January 11, 1972

INTER-OFFICE CORRESPONDENCE / SUBJECT:
BARTLESVILLE, OKLAHOMA

Norway/Prod/Torfelt 2/4 Well No. 7X, Companion Separator Sample Analyses and Total Sulfur Content, Samples from Drill Stem Test No. 3 and Taken in "F" Type Sampling Containers. RL-170-G-13-71
WFB-2-72

Mr. O. D. Thomas
International Department
12 C4 Phillips Building

Report No. RL-170-G-13-71 entitled "Norway/Prod/Torfelt 2/4 Well No. 7X Companion Separator Analyses and Total Sulfur Content, Samples from Drill Stem Test No. 3 and Taken in "F" Type Sampling Containers", reported an erroneous date tested, 9-13-71, which should have been 9-14-71, also an erroneous crude oil gravity of 42.6°API @ 60°F was reported and should have been 38.2°API @ 60°F.

Please replace the test data table in Report No. RL-170-G-13-71 with the corrected attachment.

W. F. Buce
262 RB #1, Ext. 48-431

WFB:nw
Attachment
cc: R & D Files
B. M. Boyce (8)
W. L. Culbertson (2)
M. J. Fetkovitch
J. G. Erdman
R. V. Smith (r) RBN
W. F. Buce

THORFELT 2/4 WELL NO. 7X

NORWEGIAN SECTOR, NORTH SEA

Drill Stem Test Number	3, Flow No. 1	3, Flow No. 2	3, Flow No. 3
Hour Gas Sampled (72 Hour Clock)	33.5	41.0	63.5
Hour Liquid Sampled (72 Hour Clock)	33.5	41.0	63.5
Date Sampled	9-13-71	9-13-71	9-14-71
Producing Formation	Danian	Danian	Danian
Elevation RKB, feet (Sea Level)	RKB	RKB	RKB
Perforated Interval, feet	10,840-10,870 & 10,890-10,920	10,840-10,870 & 10,890-10,920	10,840-10,870 & 10,890-10,920
Source of Sample	Meter Run & Dump Line	Meter Run & Dump Line	Meter Run & Dump Line
Separator Temperature, °F	74	50	160
Separator Pressure, psig	80	80	290
Pressure in Containers, psig	Gas 80 & Liquid 80	Gas 80 & Liquid 80	Gas 290 & Liquid 290
Oil Produced, bbl/D	664.8	324	3576
Gas Produced, Mcf/D	636.216	218.064	2475.576
Gas/Liquid Ratio (Scf/bbl)	957.0	673.0	692.3
Gravity Stock Tank Liquid, °API @ 60°F	39.0	39.0	38.2
Sample Container Numbers	(G)L-6 & L-27	G-103 & L-12	G-104 & L-164
Sample Container Type	"F" type sampling containers were used for all tests in this report.		
Tester	Strickland & Spinks	Strickland & Spinks	Strickland & Spinks
Total Sulfur Content in Gas, ppm by wt	<1	<1	<1
Total Sulfur Content in Liquid (C_{6+}), ppm by wt	600	<500	600

Attachment to WFB-68-71

ANALYSIS OF SEPARATOR PRODUCTS AND CALCULAT WELL STREAM

MULTISTAGE FLASH RECOMBINATION CALCULATIONS
CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA
DST NO. 3, FLOW NO. 1, DEPTH 10840'-10870' and 10890'-10920'

COMPONENT	SEPARATOR LIQUID MOL PER CENT	SEPARATOR GAS MOL PER CENT	CALCULATED COMPOSITE WELL STREAM MOL PER CENT
CARBON DIOXIDE	0.05	1.52	0.93
NITROGEN	0.0	0.95	0.57
HYDROGEN SULFIDE	0.0	0.0	0.0
METHANE	0.66	73.83	44.68
ETHANE	1.73	13.41	8.75
PROPANE	4.91	6.66	5.96
ISO-BUTANE	1.58	0.79	1.10
N-BUTANE	5.61	1.83	3.34
ISO-PENTANE	2.46	0.34	1.19
N-PENTANE	3.84	0.37	1.75
HEXANE	8.68	0.19	3.57
HEPTANES PLUS	70.48	0.11	28.16
HELIUM	---	<0.02	<0.02
	100.00	100.00	100.00

PROPERTIES OF HEPTANES PLUS

SPECIFIC GRAVITY	0.8470	0.7753	0.8470
MOLECULAR WEIGHT	215.0	108.7	214.8

GAS PROPERTIES

GAS COMPRESSIBILITY FACTOR (Z)		0.9726
SEPARATOR GAS GRAVITY (AIR=1.0000)		0.7617
GROSS HEATING VALUE/SCF AT 14.696 AND 60. F	DRY	1283.7 BTU
	WET	1261.3 BTU

Attachment to WFB-68-71

MULTISTAGE FLASH RECOMBINATION CALCULATIONS

CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR.NORTH SEA

DST NO.3,FLOW NO.1, DEPTH 10840'-10870'AND 10890-10920'

COMPOSITION OF FLOW STREAM, MOLE FRACTIONS

COMPONENT	WELL STREAM	STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	ATMOS PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA
	14.700	74.0	94.70	0.0	0.0	0.0	0.0	0.0	0.0
		LIQ.	GAS	LIQ.	GAS	LIQ.	GAS	LIQ.	GAS
CO2	0.00934	0.0005	0.0152	0.0	0.0	0.0	0.0	0.0	0.0
N2	0.00571	0.0000	0.0095	0.0	0.0	0.0	0.0	0.0	0.0
H2S	0.00000	0.0000	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
METHANE	0.44659	0.0066	0.7383	0.0	0.0	0.0	0.0	0.0	0.0
ETHANE	0.08754	0.0173	0.1341	0.0	0.0	0.0	0.0	0.0	0.0
PROPANE	0.05962	0.0491	0.0666	0.0	0.0	0.0	0.0	0.0	0.0
ISOBUTANE	0.01105	0.0158	0.0079	0.0	0.0	0.0	0.0	0.0	0.0
N-BUTANE	0.03337	0.0561	0.0183	0.0	0.0	0.0	0.0	0.0	0.0
ISOPENTANE	0.01185	0.0246	0.0034	0.0	0.0	0.0	0.0	0.0	0.0
N-PENTANE	0.01753	0.0384	0.0037	0.0	0.0	0.0	0.0	0.0	0.0
HEXANE	0.03575	0.0868	0.0019	0.0	0.0	0.0	0.0	0.0	0.0
C7+	0.28164	0.7048	0.0011	0.0	0.0	0.0	0.0	0.0	0.0
HELIUM	<0.0002		<0.0002						
MOLES	1.00000	0.39867	0.60133	0.0	0.0	0.0	0.0	0.0	0.0
******									
AVG. MW	81.332	170.550	22.066	0.0	0.0	0.0	0.0	0.0	0.0
C7PLUS MW	214.751	215.002	108.699	0.0	0.0	0.0	0.0	0.0	0.0
SPEC. GRAV.		0.8162	0.7617	0.0	0.0	0.0	0.0	0.0	0.0
C7PLUS SG	0.8470	0.8470	0.7753	0.0	0.0	0.0	0.0	0.0	0.0
SCF OF GAS			227.68		0.0		0.0		0.0
GAS DEN(LBS/CUFT)			0.3749		0.0		0.0		0.0
BBL OF LIQUID		0.23791		0.0		0.0		0.0	
LIQ DEN(LBS/CUFT)		50.9015		0.0		0.0		0.0	
LIQ VISCOSITY(CP)		0.7987		0.0		0.0		0.0	
GAS VISCOSITY(CP)			0.0105		0.0		0.0		0.0
GOR(SCF/BBL)		957.0		0.0		0.0		0.0	

COMBINED GOR(SCF/BBL) 957.0

API 60 DEG F 40.5267

Attachment to WFB-68-71
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MULTISTAGE FLASH RECOMBINATION CALCULATIONS

CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA

GALLONS PER MCF FOR EACH GAS STREAM

DST NO. 3, FLOW NO. 1, DEPTH 10840'-10870' and 10890'-10920'

FRACTION	STAGE 1	STAGE 2	STAGE 3	STAGE 4
C3	1.8326	0.0	0.0	0.0
C4	0.8346	0.0	0.0	0.0
C5+	0.3852	0.0	0.0	0.0
TOTAL GPM FOR EACH STAGE	3.0524	0.0	0.0	0.0

TOTAL GPM FOR ALL STAGES 3.0524

AVERAGE GAS GRAVITY ALL STAGES 0.7617

HEATING VALUES FOR EACH GAS STREAM

(14.696 PSIA AND 60 F)

BTU/SCF, GROSS - DRY	1283.7	0.0	0.0	0.0
BTU/SCF, GROSS - WET	1261.3	0.0	0.0	0.0

VAPORIZATION EQUILIBRIUM RATIO

K VALUES

COMPONENT	STAGE 1	STAGE 2	STAGE 3	STAGE 4
CO2	30.39999	0.0	0.0	0.0
N2	*********	0.0	0.0	0.0
H2S	*********	0.0	0.0	0.0
C1	111.86362	0.0	0.0	0.0
C2	7.75144	0.0	0.0	0.0
C3	1.35641	0.0	0.0	0.0
I-C4	0.50000	0.0	0.0	0.0
N-C4	0.32620	0.0	0.0	0.0
I-C5	0.13821	0.0	0.0	0.0
N-C5	0.09635	0.0	0.0	0.0
C6	0.02189	0.0	0.0	0.0
C7+	0.00156	0.0	0.0	0.0

GAS COMPRESSIBILITY FACTORS (Z)

0.97265

Attachment to WFB-68-71
Page 3

ANALYSIS OF [illegible]PARATOR PRODUCTS AND CALCULATI WELL STREAM

MULTISTAGE FLASH RECOMBINATION CALCULATIONS
CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA
DST NO. 3 FLOW NO. 2 DEPTH 10840'-10870' and 10890'-10920'

COMPONENT	SEPARATOR LIQUID MOL PER CENT	SEPARATOR GAS MOL PER CENT	CALCULATED COMPOSITE WELL STREAM MOL PER CENT
CARBON DIOXIDE	0.13	1.34	0.72
NITROGEN	0.0	0.97	0.47
HYDROGEN SULFIDE	0.0	0.0	0.0
METHANE	3.20	76.23	38.94
ETHANE	4.65	13.20	8.84
PROPANE	7.66	5.88	6.79
ISO-BUTANE	1.95	0.56	1.27
N-BUTANE	6.14	1.24	3.74
ISO-PENTANE	2.60	0.20	1.43
N-PENTANE	3.83	0.21	2.06
HEXANE	7.42	0.10	3.84
HEPTANES PLUS	62.42	0.07	31.90
HELIUM	---	<0.02	<0.02
	100.00	100.00	100.00

PROPERTIES OF HEPTANES PLUS

SPECIFIC GRAVITY	0.8460	0.7744	0.8460
MOLECULAR WEIGHT	212.0	108.1	211.9

GAS PROPERTIES

GAS COMPRESSIBILITY FACTOR (Z)		0.9727
SEPARATOR GAS GRAVITY (AIR=1.0000)		0.7303
GROSS HEATING VALUE/SCF	DRY	1238.7 BTU
AT 14.696 AND 60. F	WET	1217.1 BTU

Attachment to WFB-68-71
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MULTISTAGE FLASH RECOMBINATION CALCULATIONS

CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA

DST NO.3 FLOW NO.2 DEPTH 10840-10870'-10890-10920'

COMPOSITION OF FLOW STREAM, MOLE FRACTIONS

COMPONENT	WELL STREAM	STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	ATMOS PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA
	14.700	50.0	94.70	0.0	0.0	0.0	0.0	0.0	0.0
		LIQ.	GAS	LIQ.	GAS	LIQ.	GAS	LIQ.	GAS
CO2	0.00722	0.0013	0.0134	0.0	0.0	0.0	0.0	0.0	0.0
N2	0.00475	0.0000	0.0097	0.0	0.0	0.0	0.0	0.0	0.0
H2S	0.00000	0.0000	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
METHANE	0.38949	0.0320	0.7623	0.0	0.0	0.0	0.0	0.0	0.0
ETHANE	0.08835	0.0465	0.1320	0.0	0.0	0.0	0.0	0.0	0.0
PROPANE	0.06789	0.0766	0.0588	0.0	0.0	0.0	0.0	0.0	0.0
ISOBUTANE	0.01270	0.0195	0.0056	0.0	0.0	0.0	0.0	0.0	0.0
N-BUTANE	0.03741	0.0614	0.0124	0.0	0.0	0.0	0.0	0.0	0.0
ISOPENTANE	0.01425	0.0260	0.0020	0.0	0.0	0.0	0.0	0.0	0.0
N-PENTANE	0.02058	0.0383	0.0021	0.0	0.0	0.0	0.0	0.0	0.0
HEXANE	0.03837	0.0742	0.0010	0.0	0.0	0.0	0.0	0.0	0.0
C7+	0.31899	0.6242	0.0007	0.0	0.0	0.0	0.0	0.0	0.0
HELIUM	<0.0002		<0.0002						
MOLES	1.00000	0.51048	0.48952	0.0	0.0	0.0	0.0	0.0	0.0
******									
AVG. MW	88.707	153.413	21.156	0.0	0.0	0.0	0.0	0.0	0.0
C7PLUS MW	211.886	212.001	108.122	0.0	0.0	0.0	0.0	0.0	0.0
SPEC. GRAV.		0.8122	0.7303	0.0	0.0	0.0	0.0	0.0	0.0
C7PLUS SG	0.8460	0.8460	0.7744	0.0	0.0	0.0	0.0	0.0	0.0
SCF OF GAS			185.35		0.0		0.0		0.0
GAS DEN(LBS/CUFT)			0.3763		0.0		0.0		0.0
BBL OF LIQUID		0.27538		0.0		0.0		0.0	
LIQ DEN(LBS/CUFT)		50.6515		0.0		0.0		0.0	
LIQ VISCOSITY(CP)		0.6841		0.0		0.0		0.0	
GAS VISCOSITY(CP)			0.0101		0.0		0.0		0.0
GOR(SCF/BBL)		673.1		0.0		0.0		0.0	

COMBINED GOR(SCF/BBL) 673.1

API 60 DEG F 43.7267

Attachment to WFB-68-71
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MULTISTAGE FLASH RECOMBINATION CALCULATIONS

CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA

GALLONS PER MCF FOR EACH GAS STREAM

DST NO. 3 FLOW NO. 2 DEPTH 10840'-10870' and 10890'-10920'

FRACTION	STAGE 1	STAGE 2	STAGE 3	STAGE 4
C3	1.6180	0.0	0.0	0.0
C4	0.5736	0.0	0.0	0.0
C5+	0.2212	0.0	0.0	0.0
TOTAL GPM FOR EACH STAGE	2.4128	0.0	0.0	0.0

TOTAL GPM FOR ALL STAGES 2.4128

AVERAGE GAS GRAVITY ALL STAGES 0.7303

HEATING VALUES FOR EACH GAS STREAM

(14.696 PSIA AND 60 F)

BTU/SCF, GROSS - DRY	1238.7	0.0	0.0	0.0
BTU/SCF, GROSS - WET	1217.1	0.0	0.0	0.0

VAPORIZATION EQUILIBRIUM RATIO

K VALUES

COMPONENT	STAGE 1	STAGE 2	STAGE 3	STAGE 4
CO2	10.30769	0.0	0.0	0.0
N2	*********	0.0	0.0	0.0
H2S	*********	0.0	0.0	0.0
C1	23.82187	0.0	0.0	0.0
C2	2.83871	0.0	0.0	0.0
C3	0.76762	0.0	0.0	0.0
I-C4	0.28718	0.0	0.0	0.0
N-C4	0.20195	0.0	0.0	0.0
I-C5	0.07692	0.0	0.0	0.0
N-C5	0.05483	0.0	0.0	0.0
C6	0.01348	0.0	0.0	0.0
C7+	0.00112	0.0	0.0	0.0

GAS COMPRESSIBILITY FACTORS (Z)

0.97271

ANALYSIS OF SEPARATOR PRODUCTS AND CALCULATED WELL STREAM

MULTISTAGE FLASH RECOMBINATION CALCULATIONS
CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA
DST NO. 3, FLOW NO. 3, DEPTH 10840'-10870' and 10890'-10920'

COMPONENT	SEPARATOR LIQUID MOL PER CENT	SEPARATOR GAS MOL PER CENT	CALCULATED COMPOSITE WELL STREAM MOL PER CENT
CARBON DIOXIDE	0.25	1.99	1.13
NITROGEN	0.04	0.97	0.51
HYDROGEN SULFIDE	0.0	0.0	0.0
METHANE	7.45	72.84	40.68
ETHANE	4.92	12.82	8.93
PROPANE	6.30	6.77	6.54
ISO-BUTANE	1.56	0.87	1.21
N-BUTANE	5.16	2.14	3.63
ISO-PENTANE	2.30	0.47	1.37
N-PENTANE	3.35	0.56	1.93
HEXANE	6.84	0.33	3.53
HEPTANES PLUS	61.83	0.24	30.54
HELIUM	---	<0.02	<0.02
	100.00	100.00	100.00

PROPERTIES OF HEPTANES PLUS

SPECIFIC GRAVITY	0.8510	0.7790	0.8510
MOLECULAR WEIGHT	212.0	114.6	211.6

GAS PROPERTIES

GAS COMPRESSIBILITY FACTOR (Z)		0.9438
SEPARATOR GAS GRAVITY (AIR=1.0000)		0.7844
GROSS HEATING VALUE/SCF AT 14.696 AND 60. F	DRY	1307.3 BTU
	WET	1284.6 BTU

Attachment to WFB-68-71
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MULTISTAGE FLASH RECOMBINATION CALCULATIONS

CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR,NORTH SEA
DST NO.3, FLOW NO.3, DEPTH 10840'-10870' AND 10890-10920'

COMPOSITION OF FLOW STREAM, MOLE FRACTIONS

COMPONENT	WELL STREAM	STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	ATMOS PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA	TEMP.F	PRES.PSIA
	14.700	160.0	304.70	0.0	0.0	0.0	0.0	0.0	0.0
		LIQ.	GAS	LIQ.	GAS	LIQ.	GAS	LIQ.	GAS
CO2	0.01134	0.0025	0.0199	0.0	0.0	0.0	0.0	0.0	0.0
N2	0.00512	0.0004	0.0097	0.0	0.0	0.0	0.0	0.0	0.0
H2S	0.00000	0.0000	0.0000	0.0	0.0	0.0	0.0	0.0	0.0
METHANE	0.40671	0.0745	0.7284	0.0	0.0	0.0	0.0	0.0	0.0
ETHANE	0.08934	0.0492	0.1282	0.0	0.0	0.0	0.0	0.0	0.0
PROPANE	0.06539	0.0630	0.0677	0.0	0.0	0.0	0.0	0.0	0.0
ISOBUTANE	0.01209	0.0156	0.0087	0.0	0.0	0.0	0.0	0.0	0.0
N-BUTANE	0.03626	0.0516	0.0214	0.0	0.0	0.0	0.0	0.0	0.0
ISOPENTANE	0.01370	0.0230	0.0047	0.0	0.0	0.0	0.0	0.0	0.0
N-PENTANE	0.01933	0.0335	0.0056	0.0	0.0	0.0	0.0	0.0	0.0
HEXANE	0.03533	0.0684	0.0033	0.0	0.0	0.0	0.0	0.0	0.0
C7+	0.30540	0.6183	0.0024	0.0	0.0	0.0	0.0	0.0	0.0
HELIUM	<0.0002		<0.0002						
MOLES	1.00000	0.49196	0.50804	0.0	0.0	0.0	0.0	0.0	0.0
******									
AVG. MW	85.717	150.530	22.724	0.0	0.0	0.0	0.0	0.0	0.0
C7PLUS MW	211.613	212.001	114.575	0.0	0.0	0.0	0.0	0.0	0.0
SPEC. GRAV.		0.7611	0.7844	0.0	0.0	0.0	0.0	0.0	0.0
C7PLUS SG	0.8510	0.8510	0.7790	0.0	0.0	0.0	0.0	0.0	0.0
SCF OF GAS			192.36		0.0		0.0		0.0
GAS DEN(LBS/CUFT)			1.1026		0.0		0.0		0.0
BBL OF LIQUID		0.27787		0.0		0.0		0.0	
LIQ DEN(LBS/CUFT)		47.4666		0.0		0.0		0.0	
LIQ VISCOSITY(CP)		0.3303		0.0		0.0		0.0	
GAS VISCOSITY(CP)			0.0122		0.0		0.0		0.0
GOR(SCF/BBL)		692.3		0.0		0.0		0.0	

COMBINED GOR(SCF/BBL) 692.3
API 60 DEG F 43.3106

Attachment to WFB-68-71
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MULTI STAGE FLASH RECOMBINATION CALCULATIONS

CASE IDENTIFICATION TORFELT 2/4-7X NORWEGIAN SECTOR, NORTH SEA

GALLONS PER MCF FOR EACH GAS STREAM

DST NO. 3, FLOW NO. 3, DEPTH 10840'-10870' and 10890'-10920'

FRACTION	STAGE 1	STAGE 2	STAGE 3	STAGE 4
C3	1.8629	0.0	0.0	0.0
C4	0.9584	0.0	0.0	0.0
C5+	0.6219	0.0	0.0	0.0
TOTAL GPM FOR EACH STAGE	3.4431	0.0	0.0	0.0

TOTAL GPM FOR ALL STAGES 3.4431

AVERAGE GAS GRAVITY ALL STAGES 0.7844

HEATING VALUES FOR EACH GAS STREAM

(14.696 PSIA AND 60 F)

BTU/SCF, GROSS - DRY	1307.3	0.0	0.0	0.0
BTU/SCF, GROSS - WET	1284.6	0.0	0.0	0.0

VAPORIZATION EQUILIBRIUM RATIO

K VALUES

COMPONENT	STAGE 1	STAGE 2	STAGE 3	STAGE 4
CO2	7.96000	0.0	0.0	0.0
N2	24.25000	0.0	0.0	0.0
H2S	*********	0.0	0.0	0.0
C1	9.77719	0.0	0.0	0.0
C2	2.60569	0.0	0.0	0.0
C3	1.07460	0.0	0.0	0.0
I-C4	0.55769	0.0	0.0	0.0
N-C4	0.41473	0.0	0.0	0.0
I-C5	0.20435	0.0	0.0	0.0
N-C5	0.16716	0.0	0.0	0.0
C6	0.04825	0.0	0.0	0.0
C7+	0.00388	0.0	0.0	0.0

GAS COMPRESSIBILITY FACTORS (Z)

0.94375

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS
December 21, 1971

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

Attention: Mr. P. W. Reynolds

Subject: Reservoir Fluid Study
2/4-7X Well
DST 3
Torfelt Field
North Sea, Norway
Our File Number: RFL 7373

Gentlemen:

Two subsurface fluid samples were collected from the subject well during the shut-in period following flow period 2 of DST 3. These samples were forwarded to our Dallas laboratory for use in a reservoir fluid study. Presented in the following report are the results of the study as requested by Phillips Petroleum Company - Norway.

Prior to the reservoir fluid study, room-temperature saturation pressure determinations were performed on both subsurface fluid samples. At 72° F. subsurface fluid Sample Nos. 1 and 2 were found to have bubble points of 2941 psig and 3007 psig, respectively. At this point, subsurface fluid Sample No. 2 was selected for use in the reservoir fluid study. Subsurface Sample No. 1 was subjected to pressure-volume measurements at the reported reservoir temperature of 280° F., and the data from this test are presented on pages two through four of the report. Sample No. 1 was determined to have a bubble point pressure of 3910 psig at 280° F.

At this point in the analysis, subsurface Sample No. 1 was set aside and subsurface Sample No. 2 was used for the remainder of the testing. During a constant composition expansion at 280° F., the fluid was found to have a

bubble point pressure of 3986 psig. During differential pressure depletion the fluid liberated a total of 1662 standard cubic feet of gas per barrel of residual oil at 60° F. The resulting formation volume factor was 2.147 barrels of saturated fluid per barrel of residual oil. The oil density, gas gravity and gas deviation factors were measured at each point during the differential pressure depletion, and these data are presented on page eight. The viscosity of the fluid at 280° F. varied from a minimum of 0.192 centipoise at the saturation pressure to a maximum of 1.050 centipoises at atmospheric pressure.

A multi-stage separator test was performed and the data from this test are given on page nine. In addition, the primary separator gas from the multi-stage separator test was collected and analyzed for hydrocarbons. The results of this analysis are presented on page ten. The hydrocarbon composition of the reservoir fluid was measured by low temperature, fractional distillation. The results of this distillation, including the physical properties of the heptanes plus fraction are given on page 11.

Thank you for the opportunity to be of service to Phillips Petroleum Company - Norway. If you have any questions regarding these data or if we may be of further assistance to you in any manner, please feel free to call on us.

Very truly yours,

Core Laboratories, Inc.
Reservoir Fluid Analysis

P. L. Moses (JF)

P. L. Moses
Manager

PLM:JF:dl

CL-505 CANADA

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 7373

Company Phillips Petroleum Company - Norway Date Sampled September 14, 1971

Well 2/4-7X, DST 3 Province

Field Torfelt Country North Sea, Norway

FORMATION CHARACTERISTICS

Formation Name	
Date First Well Completed	, 19
Original Reservoir Pressure	PSIG @ Ft.
Original Produced Gas-Oil 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	10840-10870; 10890-10920 Ft.
Tubing Size and Depth	3-1/2 In. to 10811 Ft.
Productivity Index	Bbl/D/PSI @ Bbl/Day
Last Reservoir Pressure	PSIG @ Ft.
Date	, 19
Reservoir Temperature	280* °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	15-20 % Cut

SAMPLING CONDITIONS

Sampled at	9000, 8000 Ft.
Status of Well	Shut in
Gas-Oil Ratio	SCF/Bbl
Separator Pressure and Temperature	PSIG, °F.
Tubing Pressure	3773 PSIG
Casing Pressure	PSIG
Core Laboratories Engineer	LBB
Type Sampler	Wofford

REMARKS:

* Analysis temperature.

Subsurface Sample Number	1	2	
Sampling depth, feet	9000	8000	
Saturation pressure at 72° F., PSIG	2941	3007	4.66 psi/°F
Saturation pressure at 280° F., PSIG	3910	3986	4.71 psi/°F

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File RFL 7373
Well 2/4-7X, DST 3

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE*

1. Saturation pressure (bubble-point pressure) 3910 PSIG @ 280 °F.
2. Thermal expansion of saturated oil @ 6500 PSI $= \frac{V \text{ @ } 280 \text{ °F}}{V \text{ @ } 73 \text{ °F}} =$ 1.14218
3. Compressibility of saturated oil @ reservoir temperature: Vol/Vol/PSI:

   From 6500 PSI to 5500 PSI = 18.19×10^{-6}

   From 5500 PSI to 4500 PSI = 22.25×10^{-6}

   From 4500 PSI to 3910 PSI = 27.83×10^{-6}

* Subsurface Sample No. 1

Pressure-Volume Relations of Reservoir Fluid at 280° F.*

Pressure, PSIG	Relative Volume
6500	0.9442
6000	0.9524
5500	0.9617
5000	0.9720
4500	0.9836
4300	0.9890
4200	0.9917
4100	0.9946
4000	0.9974
3910	1.0000
3880	1.0028
3858	1.0050
3807	1.0104
3675	1.0232
3490	1.0450
3248	1.0788
3001	1.1218
2698	1.1881
2397	1.2768
2096	1.3992
1807	1.5625
1540	1.7764
1202	2.2090
902	2.8789
653	3.9301

* Subsurface Sample No. 1

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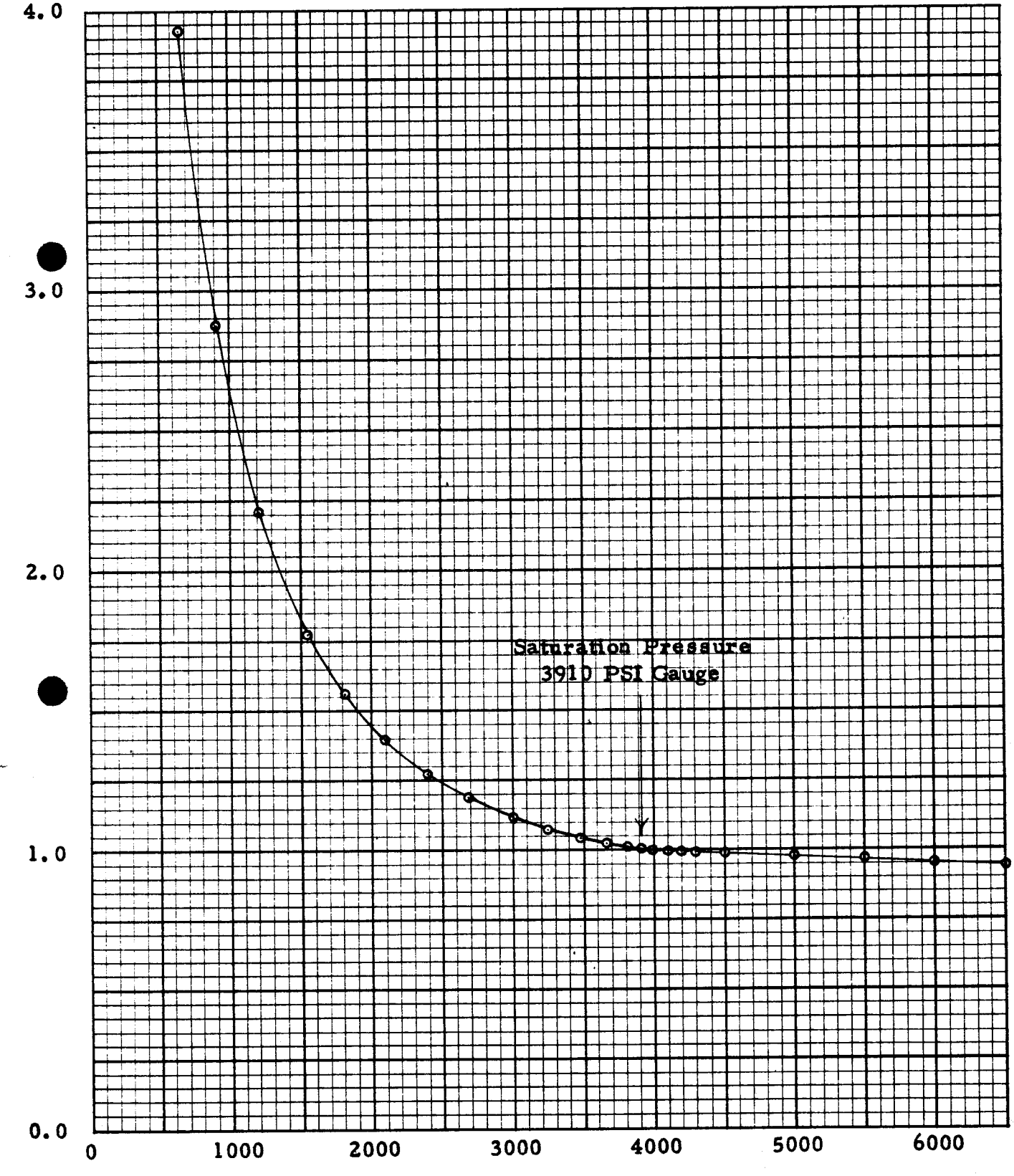
Pressure-Volume Relations of Subsurface Sample No. 1 at 280° F.

Phillips Petroleum

Company Company - Norway Formation
Well 2/4-7X, DST 3 Province
Field Torfelt Country North Sea, Norway



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Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 7373
Well 2/4-7X, DST 3

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 3986 PSIG @ 280 °F.
2. Thermal expansion of saturated oil @ 6500 PSI $= \frac{V \text{ @ } 280 \text{ °F}}{V \text{ @ } 73 \text{ °F}} =$ 1.14481
3. Compressibility of saturated oil @ reservoir temperature: Vol/Vol/PSI:

   From 6500 PSI to 5500 PSI = 18.67×10^{-6}

   From 5500 PSI to 4500 PSI = 23.34×10^{-6}

   From 4500 PSI to 3986 PSI = 28.55×10^{-6}
4. Specific volume at saturation pressure: ft^3/lb 0.02785 @ 280 °F.

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Well 2/4-7X, DST 3

Reservoir Fluid SAMPLE TABULAR DATA

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATION @ 280 °F., RELATIVE VOLUME OF OIL AND GAS, V/VSAT.	VISCOSITY OF OIL @ 280 °F., CENTIPOISES	DIFFERENTIAL LIBERATION @ 280 °F.		
			GAS/OIL RATIO LIBERATED PER BARREL OF RESIDUAL OIL	GAS/OIL RATIO IN SOLUTION PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/VR
6500	0.9444	0.235			2.028
6000	0.9527	0.226			2.046
5500	0.9623	0.218			2.066
5000	0.9729	0.209			2.089
4500	0.9853	0.200			2.116
4300	0.9909				2.128
4200	0.9937				2.134
4100	0.9966	0.194			2.140
4000	0.9996				2.146
3986	1.0000	0.192	0	1662	2.147
3959	1.0024				
3939	1.0042				
3882	1.0096				
3737	1.0234				
3700		0.207	191	1471	2.025
3574	1.0417				
3431	1.0599				
3400		0.225	365	1297	1.923
3243	1.0873				
3036	1.1239				
3000		0.250	558	1104	1.811
2782	1.1792				
2600		0.277	722	940	1.717
2505	1.2529				
2226	1.3547				
2200		0.308	861	801	1.641
1992	1.4659				
1807	1.5773				
1800		0.342	989	673	1.572
1413	1.9356				
1400		0.381	1109	553	1.506

V = Volume at given pressure
VSAT. = Volume at saturation pressure and the specified temperature.
VR = Residual oil volume at 14.7 PSI absolute and 60° F.

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DALLAS, TEXAS 75207

File RFL 7373

Well 2/4-7X, DST 3

Reservoir Fluid SAMPLE TABULAR DATA

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATION @ 280 °F., RELATIVE VOLUME OF OIL AND GAS, V/VSAT.	VISCOSITY OF OIL @ 280°F., CENTIPOISES	DIFFERENTIAL LIBERATION @ 280 °F.		
			GAS/OIL RATIO LIBERATED PER BARREL OF RESIDUAL OIL	GAS/OIL RATIO IN SOLUTION PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/VR
1067	2.4940				
1000		0.427	1222	440	1.444
767	3.4045				
600		0.491	1333	329	1.381
248		0.579	1451	211	1.300
118			1516	146	1.247
0		1.050	1662	0	1.108
				@ 60° F.	= 1.000

Gravity of residual oil = 36.5° API @ 60° F.

V = Volume at given pressure
VSAT. = Volume at saturation pressure and the specified temperature.
VR = Residual oil volume at 14.7 PSI absolute and 60° F.

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Well 2/4-7X, DST 3

Differential Pressure Depletion at 280° F.

Pressure PSIG	Oil Density Gms/Cc	Gas Gravity	Deviation Factor Z
3986	0.5752		
3700	0.5916	0.927	0.923
3400	0.6053	0.907	0.900
3000	0.6220	0.885	0.886
2600	0.6380	0.864	0.881
2200	0.6520	0.854	0.883
1800	0.6656	0.852	0.887
1400	0.6797	0.861	0.900
1000	0.6938	0.891	0.920
600	0.7084	0.973	0.945
248	0.7282	1.236	0.974
118	0.7408	1.633	
0	0.7594	2.562	

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Well 2/4-7X, DST 3

SEPARATOR TESTS OF Reservoir Fluid SAMPLE

SEPARATOR PRESSURE, PSI GAUGE	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
1000	150	691	839			1.214	0.727
to 250	80	159	174			1.097	0.746
to 0	60	160	160	43.6	1.761	1.000	1.311

1173

(1) Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.7 PSI absolute per barrel of oil @ indicated pressure and temperature.

(2) Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.7 PSI absolute per barrel of stock tank oil @ 60° F.

(3) Formation Volume Factor is barrels of saturated oil @ 3986 PSI gauge and 280° 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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File RFL 7373

Company Phillips Petroleum Company - Norway Formation

Well 2/4-7X, DST 3 Province

Field Torfelt Country North Sea, Norway

HYDROCARBON ANALYSIS OF Primary Separator GAS SAMPLE

COMPONENT	MOL PER CENT	G P M
Hydrogen Sulfide	Nil	
Carbon Dioxide	1.23	
Nitrogen	1.30	
Methane	79.05	
Ethane	10.59	2.668
Propane	4.60	1.263
iso-Butane	0.54	0.176
n-Butane	1.30	0.409
iso-Pentane	0.29	0.106
n-Pentane	0.36	0.130
Hexanes	0.25	0.102
Heptanes plus	0.49	0.222
	100.00	5.076

Calculated gas gravity (air = 1.000) = 0.727

Calculated gross heating value = 1227 BTU
per cubic foot of dry gas at 14.696 psia at 60° F.

Collected at 1000 psig and 150 °F. in the laboratory.

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Company Phillips Petroleum Company - Norway Formation

Well 2/4-7X, DST 3 Province

Field Torfelt Country North Sea, Norway

HYDROCARBON ANALYSIS OF Reservoir Fluid SAMPLE

COMPONENT	MOL PER CENT	WEIGHT PER CENT	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Hydrogen Sulfide	Nil	Nil			
Carbon Dioxide	0.89	0.52			
Nitrogen	0.73	0.27			
Methane	47.70	10.21			
Ethane	9.52	3.82			
Propane	6.58	3.87			
iso-Butane	1.25	0.97			
n-Butane	3.62	2.80			
iso-Pentane	1.48	1.43			
n-Pentane	1.38	1.33			
Hexanes	1.88	2.15			
Heptanes plus	24.97	72.63	0.8415	36.5	218
	100.00	100.00			

Core Laboratories, Inc.
Reservoir Fluid Analysis

P. L. Moses (JF)

P. L. Moses
Manager

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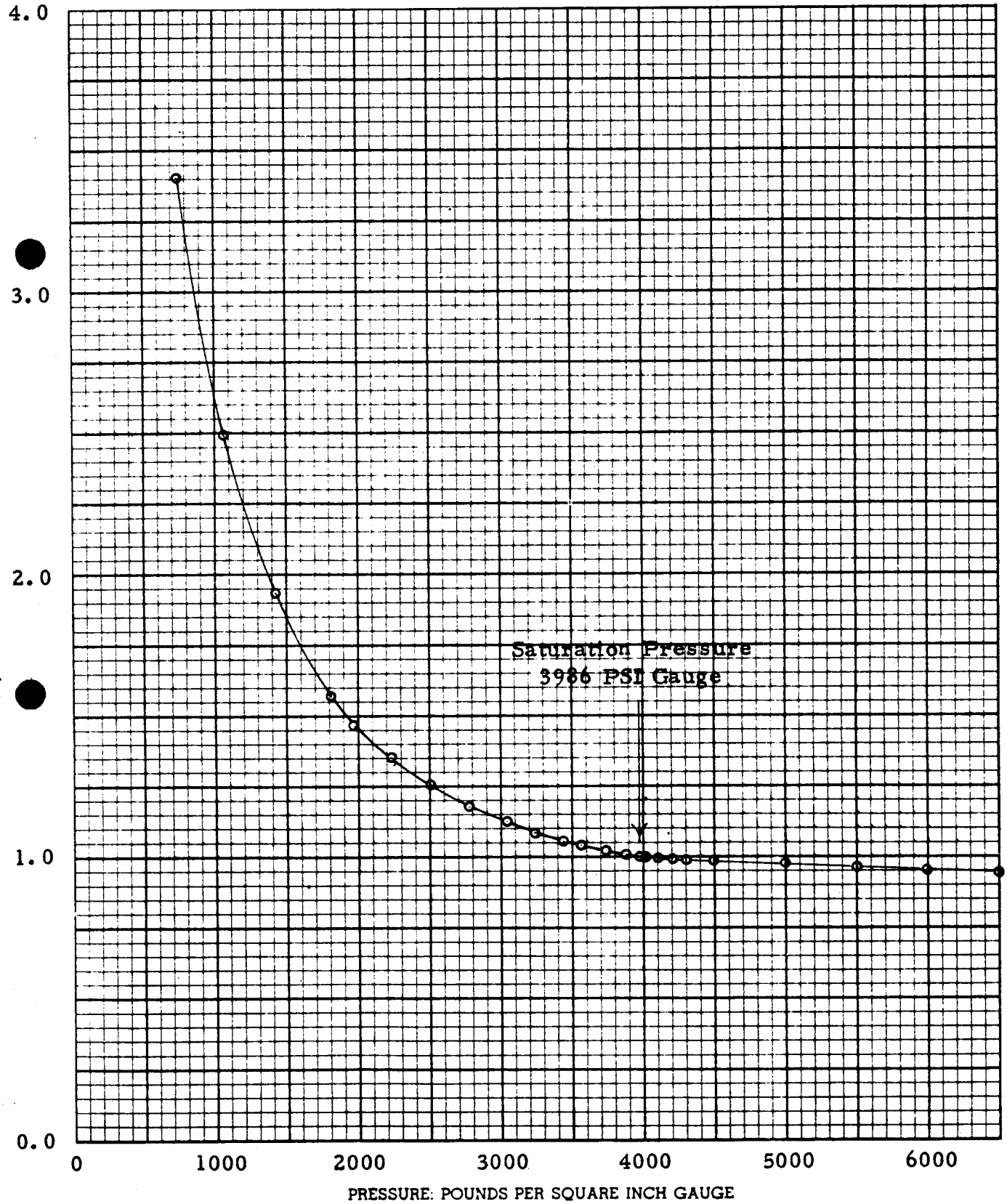
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 7373

PRESSURE-VOLUME RELATIONS OF RESERVOIR FLUID

Company Phillips Petroleum Company - Norway Formation
Well 2/4-7X, DST 3 Province
Field Torfelt Country North Sea, Norway



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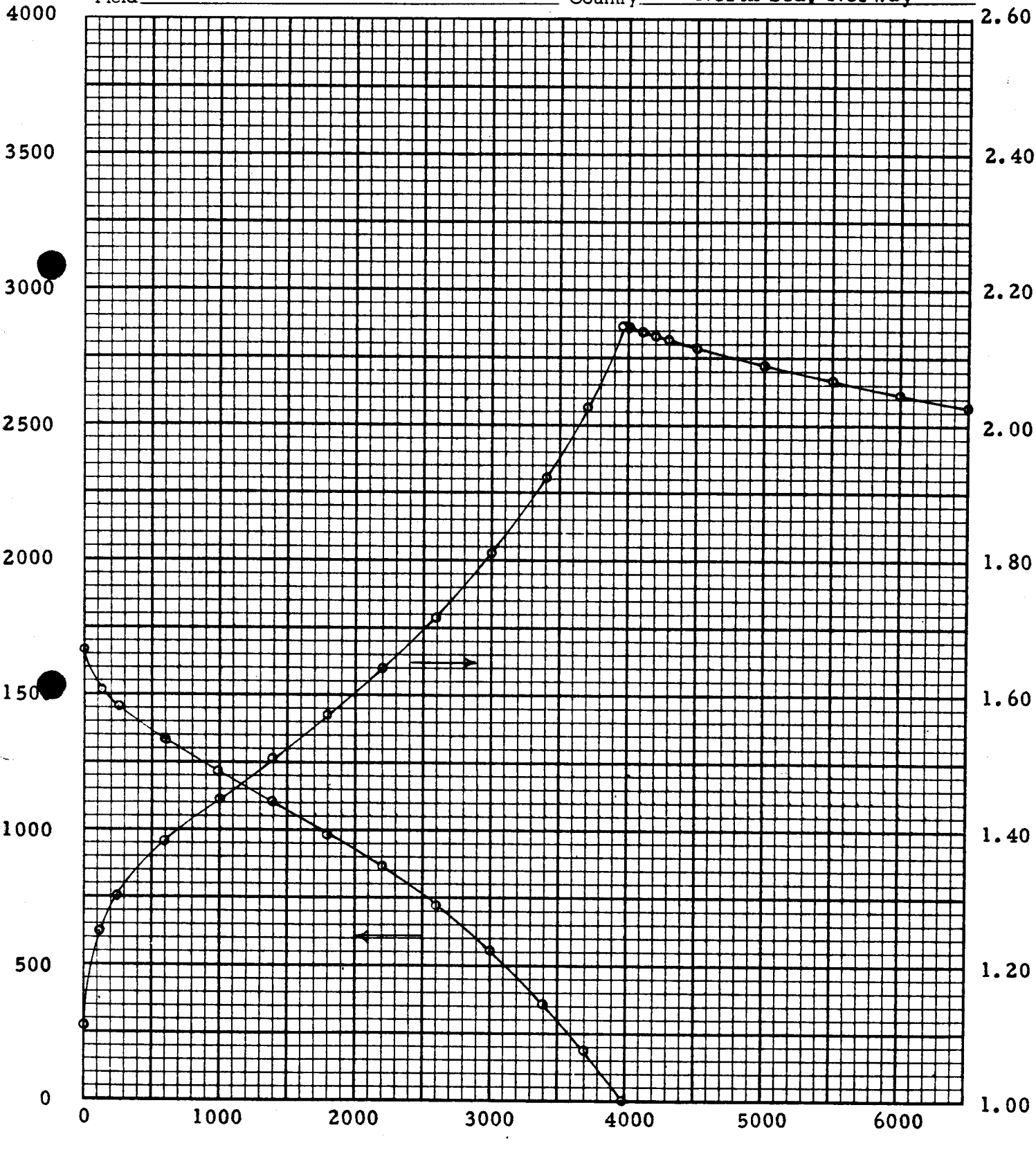
DIFFERENTIAL VAPORIZATION OF RESERVOIR FLUID

Company Phillips Petroleum Company - Norway Formation
Well 2/4-7X, DST 3 Province
Field Torfelt Country North Sea, Norway



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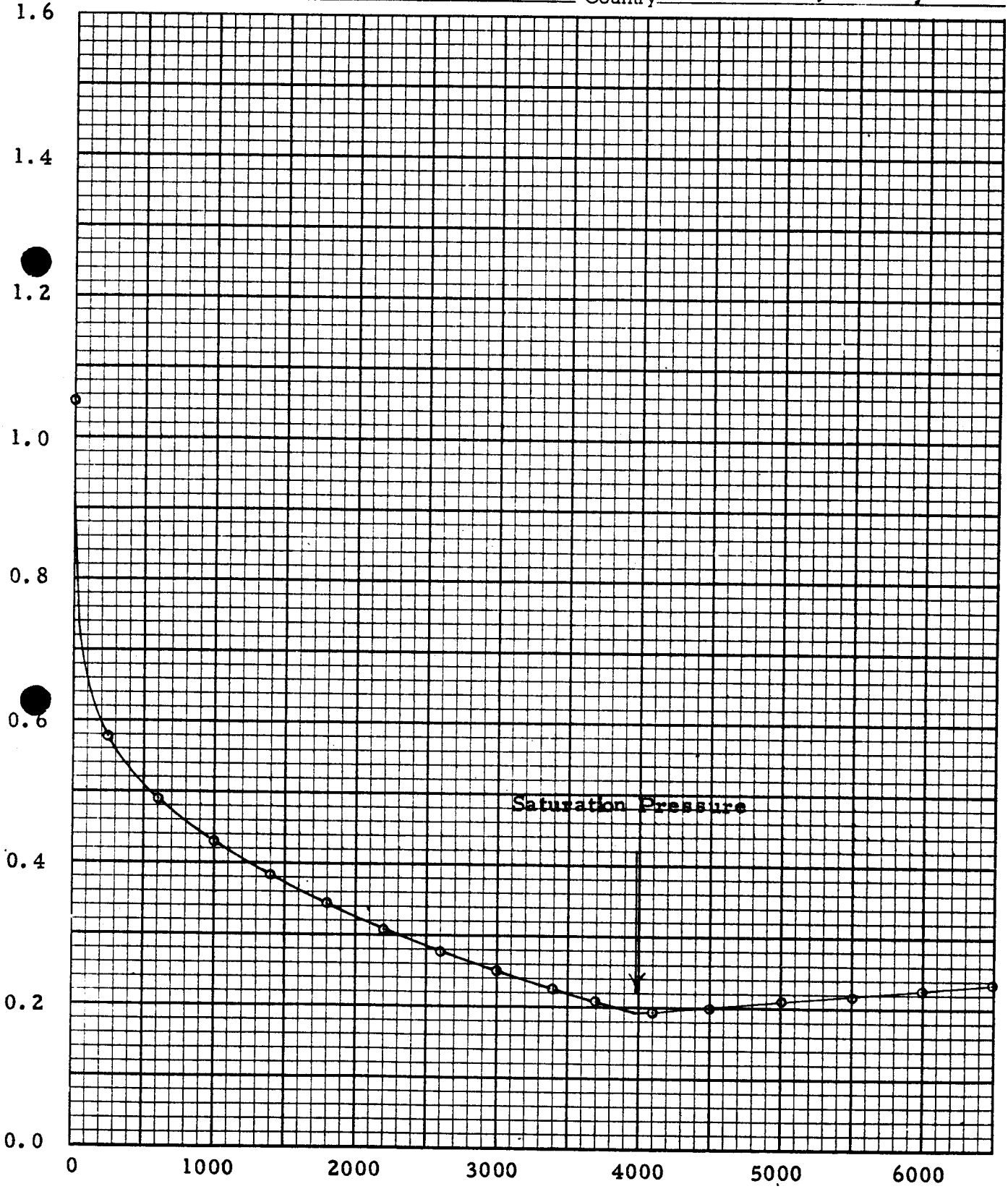
VISCOSITY OF RESERVOIR FLUID

Company Phillips Petroleum Company - Norway
Formation
Well 2/4-7X, DST 3
Province
Field Torfelt
Country North Sea, Norway



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