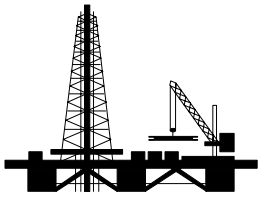
CRUDE OIL ASSAY

Oseberg Blend 2007



Norsk Hydro ASA

The assay was prepared by
Statoil PKS
Product Technology and Customer Service
Crude Oil and Products Department

DATE: 18.01.07

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1. SAMPLE DATA

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SAMPLE:	Crude oil
DESCRIPTION:	Oseberg Blend
DATE OF SAMPLING:	November 2006 at Sture Terminal
SAMPLE VOLUME:	60 litres
SAMPLE PACKAGE:	Jerrycans
LABORATORY:	This assay was prepared by Statoil PKS

2. DISTILLATION CONDITIONS

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The following conditions according to ASTM are used:

TRUE BOILING POINT DISTILLATION

EQUIPMENT:
The distillation up to 375°C is performed according to D-2892, and from 375°C according to D-5236 (Vacuum Potstill Method)

CONDITIONS:
The cutpoints are as follows:

Atmospheric distillation:	C5 - 205°C AET
100 Torr:	205 - 240°C AET
10 Torr:	240 - 320°C AET
5 Torr:	320 - 375°C AET
From 1 to 0.1 Torr:	375 - 525°C AET

The atmospheric cutting points are corrected to 760 mmHg.

VOLUME:
Volume expansion or contraction are normalized among fractions boiling below 150°C in proportion to their yields.
(Usually the "Loss" is negative due to volume expansion)

HOLD UP:
Hold up at 375°C AET is distributed as follows: 50% on the first fraction of the Pot Still (375°C-420°C) and 50% in accordance with the mass-ratios of the fractions from 420°C AET.

LOSS:
Loss up to 375°C AET is distributed with 2/3 in the gas-fraction and 1/3 in the first liquid-fraction.

3. ANALYTICAL RESULTS

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PROJECT: CRUDE OIL ASSAY
REF.NO: 800-034

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Table 1 SAMPLE: 800-034 Oseberg Blend 2007

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Analysis of the whole crude:	Light ends - see tables 8a-8e	
Density at 15°C	kg/l	0.8355
Specific gravity at 60/60°F		0.8359
API gravity at 60/60°F	°API	37.8
Sulphur	mass %	0.274
Total Acid Number (TAN)	mg KOH/g	0.26
Reid Vapor Pressure (RVP)	kPa	43.4
Pour point	°C	-15
Kin. viscosity at 20°C	cSt	4.90
Kin. viscosity at 40°C	cSt	3.20
Nitrogen	mg/kg	1000
Hydrogen sulphide	mass %	ND
Vanadium (V)	mg/kg	2.3
Nickel (Ni)	mg/kg	1.5
Sodium (Na)	mg/kg	13
Salt as NaCl	mg/l	32.1
Wax content	mass %	5.5
Flash point **	°C	<10
Water content	mass %	0.08

ND: not detectable
**: New method, see table 9a

Table 2 SAMPLE: 800-034 Oseberg Blend 2007

Fraction	°C	C5-65	65-90	90-150
Yield on crude	mass %	3.98	3.84	13.44
Yield on crude	vol %	5.06	4.39	14.61
Density at 15°C	kg/l	0.6457	0.7176	0.7545
Specific gravity at 60/60°F		0.6457	0.7177	0.7547
API gravity at 60/60°F	°API	87.6	65.6	56.0
Sulphur	mass %		<0,001	<0,001
Mercaptan sulphur	mg/kg	<3	<3	<3
n-Paraffins	mass %	50.2	27.6	21.8
i-Paraffins	mass %	42.0	25.5	22.6
Naphthenes	mass %	5.9	39.0	39.4
Aromatics (incl. benzene)	mass %	1.9	7.8	16.2
Benzene	mass %		7.1	0.6
n-Paraffins	vol %	51.1	29.9	23.6
i-Paraffins	vol %	42.5	27.2	24.0
Naphthenes	vol %	5.0	36.5	38.4
Aromatics (incl. benzene)	vol %	1.4	6.4	14.0
Benzene	vol %		5.7	0.5
Vapor Pressure (DVPE)	kPa	110.9	35.1	
Flash point **	°C			<10
Research Octane Number (RON)		74.2	66.4	
Motor Octane Number (MON)		72.5	64.6	
Research Octane Number (RON) *		74.0	66.2	
Motor Octane Number (MON) *		72.3	64.4	
Nitrogen	mg/kg		<1	<1

*: Corrected in accordance with EN 228

**: New method, see table 9a

Table 3	SAMPLE: 800-034 Oseberg Blend 2007				
Fraction	°C	150-180	180-240	240-320	320-375
Yield on crude	mass %	5.60	11.60	16.18	8.97
Yield on crude	vol %	6.00	11.99	15.91	8.50
Density at 15°C	kg/l	0.7806	0.8083	0.8497	0.8821
Specific gravity at 60/60°F		0.7809	0.8086	0.8501	0.8825
API gravity at 60/60°F	°API	49.7	43.5	35.0	28.8
Sulphur	mass %	0.002	0.016	0.104	0.336
Mercaptan sulphur	mg/kg	<3	<3		
Copper corrosion		1a	1a		
Total Acid Number (TAN)	mg KOH/g	0.01	0.02	0.08	0.35
n-Paraffins	mass %	21.1			
i-Paraffins	mass %	26.5			
Naphthenes	mass %	33.9			
Aromatics	mass %	18.5			
n-Paraffins	vol %	22.7			
i-Paraffins	vol %	27.7			
Naphthenes	vol %	33.0			
Aromatics	vol %	16.6			
Aromatics (HPLC)					
Total	mass %	17.1	16.4	26.0	31.0
Mono-Aromatics	mass %	17.1	13.8	16.1	18.7
Di-Aromatics	mass %	<0,1	2.6	9.7	9.4
Polycyclic Aromatics	mass %	<0,1	<0,1	0.2	2.9
Naphtalenes	vol %	0.04	1.80		
Aniline point	°C	53.4	61.0	68.1	74.8
Smoke point	mm	24.5	23.0		
Watson K-factor					11.7
Flash point **	°C	30.0			
Freezing point	°C	<-60,0	-52.0		
Cloud point	°C		<-52	-19	8
Cold Filter Plugging Point (CFPP)	°C		<-51	-21	9
Pour point	°C		<-51	-18	6
Cetane number			47.9	54.2	59.6
Cetane index (D-976)		32.0	43.0	48.4	47.7
CCI (D-4737)		36.9	44.1	51.3	*
Conradson Carbon Residue (CCR)	mass %				<0,10
Kin. viscosity at 20°C	cSt	1.10	1.88	5.16	19.9
Kin. viscosity at 50°C	cSt	0.77	1.19	2.62	6.91
Kin. viscosity at 100°C	cSt				2.42
Nitrogen	mg/kg	<1	<1	12	172
Basic nitrogen	mass %			0.001	0.008
Refractive index at 67°C					1.472
Distillation D-86 (50%)	°C	160.0	204.4	272.0	334.9

*: 10 vol% rec. value too uncertain to be used in calculation of CCI.

**: New method, see table 9a

Table 4	SAMPLE: 800-034	Oseberg Blend 2007	
Fraction	°C	375-420	420-525
Yield on crude	mass %	5.40	14.38
Yield on crude	vol %	5.00	13.04
Density at 15°C	kg/l	0.9032	0.9216
Specific gravity at 60/60°F		0.9037	0.9221
API gravity at 60/60°F	°API	25.1	22.0
Sulphur	mass %	0.397	0.480
Total Acid Number (TAN)	mg KOH/g	0.46	0.61
Aniline point	°C	83.9	88.8
Watson K-factor		11.8	11.8
Pour point	°C	27	39
Conradson Carbon Residue (CCR)	mass %	<0,10	0.12
Kin. viscosity at 50°C	cSt	21.0	66.6
Kin. viscosity at 100°C	cSt	4.97	10.3
Vanadium (V)	mg/kg	<0,1	<0,1
Nickel (Ni)	mg/kg	<0,1	<0,1
Nitrogen	mg/kg	590	1270
Basic nitrogen	mass %	0.022	0.042
Refractive index at 67°C		1.482	1.493

Table 5	SAMPLE: 800-034	Oseberg Blend 2007	
Fraction	°C	375+	525+
Yield on crude	mass %	34.01	14.22
Yield on crude	vol %	30.00	11.96
Density at 15°C	kg/l	0.9475	0.9933 (1)
Specific gravity at 60/60°F		0.9481	0.9940
API gravity at 60/60°F	°API	17.8	10.9
Sulphur	mass %	0.643	0.891
Total Acid Number (TAN)	mg KOH/g	0.61	
Aniline point	°C	87.5	>120
Watson K-factor		11.7	11.6
Pour point	°C	42	33
Conradson Carbon Residue (CCR)	mass %	6.1	14.9
Asphaltenes	mass %	1.0	2.2
n-Pentane insolubles	mass %	3.7	8.7
Ash	mass %	<0,001	0.010
Kin. viscosity at 50°C	cSt	350	
Kin. viscosity at 100°C	cSt	31.5	570
Kin. viscosity at 135°C	cSt		106
Vanadium (V)	mg/kg	6.9	17
Nickel (Ni)	mg/kg	4.7	11
Nitrogen	mg/kg	2970	5380
Basic nitrogen	mass %	0.085	0.151
Penetration at 25°C	0.1mm		115
Refractive index at 67°C		1.514	

(1): Calculated density for 525+ fraction.

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Table 6 SAMPLE: 800-034 Oseberg Blend 2007

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DISTILLATION

YIELD MASS-%

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Date: 13-des-06
Intake: 23368.5 g
Density at 15°C: 0.8355 kg/l

FRACTION	Mass g	Yield mass %	Cumul. yield mass %	Temperature °C
Loss	0.0	0.00	0.00	
Gases	552.0	2.36	2.36	15
C5-65	930.7	3.98	6.34	65
65-90	897.3	3.84	10.18	90
90-150	3140.9	13.44	23.63	150
150-180	1309.1	5.60	29.23	180
180-205	1021.5	4.37	33.60	205
205-240	1690.0	7.23	40.83	240
240-320	3782.1	16.18	57.02	320
320-375	2097.3	8.97	65.99	375
375-420	1262.4	5.40	71.39	420
420-525	3361.0	14.38	85.78	525
525+	3324.2	14.22	100.00	525+

Table 7 SAMPLE: 800-034 Oseberg Blend 2007

DISTILLATION

YIELD VOL-% AND DENSITY

Date: 13-des-06
Intake: 23368.5 g
Density at 15°C: 0.8355 kg/l

FRACTION	Density at 15°C (kg/l)	Yield vol %	Cumul. yield vol %	Temperature °C
Loss		0.00	0.00	
Gases	0.5464	3.54	3.54	15
C5-65	0.6457	5.06	8.60	65
65-90	0.7176	4.39	12.99	90
90-150	0.7545	14.61	27.59	150
150-180	0.7806	6.00	33.59	180
180-240	0.8083	11.99	45.58	240
240-320	0.8497	15.91	61.50	320
320-375	0.8821	8.50	70.00	375
375-420	0.9032	5.00	75.00	420
420-525	0.9216	13.04	88.04	525
525+	0.9933	11.96	100.00	525+

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Table 8a SAMPLE: 800-034 Oseberg Blend 2007

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COMPOSITIONAL ANALYSIS OF CRUDE OIL (MASS %)

NORMAL PARAFFINS:

Methane	<0,01
Ethane	0.02
Propane	0.64
Butane	1.31
Pentane	1.49
Hexane	1.37
Heptane	1.33
Octane	1.30
Nonane	1.11
Sum n-paraffins	8.57

C4 HYDROCARBONS

i-Butane	0.42

C5 HYDROCARBONS

ISO PARAFFINS:

2,2-Dimethylpropane	<0,01
i-Pentane	1.02
Sum C5 i-paraffins	1.02

NAPHTHENES:

Cyclopentane	0.16

Table 8b SAMPLE: 800-034 Oseberg Blend 2007

C6 HYDROCARBONS

ISO PARAFFINS:

2,2-Dimethylbutane	0.04
2,3-Dimethylbutane	0.09
2-Methylpentane	0.71
3-Methylpentane	0.41
Sum C6 i-paraffins	1.25

NAPHTHENES:

Methylcyclopentane (Inc. 2,2-Dimethylpentane)	0.66
Cyclohexane	1.04
Sum C6 naphthenes	1.70

AROMATICS:

Benzene	0.43

Table 8c SAMPLE: 800-034 Oseberg Blend 2007

C7 HYDROCARBONS

ISO PARAFFINS:

2,2,3-Trimethylbutane	<0,01
3,3-Dimethylpentane	0.02
2,4-Dimethylpentane	0.06
2-Methylhexane	0.46
2,3-Dimethylpentane	0.08
3-Methylhexane	0.45
Sum C7 i-paraffins	1.07

NAPHTHENES:

cis-1,3-Dimethylcyclopentane	0.14
trans-1,3-Dimethylcyclopentane	0.13
trans-1,2-Dimethylcyclopentane	0.28
Methylcyclohexane	1.80
Ethylcyclopentane	0.10
1,1-Dimethylcyclopentane	0.09
Sum C7 naphthenes	2.55

AROMATICS:

Toluene	1.03

Table 8d SAMPLE: 800-034 Oseberg Blend 2007

C8 HYDROCARBONS

ISO PARAFFINS:

2,2,4-Trimethylpentane	<0,01
2,5-Dimethylhexane	0.06
2,4-Dimethylhexane	0.07
3,4-Dimethylhexane	<0,01
3,3-Dimethylhexane	0.02
2,3-Dimethylhexane	0.09
(Inc. naphthenic compound)	
2-Methyl-3-ethylpentane	0.02
2-Methylheptane	0.45
4-Methylheptane	0.17
3-Methylheptane	0.28
2,3,4-Trimethylpentane	0.02
Sum C8 i-paraffins	1.18

NAPHTHENES:

1,1,3-Trimethylcyclopentane	0.09
(Inc. 2,2-Dimethylhexane)	
trans, cis-1,2,4-Trimethylcyclopentane	0.08
trans,cis-1,2,3-Trimethylcyclopentane	0.09
trans-1,4-Dimethylcyclohexane	0.14
1,1-Dimethylcyclohexane	0.06
trans-1-Methyl-3-ethylcyclopentane	0.04
cis-1-Methyl-3-ethylcyclopentane	0.03
trans-1-Methyl-2-ethylcyclopentane	0.09
trans-1,2-Dimethylcyclohexane	0.18
2-Propylcyclopentane	0.02
cis-1,2-Dimethylcyclohexane	0.10
Ethylcyclohexane	0.49
1-Propylcyclopentane	0.17
cis,cis-1,2,4-Trimethylcyclopentane	0.01
1-Methyl-1-ethylcyclopentane	0.01
cis-1,3-Dimethylcyclohexane	0.38
(Inc. naphthenic compound)	
Sum C8 naphthenes	1.98

Table 8e SAMPLE: 800-034 Oseberg Blend 2007

AROMATICS:

Ethylbenzene	0.22
m- & p-Dimethylbenzene (m- & p- xylene)	0.86
o-Dimethylbenzene (o-Xylene)	0.30
Sum C8 aromatics	1.39

C9 HYDROCARBONS

ISO PARAFFINS:

3,5-Dimethylheptane	0.13
4-Methyloctane	0.14
2-Methyloctane	0.20
3-Methyloctane	0.23
2,3,4-Trimethylhexane	<0,01
Unidentified paraffin	0.06
Sum C9 i-paraffins	0.77

NAPHTHENES:

1,1,3-Trimethylcyclohexane	0.16
1-Methyl-2-propylcyclopentane	0.07
1-Methyl-3-ethylcyclohexane	0.15
1-Methyl-4-ethylcyclohexane	0.11
1,1,4-Trimethylcyclohexane	0.06
Unidentified naphthenes	0.08
Sum C9 naphthenes	0.62

TOTAL IDENTIFIED	24.15
TOTAL UNIDENTIFIED	0.16
TOTAL C10+	75.69

4. ANALYTICAL METHODS

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Table 9a SAMPLE: 800-034 Oseberg Blend 2007

TEST	UNITS	METHOD
Density at 15°C	kg/l	D-4052/D-5002
Specific gravity at 60/60 °F		-
Total Sulphur	mass %	D-4294
Total Sulphur	mass %	D-5453 for sulphur content less than 0,01%
Hydrogen sulphide	mass %	To be indicated on lead acetate paper
Mercaptan sulphur	mg/kg	D-3227
n-Paraffins	mass %	GC
i-Paraffins	mass %	GC
Naphthenes	mass %	GC
Aromatics	mass %	GC
Benzene	mass %	GC
Aromatics - HPLC	mass %	IP-391
Naphthalene	vol %	D-1840
Watson K		UOP 375
Vapor Pressure (DVPE)	kPa	D-5191
Reid Vapor Pressure (RVP)	kPa	D-323
Flash point (Cont. Closed Cup)	°C	D-6450
Freezing point	°C	D-2386
Cloud point	°C	D-2500/D-5772
Pour point	°C	D-5853/D-5950
Could Filter Plugging Point	°C	IP 309
Kin. viscosity at 20°C	cSt	D-445
Kin. viscosity at 40°C	cSt	D-445
Kin. viscosity at 50°C	cSt	D-445
Kin. viscosity at 80°C	cSt	D-445
Kin. viscosity at 100°C	cSt	D-445

Table 9b	SAMPLE: 800-034	Oseberg Blend 2007

TEST	UNITS	METHOD
Aniline Point	°C	D-611
Research Octane Number (RON)		D-2699
Motor Octane Number (MON)		D-2700
Cetane index		D-976
Calculated Cetane Index (CCI)		D-4737
Cetane number		D-613
Smoke point	mm	D-1322
Distillation of the whole crude up to 375°C		D-2892
Distillation of the indivudal fractions		D-86
Distillation of 375+ °C		D-5236
Total Acid Number (TAN)	mgKOH/g	D-664
Copper corrosion		D-130
Nitrogen: fractions up to 420 °C	mg/kg	D-4629
Nitrogen: fractions above 420 °C	mg/kg	D-4629 modified
Basic nitrogen	mass %	UOP 269
Vanadium (V)	mg/kg	ICP-AES
Nickel (Ni)	mg/kg	ICP-AES
Sodium (Na)	mg/kg	ICP-AES
Salt as NaCl	mg/l	IP 265
Conradson Carbon Residue or	mass %	D-189
Carbon Residue (Micro Method)	mass %	D-4530
Asphaltenes	mass %	IP 143
n-C5 Insolubles	mass %	D-4055
Ash	mass %	D-482
Penetration at 25°C	0.1mm	D-1321
Refractive index at 67°C		Abbe refractometer
Wax content	mass %	UOP 46 (mod. acetone precip.)
Water content	mg/kg	D-4928
Compsitional analysis of crude oil	mass %	D-5134