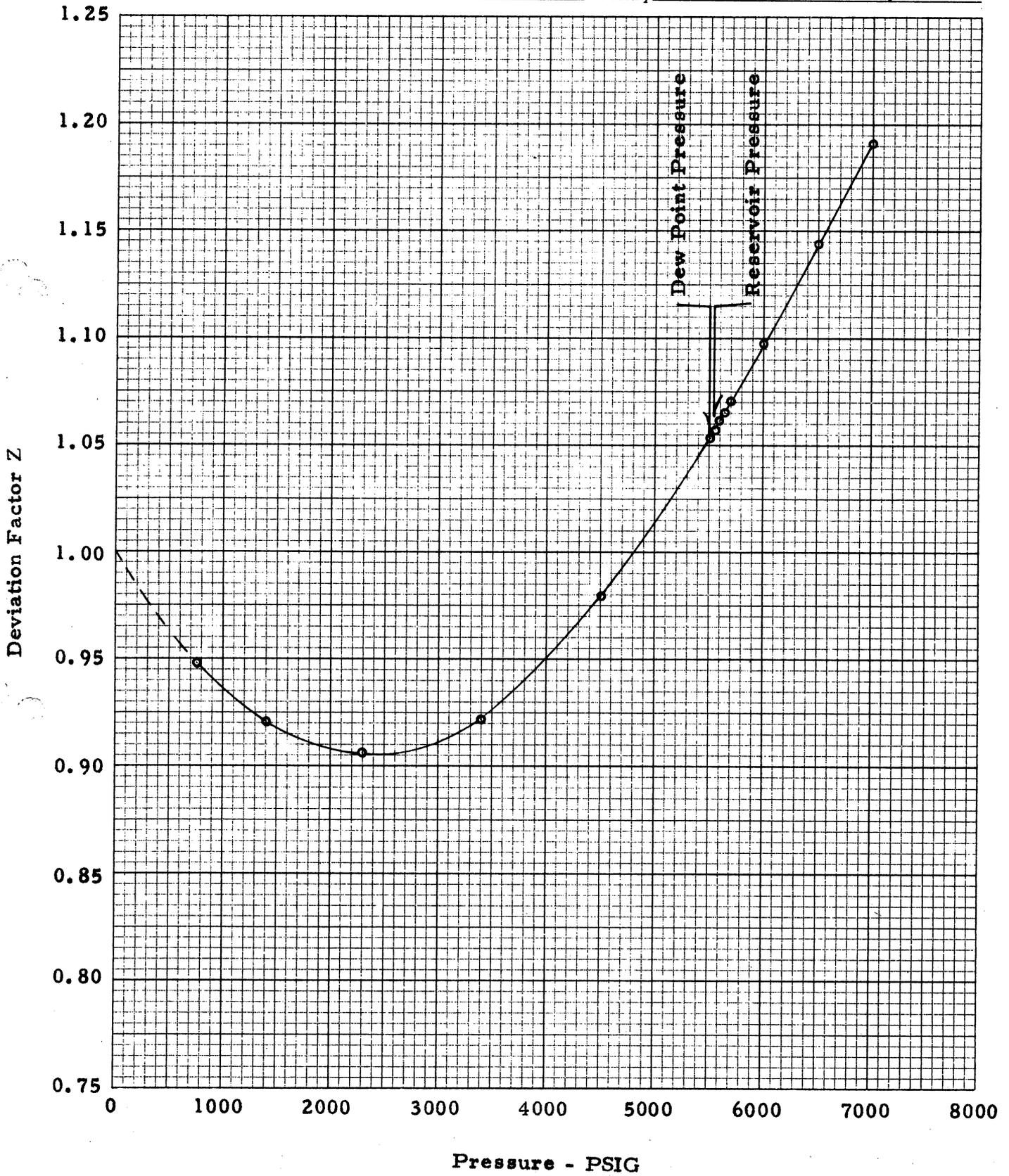
Hydrocarbon Analyses of Produced Well Stream
During Depletion at 253° F.

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File RFL 5114
Well 7/11-2X



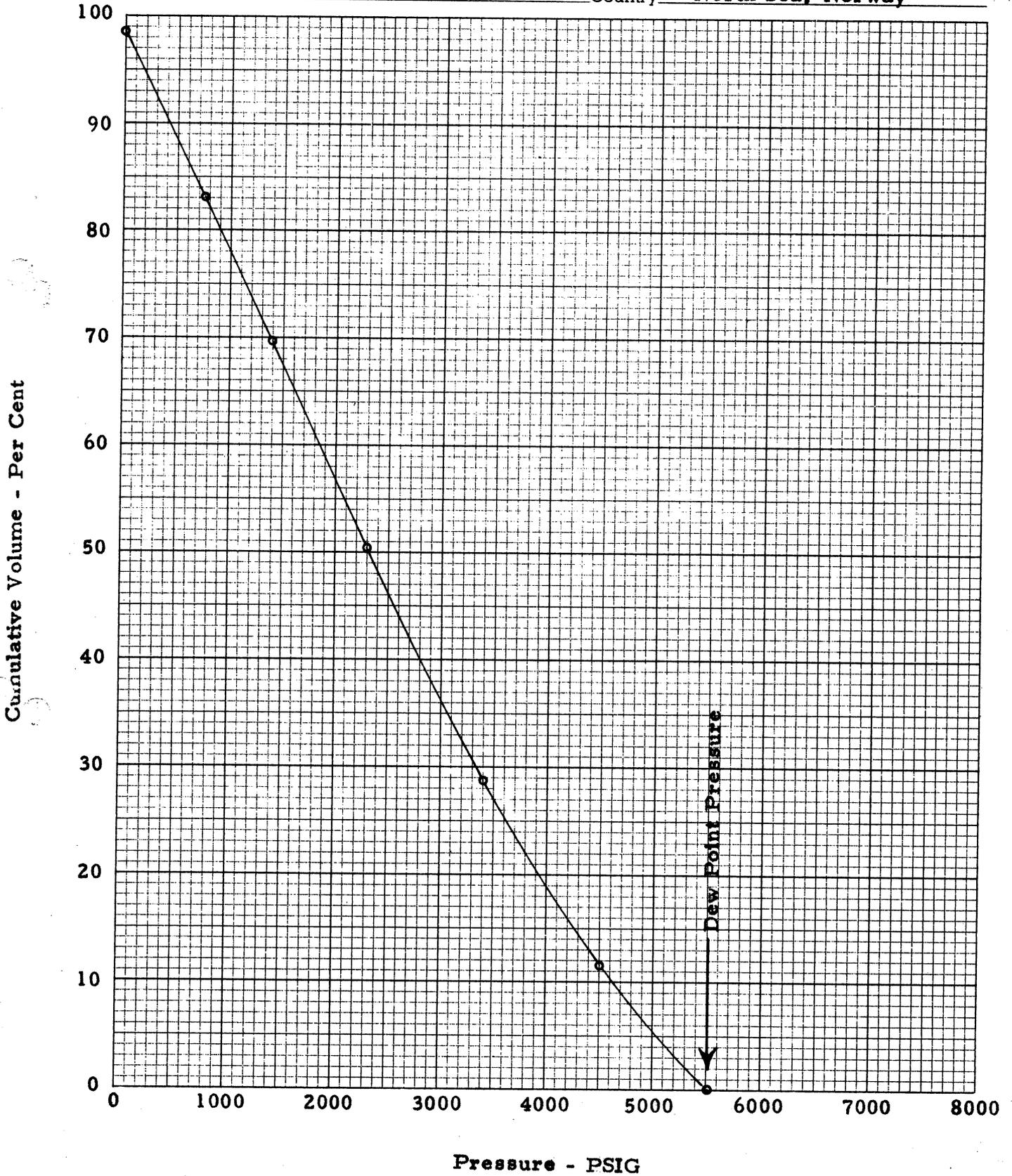
Deviation Factor Z of Well Stream During Depletion at 253°F.

Company Phillips Petroleum Company Formation _____
Well 7/11-2X Province _____
Field Block 7/11 Country North Sea, Norway



Volume of Well Stream Produced During Depletion

Company Phillips Petroleum Company Formation _____
Well 7/11-2X Province _____
Field Block 7/11 Country North Sea, Norway

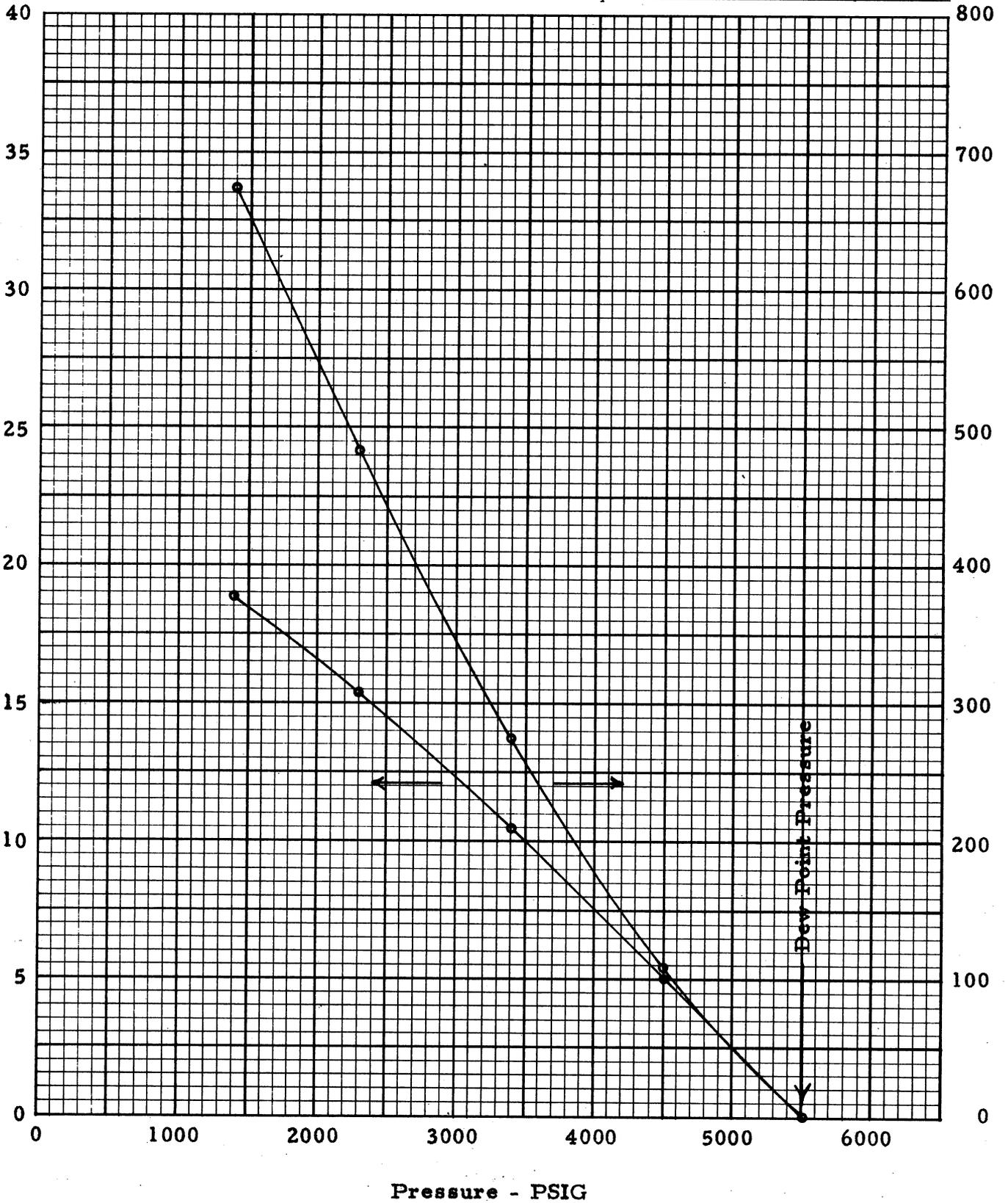


Cumulative Recovery During Depletion

Company Phillips Petroleum Company Formation _____
Well 7/11-2X Province _____
Field Block 7/11 Country North Sea, Norway

Stock Tank Liquid - Barrels per MMSCF of Original Fluid

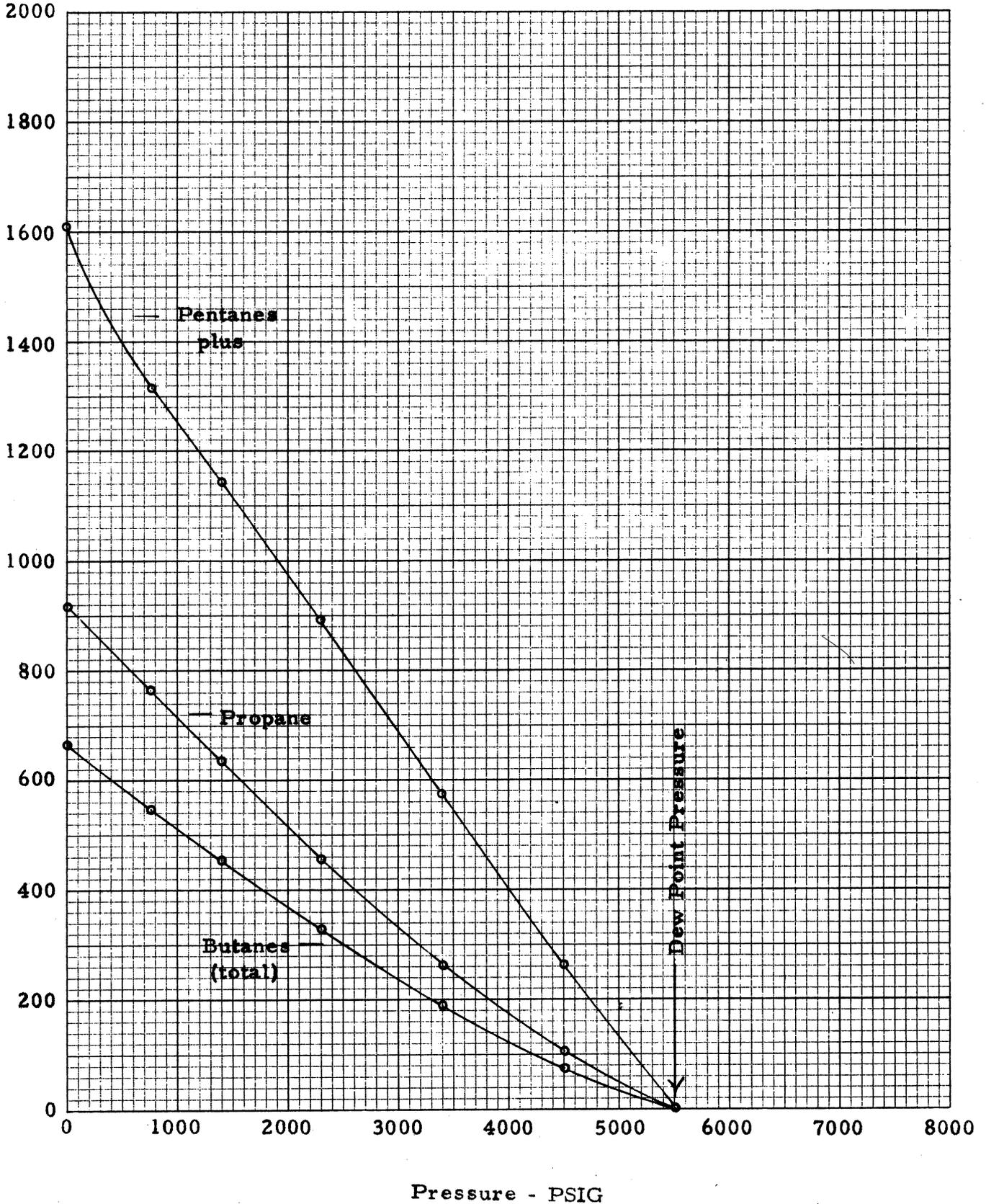
Primary Separator Gas - MSCF per MMSCF of Original Fluid



Cumulative Recovery - "Plant Products" in Well Stream

Company Phillips Petroleum Company Formation _____
 Well 7/11-2X Province _____
 Field Block 7/11 Country North Sea, Norway

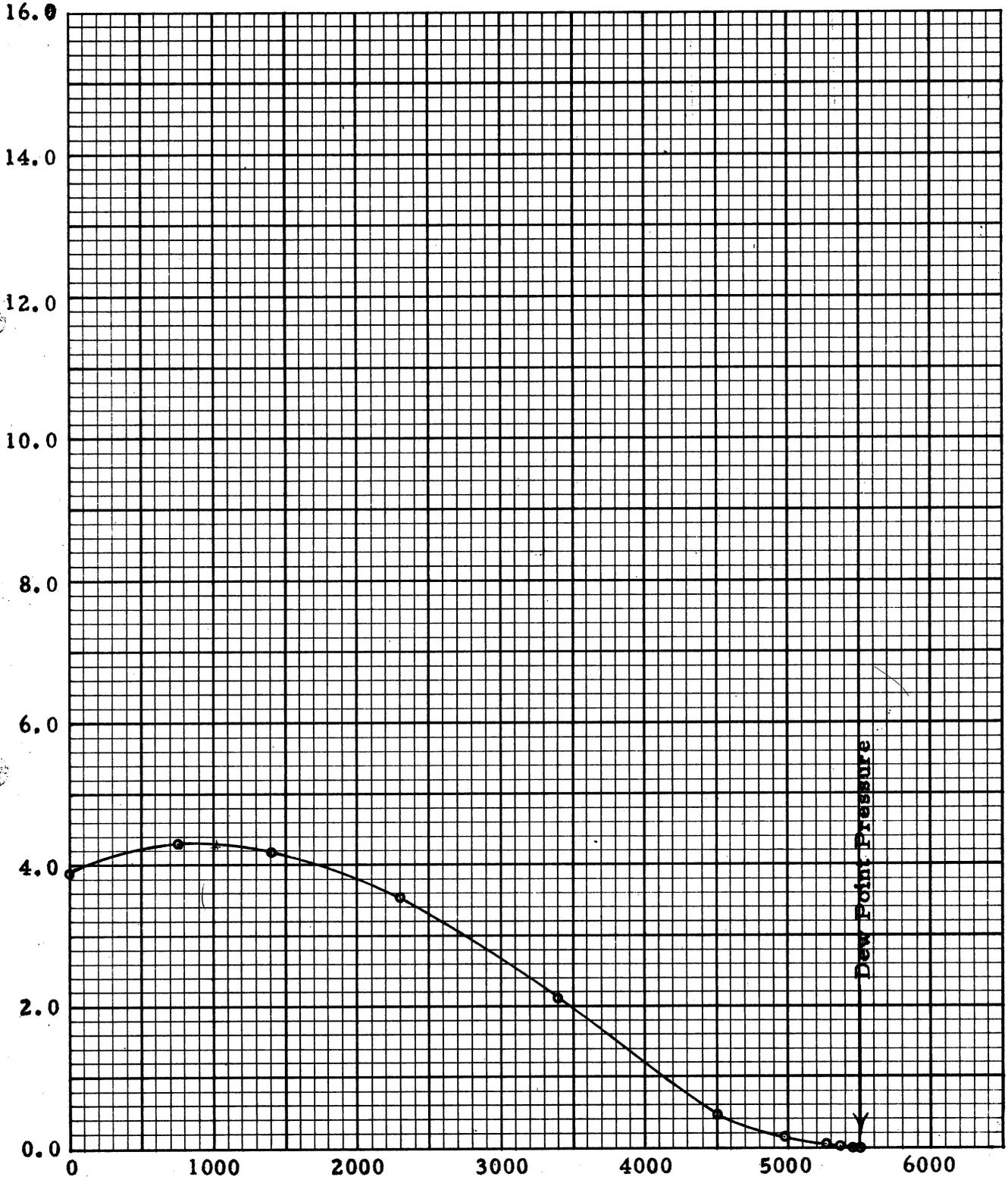
Plant Product - Gallons per MMSCF of Original Fluid



Retrograde Condensation During Depletion

Company Phillips Petroleum Company Formation _____
Well 7/11-2X Province _____
Field Block 7/11 Country North Sea, Norway

Retrograde Liquid Volume - Per Cent of Hydrocarbon Pore Space



Pressure - PSIG