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Denne rapport  
tilhører



L&U DOK.SENTER

Moore, Barrett & Redwood

L.NR. 20090120005  
KODE Well 31/2-11 nr 27

Roscliffe Road,  
Ellesmere Port  
South Wirral,  
Cheshire, L65 3AS  
Tel 051 355 4931  
Cables Ellesmere Port  
Telex 627250

Returneres etter bruk

Statoil  
Den Norske Stats Oljeselskap a.s.  
Postboks 300  
N-4001 STAVANGER  
Norway

Attention: Mr. D. Uthaug

Analytical Report No: EPL. 20222 31st October 1983

Assay of Crude Oil Sample 31/2 - 11

This assay was carried out according to the tables given with your letter (reference FOR/83 - 1492) of 30.08.83 with modifications as listed below.

- 1) The light ends analysis (C<sub>1</sub>-C<sub>5</sub>) on the crude oil will be reported later due to a need for repeat check analyses.
- 2) No RVPs were measured on the naphthas due to insufficient sample. Preference given to Octane No. tests.
- 3) Nitrogen contents of gas oils (Table 5) will be reported later.

Crude oil general tests are on Table 1.

The TBP distillation was carried out on the ASTM D 2892 still under atmospheric pressure up to 190°C, under vacuum at 100mm pressure to 250°C and under 10mm pressure to 375°C. The distillation was continued in a High Vac. still at 0.2mm pressure to 550°C AET.

The TBP distillation is reported as % wt. and % vol. together with cut densities and molecular weights on Table 2.

Various products were blended from the TBP cuts and tested as shown below:-

Table 3	Test Data of Naphthas
Table 4	Test Data of Kerosines
Table 5	Test Data of Gas Oils and Residues

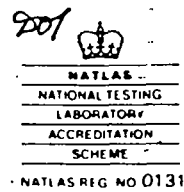
for Moore, Barrett & Redwood Ltd



**Moore, Barrett & Redwood Ltd.**

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FOR - 1427  
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for Moore Barrett & Redwood Ltd

Table 1Crude Oil General Tests

Density at 15°C	0.885
A.P.I. Gravity	28.3
Water % vol. (by distillation)	0.50
Sulphur % wt.	0.32
Pour Point °C	- 24
Viscosity cS at 20°C	18.66
Conradson C.R. % wt.	1.79
Total Acid No. mg.KOH/gm	1.2
Salt mg/litre	338
Light Hydrocarbon ( as % wt. on Crude)	
Methane	)
Ethane	)
Propane	) Results to be
iso-Butane	) reported later
n-Butane	)
iso-Pentane	)
n-Pentane	)
<u>Metal Content of dry crude</u>	
Vanadium ppm	2.8
Nickel ppm	1.1
Sodium ppm	7.0
<u>Distillation (ASTM D 86) °C</u>	
IBP	71
5%	93
10%	140
20%	201
30%	247
40%	296
50%	322
60%	347
70%	cracking
Recovery/Residue/Loss	61/39/0

Table 2

Distillation of Statoil Sample 31/2-11 Crude Oil

<u>Cut No.</u>	<u>% Weight</u>	<u>% Volume</u>	<u>Head Temp. °C AET</u>	<u>Cut Density at 15°C</u>	<u>Molecular Weight</u>
IBP	0.0	0.0	-	-	-
1	0.3	0.5	46	0.621	77
2	1.7	2.2	70	0.703	82
3	2.7	3.4	85	0.749	88
4	4.3	5.3	95	0.759	94
5	6.1	7.3	106	0.770	98
6	7.8	9.3	123	0.782	105
7	9.6	11.3	136.5	0.798	113
8	11.1	12.9	145	0.806	118
9	12.3	14.2	157	0.811	124
10	13.5	15.5	165	0.816	130
11	15.0	17.1	175	0.824	135
12	16.8	19.1	190	0.829	142
13	18.7	21.1	204	0.839	151
14	20.6	23.0	217	0.845	161
15	22.6	25.2	229	0.850	171
16	24.7	27.3	239	0.855	178
17	27.1	29.8	250	0.862	186
18	29.4	32.1	261	0.868	194
19	31.4	34.1	269	0.871	201
20	33.5	36.3	278	0.875	209
21	35.7	38.5	287	0.878	215
22	37.8	40.6	297	0.881	224
23	39.6	42.4	304	0.884	232
24	41.0	43.8	310	0.886	238
25	43.4	46.2	320	0.889	246
26	45.3	48.1	329	0.892	257
27	47.3	50.1	338	0.894	266
28	49.3	52.1	348	0.899	275
29	51.4	54.2	357	0.902	284
30	53.3	56.0	367	0.907	295
31	55.0	57.7	375	0.909	300
32	62.0	64.5	420	0.917	336
	71.2	-	472	-	
	77.7	-	516	-	
33	81.9	83.6	550	0.924	510
Residue	17.9	16.1	550+	0.984	-
Gas	0.2	0.3			
	100.0	100.0			

Table 3  
Test Data of Naphthas

Boiling Range °C	IBP - 85	70 - 145	85 - 165
% wt. on crude	2.7	9.4	10.8
% vol. on crude	3.4	10.7	12.1
Density at 15°C	0.711	0.781	0.791
Sulphur ppm	<10	20	40
D86 IBP°C	27	89	96
5%	44.5	94	102.5
10%	51.5	97.5	106
20%	61	100.5	110
30%	66.5	103.5	114
40%	70.5	107	119
50%	73.5	110.5	124
60%	76.5	115	129
70%	79	120.5	136
80%	83	127.5	143
90%	90	135.5	151
95%	97	141	156
FBP	97.5	147	162
Rec/Res/Loss	98/1/1	99/1/0	98/1/1
Research O.N.	86.5	78.2	76.0
Motor O.N.	81.4	74.4	73.3
Paraffins %	40.48	13.82	14.13
Naphthenes %	57.82	72.87	69.27
Aromatics %	1.7	13.3	16.6

Table 4  
Test Data of Kerosines

<u>Boiling Range °C</u>	<u>145 - 175</u>	<u>165 - 190</u>	<u>190 - 250</u>
% wt. on Crude	3.9	3.3	10.3
% vol. on Crude	4.2	3.6	10.7
Density at 15°C g/cc	0.815	0.825	0.851
Viscosity at 20°C, cS			2.556
Sulphur % wt.	0.007	0.007	0.01
Smoke Point mm	18	17	16
Freeze Point °C	below -70	below -70	below -70*
Flash Point (Abel) °C	-	-	71
Paraffins %	13.27	13.68	-
Naphthenes %	61.03	58.82	-
Aromatics	25.7	27.5	29.8
ASTM D86 Distillation			
Initial Boiling Point °C	152	166	202
5% Vol.	155	171.5	209
10%	156	172	210.5
20%	157.5	173	213
30%	158.5	174	215
40%	160	175.5	217
50%	161.5	176.5	220
60%	163	178	223
70%	165.5	180	226
80%	168	183	230
90%	172	187	235.5
95%	176.5	190.5	240
Final Boiling Point	183	197	246
Recovery/Residue/Loss	98.5/1.5/0	99/1/0	99/1/0
Cetane Index (D976)			33.5

\* Cloud and Pour Point not measured since Freeze Point is below -70°C

Table 5

Test Data on Gas Oils and Residues

<u>Cut Temperature °C</u>	<u>250 - 310</u>	<u>310 - 375</u>	<u>375 - 420</u>	<u>420 - 550</u>	<u>375+</u>	<u>550+</u>
% wt. on Crude	13.9	14.0	7.0	19.9	44.8	17.9
% vol. on Crude	14.0	13.9	6.8	19.1	42.0	16.1
Density at 15°C	0.875	0.896	0.917	0.924	0.946	0.984
Sulphur % wt.	0.09	0.28	0.40	0.46	0.62	0.91
Asphaltenes % wt.						0.70
Aniline Point °C	58.4	67.8	78.8	87.2	Too dark	
25°C Penetration mm						>350
Cetane Index (D976)	41.0	42.3				
Cloud Point °C	below -40	-13				
Pour Point °C	below -40	-12	+15	+33	+24	+49
C.F.P. Point °C	-41	-12				
Ramsbottom C.R. % wt.			0.12	0.19	4.0	10.4
Conradson C.R. % wt.			0.01	0.08	4.5	11.4
Viscosity at 20°C, cS	6.07					
Viscosity at 50°C, cS	2.84	7.10	25.35	71.87	327.4	1534 at 80°C
Viscosity at 100°C, cS		2.44	5.48	10.77	29.88	413.2
Viscosity at 135°C, cS						82
Distillation Test °C*						
IBP	259	314	377	391	382	372
5% vol.	263	318	400	420	413	cracking
10%	265	320	406	431	427	-
20%	267	322.5	413	443	442	-
30%	269	325	417	451	458	-
40%	270.5	327	420	460	474	-
50%	272.5	329	422	469	490	-
60%	275	332	426	479	517	-
70%	278	335	432	490	-	-
80%	282	339.5	438	503	-	-
90%	288	347	450	517	-	-
95%	293.5	352	459	524	-	-
FBP	301	356	-	cracking	-	-
Recovery	99	98	96	-	-	-
Residue	1	2	4	-	-	-
Loss	0	0	0	-	-	-
Vanadium				1.4	4.6	15.2
Nickel ppm				nil	2.8	11.0
Sodium ppm				0.3	17.3	61.4

\* ASTM D86 for first two samples. D1160 for remainder at 10mm Hg.



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Attention: Mr. D. Uthaug

17th November

**Analytical Report No: EPL. 20222 Appendix**

Please find herewith appendix to our analytical report no. EPL. 20222 concerning assay of crude oil sample 31/2 - 11.

### Table 1

Light hydrocarbons (% wt. on crude)

C1 % wt.	less than 0.01
C 2 % wt.	0.04
C 3 % wt.	0.16
i C 4 % wt.	0.23
N C 4 % wt.	0.23
Neo C 5 % wt.	-
i C 5 % wt.	0.36
N C 5 % wt.	0.19
Cyclo C 5 % wt.	0.14

### Table 3

Test data of Naphthas

°C	<u>IBP - 85</u>	<u>85 - 165</u>
C 3 % wt.	0.01	-
C 4 % wt.	0.45	-
C 5 N % wt.	3.20	-
C 5 P % wt.	1.54	0.06
C 6 N % wt.	3.66	0.08
C 6 P % wt.	10.20	0.62
C 7 N % wt.	32.58	7.03
C 7 P % wt.	20.20	0.78
C 8 N % wt.	17.03	21.93
C 8 P % wt.	6.51	3.70
C 9 N % wt.	1.36	25.29
C 9 P % wt.	1.56	3.25
C 10 N % wt.	-	18.54
C 10 P % wt.	-	5.40
Total Aromatics	1.70	13.3

for Moore, Barrett & Redwood, Ltd.

*G. Jones*



Table 4

Test data of Kerosines

°C	<u>165 - 190</u>	<u>190 - 250</u>	
Naphthalenes % vol.	0.60	4.60	ASTM D1840

Table 5

Test data for Gas Oil and Residues

°C	<u>250 - 310</u>	<u>310 - 375</u>	<u>375 - 420</u>	<u>420 - 550</u>
Nitrogen, mg/Kg	5	72	322	760



5.12.83  
DU/TOL  
FOR/83-2111

N O T A T

TIL: MRP

Cc.: ØRH, FLT v/Roger Tailby  
ØP, PPa, MSx, SAF, EH

Fra: FOR *W*

Vurdering av Troll råolje *Well 3/2-11*

Troll råolje er analysert av Moore, Barret og Redwood. Detaljert rapport nr. EPL 20222 av 31.10.83 følger vedlagt.

Generelt:

Troll råolje er en tung, lavsvovlig råolje,  $28.3^{\circ}\text{API}$  og  $0.32 \text{ wt\% S}$ .

Oljen inneholder svært mye naftener og aromater og likner således mye på Gullfaks (fase I). Til tross for  $28.3^{\circ}\text{API}$  er innholdet av long residue ( $375^{\circ}\text{C}+$ ) bare  $44.8 \text{ wt\%}$ . Til sammenlikning kan nevnes at Arabisk tung er  $27.0^{\circ}\text{API}$ , men har long residue på  $58 \text{ wt\%}$ .

Oljen har som andre Nordsjøoljer lavt metallinnhold og lav Conradson Carbon. Det synes umulig å produsere en fullverdig produktpakke fra denne råolje i et enkelt hydroskimming raffinering uten å forutsette innblanding av andre, parafinske råoljer. Som all annen naftensk råolje, vil oljen ha god nytte av hydrogenprosessering av mellomdestillater og gassoljer. En vurdering av de enkelte fraksjoner fra en TBP-destillasjon følger:

Lett nafta (IBP-85°C):  
-----

Lett nafta fraksjone har høy density = 0,71 kg/l. Parafin, Naften og Aromatinhold (PNA) på h.h.v. 40, 58 og 2 wt% gir høyt oktantall i bensinblanding, RONC = 87. Denne nafta vil være en usedvanlig god bensinblandekomponent, nær "once through"-isomerat.

Medium nafta (85-165°C):  
-----

PNA innhold på h.h.v. 14, 69 og 17 wt% (N+2A = 103) gjør at denne fraksjonen gir meget høyt utbytte fra reformer. Fraksjonen kan alene gi kapasitetsproblem i reformerovner, men vil være meget godt egnet for innblanding med annet reformer- råstoff.

Tung nafta (165-190°C)  
-----

Densitet = 0.825 kg/l

Et innhold på 27.5 wt% aromater gir lavt røkpunkt (17 mm).

Frysepunktet er meget lavt.

Fraksjonen er alene lite egnet som kerosin-kvalitet, men kan i mindre mengder benyttes som blandekomponent.

Kerosin (190-250°C)  
-----

Densitet = 0.851 kg/l

Aromatinhold på 30 vol %, hvorav 4.6 vol % naftalener.

Det høye aromatinhold gjør denne fraksjonen lite egnet for produksjon av kerosinkvaliteter.

Lett Gassolje (250-310°C) og  
Tung Gassolje (310-375°C):  
-----

Densitet = 0.875 kg/l og 0,896 kg/l.

Gassoljene har høy tetthet og lav cetanindex. Cloudpunkt er lavt.  
Gassoljene tilfredsstiller ikke alene kravene til autodiesel.

Residue, 375°C t:  
-----

Densitet = 0.946 kg/l

Svovelinhold på 0.62 wt %, Conradson Carbon på 4.5 wt % og lavt metallinnhold gir grunnlag for å forvente et residue som er akseptabel føde til koksanlegg og tung olje cracker. Mer detaljert informasjon er nødvendig for å avklare dette.