MUD CONTROL (IMCO)

BP Petroleum Development Norway

Well 35/3-2

17 1/2" hole
Interval Discussion

The initial mud program for the 17 1/2" hole interval recommended that the hole be drilled with seawater and natural clays. The materials recommended in the program were to provide an initial viscosity which was to be supplemented with hi-vis slurry sweeps for added lifting capacity and adequate hole cleaning. The use of dispersants were recommended to thin out viscosity and gels toward the interval TD in preparation to log and run casing.

No barite additons were planned or recommended and no control of filtration was required. At the end of the interval 30% of the cost was spent on barite and 25% on maintaining filtration control.

The mud used to drill the interval was a bentonite/drispac mud providing viscosity, fluid loss control and encapsulating inhibition.

Primary concern on drilling out of the 18 3/8" csg was to maintain mud wt to a minimum. (Max of 1.1 sg (9 ppg)).

At an average penetration rate of 15-20 meter/hr and at times as high as 50 m/hr the solids control equipment proved inadequate and in order to maintain mud wt within ordered limits, large additions of water were required. The sandtraps were dumped frequently and shaker box dumped on each connection.

With the high surface mud losses, large additions of chemicals were used in an endeavour to both make up volume and to reduce fluid loss, within mud property requirements of 10-15 ml. In one particular day 48 sacks of drispac were used in trying to lower fluid loss ($7.500).

17 1/2" hole interval discussion cont....

Toward the end of the interval while drilling thro' bentonitic clays, which raised the MBT as high as 30 ppb, large additions of dispersant were added to reduce gel strengths in preparation to log and run casing.

In one day, 120 sacks of RD-555/thin were added and this is reflected in the high cost of dispersants used. 9% of interval cost.

Mud wt was maintained at a minimum till 2100 m and then increased to 1.15 sg and drilled to TD with a 1.23 sg mud. This was increased to 1.27 sg when it was necessary to ream to bottom after making a wiper trip on reaching TD.

The hole was logged with no problems with a bottom hole temperature of 118 F^{o}.

The 13 3/8" casing was stuck at 1890 m. After a lapsed time of 12 hours of placing a 120 bbl pill of IMCO spot, this was freed and run to TD and cemented. 240 bbls of mud were lost to subsurface when cementing the 1st stage with further losses during the 2nd stage cementing. Mud wt was reduced to 1.15 sg and the 2nd stage cemented down the annulus.

Drilling the early part of the interval posed a series of conflicting practical drilling fluid requirements. Large additions of water to contain mud wt with the consequent expensive addition of chemicals, particularly fluid loss control materials to maintain the mud within ordered limits.

Dilution, as a form of solids control, is expensive, particularly in conjunction in trying to maintain a strict fluid loss with the use of expensive polymers.

17 1/2" hole interval discussion cont....

The coarse sand section could have been drilled with a high viscous mud, with no stipulated, stringent fluid loss control, but containing a high content of hi vis CMC, 4-5 ppb or starch, supplemented with fine myca. The intention being to 'plaster' the 300 m of coarse unconsolidated sand section down to 1200 m. The remainder of the hole to be drilled with seawater and viscous prehydrated, drill water bentonite/CMC slurries, mixed as viscosity and fluid loss requirements dictated.

The use of CMC and starch is normaly restricted by the lack of yield in seawater and more saline solutions. The total salinity of the mud did not rise above 12-15 K ppm. Chlorides and the use of CMC or starch would have yielded adequately in this environment.

Other than dilution, to control gel strengths the use of a centrifuge is required to remove and control the fine solids content of the mud.

The use of a centrifuge in drilling surface hole is highly underated. This solids control equipment offers not only control over the percentage of solids in the mud, but more important the control over the type of solids in the mud.

A mud wt of 1.25 sg (10.2 ppg) can be maintained, without the addition of barite and still have good rheological properties.

1390 m of hole drilled at a mud cost of $ 61.7/m = $ 18.8 /ft.

BP Petroleum Development Norway

Well 35/3-2

Interval Discussion

12 1/4" Hole

The mud for the 12 1/4" was brought forward from the previous interval - a dispersed bentonite/drispac mud with a mud wt of 1.27 sg to drill out of the 13 3/8" csg shoe. The leak off test gave a Fracture Gradient of an equivalent mud wt of 1.63 sg. With cavings over the shale shaker the mud wt. was soon increased to 1.36 sg at 3345m, and with still shows of concentration gas to a mud wt of 1.43 sg.

The mud wt at TD was 1.45+ sg, but was increased to 1.47 sg to run logs, and finally to 1.49 sg to facilitate running the 9 5/8" csg.

There were no hole problems while drilling this interval. The Rheology during the interval was well maintained with good yield point and a low gel strengths. The solids percentage content was well contained with the VSM solids control equipment run with 200 mesh screens, and run continously while drilling/circulating and also on Active Surface Volume while tripping.

There were no abnormal losses of mud, surface or subsurface and any problems with the drilling fluid lay within the chemistry of the mud.

The Ph of the mud was raised to 12.4 - this was on the pretext of a sulphurous smell in the pit area and suspected H_2S gas, although the logging unit recorded no evidence of this gas.

A Ph above 11.5 should in most cases be avoided unless a lime based mud is being used.

An ultra high Ph is detrimental to the functioning of most organic mud additions i.e. polymers such as drispac and poly rx. Also the use of caustic soda, as a source of hydroxyl ion, over long periods and in excessively concentrated additions (to an extent of 85 sacks in one day) can lead to an aikalinity imbalance in the mud. There is usually a correlation between Ph andPf in balanced alkalinity. An excess of sodium ions, supplied by the caustic soda, activng as a buffering agent, can interfere with this balance, with a consequent misinterpretation of Ph readings. This evident from mud reports i.e. Ph = 10.8 - Pf = 2.2.

The total usage of caustic soda during this interval, although not considered high in cost, is extraordinaryly excessive in the quality used and amounts to a high concentration of approximately 5 ppb over the interval.

The imbalance of the alkalinity and misterpreted Pa may explain the disproportionate high usuage of the polymers, drispac and poly rx, which amount to 36% of the material cost of the interval. Poly rx and drispac superlo, total usuage of 651 (50 lb) sacks, with the total mud volume including dilution, equaling approximately 3500 bbls. This gives a high concentration of polymers used of 9 lbs per bbl.

The use of soltex, in a wildcat well, unless specifically for remedial purposes of wellbore stability and problems shales, may be open to question - as the water insoluble portion of soltex remains in the mud and will fluoresce with the possible misinterpretation of oil shows in cuttings and core.

Bottom hole temperature recorded at TD of 3836m was 205^{o}F - not a high temperature to cause the break down of lignosulphonates, as suspected or to cause a problem in the mud chemistry due to high temperature instability.

Fluid loss is unboubtedly one of the most controversial subjects in drilling fluid technology. A large percentage of cost is spent on maintaining a specific fluid loss. Bentonite remains one of the best filtration control agents and one of the most temperature stable mud additives, also the most economic and when used properly has the capability of solving most filtrations problems.

The daily volume requirements of drilling the 12 1/4" Hole offer the opportunity of adding to the system pre-hydrated bentonite. These additions are greatly facilitated by a sizeable mixing pit for pre-hydration of 6-8 hours, and the use of an air rig activated transfer pump to allow slow but steady transfer over to the active system.

The pump requires to be air activated to both allow easier control of the rate of addition and also that the transfer system does not interfere with other mixing and transfers of mud. The slow steady addition, not only gives a better mix to the active system, but also that abnormal pit gains or losses are more easily observed or monitored.

The use of an Atlas Copco sumersible pump is strongly recommended and has on other wells proved invaluble in running an economically engineered mud system.

BP Petroleum Development Norway

Well 35/3-2

Interval Discussion

8 3/8" Hole

The dispersed bentonite/drispac used during the previously interval was brought forward maintaining previous mud properties.

Mud weight was immediately raised to 1.52 sg and Filtrate lowered to less than 5cc per 30 min. A mud weight of 1.57 sg was reached by 3857m and maintained until T.D.

Gas units of 480 were recorded by 3922m but a flow check confirmed that the well would remain static.

No abnormal hole problems were encountered either while drilling or coring during this interval. Solids content were maintained at a minimum thru the use of solids control equipment and dilution. The use of a centrifuge would have been beneficial during this interval, as Barite amounted to 42.5% of the total cost. The centrifuge has been shown to be economical when a sg of 1.4 or above is reached.

Mud rheology properties were maintained at proper levels throughout the 8 3/8" interval.

Bentonite as a fluid loss reducer is very underated. Due to the salinity of the water, bentonite should be prehydrated to obtain maximum benefit. Bentonite also provides the added advantage of "slicking up" the hole, which helps prevent drag and torque. This product does "wear out" so regular additions should be maintained at all times. The added advantage is that additions of fluid loss materials (Drispac,CMC, etc.) can be reduced to provide a savings in total cost of well.

Drilling was completed on September 19, 1980 at a depth of 4400 m. Three days of logging were then undertaken with no hole problems.

IMCO SERVICES
A Division of HALLIBURTON Company
2400 West Loop South, P. O. Box 22605,
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

IMCO REPRESENTATIVE Chavez/Shackleton

TYPE MUD Spud

CASING	HOLE SIZE	NO. BITS	NO. DAYS
30" @ 458 m	36"		
@	24"		
@			
@			
@			

COMPANY: BP Norway
WELL NAME & NO.: 35/3-2
API WELL NO. | STATE | COUNTY | WELL | S/T
FIELD: WC | COUNTY: North Sea | STATE: Norway
CONTRACTOR: Sedco | Sec. | T | R

DATE 1980	DEPTH m	WEIGHT ☐ lbs/gal ☐ sg	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP °F	CAKE 32nd IN	ALKALINITY Pf	Mf	Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ ppg	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE ml/ml	lbs/bbl
19.5		min	80-100		30	spud mud and drilling w/seawater																
20.5		"	"																			
21.5		"	"																			
22.5		"	"																			
23.5		"	"																			
24.5		"	"																			
25.5		"	"																			
26.5		"	"																			
27.5		"	"																			
28.5		"	"																			
29.5		"	"																			
30.5		"	"																			
31.5	662	seawater																				
1.6	685	1.08	65+	10	22																	
2.6	900	1.08	100+	15	35	-	-	11.6	12	-	3	-	-	-	10k	-	-	5	-	-	5	25
3.6	900	1.09	45	15	20	-	-	9.0	18	-	2	-	-	-	22k	360	3	5	-	95	3.5	17.5
4.6	900	1.09+	45	17	15	8	10	9.5	19	-	2	-	-	-	15k	300	3	7	-	93	3.5	17.5
5.6	900	1.09+	48	22	20	-	-	9.5	19	-	2	-	-	-	16k	300	3	7	-	93	3.5	17.5

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IMCO SERVICES

A Division of HALLIBURTON Company
2400 West Loop South, P. O. Box 22606
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

COMPANY: BP Norway

WELL NAME & NO.: 35/3-2

API WELL NO. | STATE | COUNTY | WELL | S/T

FIELD: WC | COUNTY: North Sea | STATE: Norway

CONTRACTOR: Sedco | Sec. | T | R

IMCO REPRESENTATIVE: Shackleton/Chavez

TYPE MUD: Bentonite/Drispac

CASING	HOLE SIZE	NO. BITS	NO. DAYS
30" @ 458m	36"		
18 5/8" @ 893m	24"		
@	17 1/2"		
@			
@			

DATE 1980	DEPTH m	WEIGHT ☐ lbs/gal ☐ sg	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	GEL STRENGTH 10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP. °F	CAKE 32nd IN.	ALKALINITY Pf	ALKALINITY Mf	ALKALINITY Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ gpg	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE me/ml	METHYLENE BLUE lbs/bbl
6.6	900	1.09	48	20	18	-	-	9.5	19	-	2	-	-	-	16k	300	3	7	-	93	3.5	17.5
7.6	900	1.09	48	16	18	7	27	9.5	15	-	2	.3	-	-	12k	250	2	6	-	94	-	-
8.6	900	1.10	55	-	22	-	-	9.5	15	-	2	.3	-	-	11k	200	-	-	-	-	-	-
9.6	900	1.09	45	22	18	7	27	9.5	15	-	2	.3	-	-	12k	140	2	6	-	94	-	-
10.6	900	1.09	48	12	20	10	28	9.5	25	-	2	.3	-	-	14k	140	2	6	-	94	-	-
11.6	900	1.09	50	15	20	10	28	9.5	25	-	3	-	-	-	14k	140	2	6	-	94	-	-
12.6	900	1.1	45	11	23	11	24	9.5	17	-	2	nil	-	-	12k	120	2	8	-	92	4	20
13.6	900	1.1	45	11	23	11	24	9.4	17	-	2	nil	-	-	12k	120	2	8	-	92	4	20
14.6	893	1.11	45	12	24	10	25	9.4	15	-	2	.03	-	-	12k	120	2	10	-	90	4	20
15.6	853	1.10	51	14	13	10	30	9.5	9.8	-	1	.05	1.0	-	12k	80	1½	5	-	95	3	15
16.6	1023	1.10	49	12	20	15	30	11.5	25	-	3	1.0	1.4	-	12k	120	2	7	-	93	3.5	17.5
17.6	1225	1.11	50	13	15	10	25	10.5	21	-	2	.2	.2	-	12000	120	2	8	0	92	3.5	17.5
18.6	1522	1.10	41	10	12	8	24	9.3	18	-	1	.1	-	-	14k	120	3	6	0	94	3.5	17.5
19.6	1732	1.12	44	11	10	5	19	9.0	20	-	2	.1	.4	-	15k	120	1	9	-	91	5	25
20.6	1930	1.13	41	10	12	6	25	9.0	18	-	2	.1	.3	-	15	80	1	9	-	91	6.0	30
21.6	2094	1.13	47	12	17	4	38	9.0	22	-	2	.1	.3	-	18	120	2	11	-	89	6.0	30
22.6	2229	1.15	45	11	14	7	25	9.4	17	-	1	.1	.3	-	19	120	1	9	-	91	5	25
23.6	2290	1.23	43	10	17	11	37	9.0	22	-	2	.1	.8	-	21	240	½	12	-	88	6	30

FORM 514

IMCO SERVICES
A Division of HALLIBURTON Company
2400 West Loop South, P. O. Box 22605
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

	CASING	HOLE SIZE	NO. BITS	NO. DAYS
	30" @ 458m	36"		
18	5/8"@ 893m	24"		
13	3/8"@2286m	17 1/2"		
	@	12 1/4"		
	@			

IMCO REPRESENTATIVE Chavez/Shackleton

TYPE MUD Ligno/Drispac

COMPANY BP Norway

WELL NAME & NO. 35/3-2

API WELL NO.	STATE	COUNTY	WELL	S/T

FIELD WC — COUNTY North Sea — STATE Norway

CONTRACTOR Sedco

Sec. T R

DATE 1980	DEPTH m	WEIGHT ☐ lbs/gal ☐ lbs/cu ft sg	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	GEL STRENGTH 10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP °F	CAKE 32nd IN.	ALKALINITY Pf	ALKALINITY Mf	ALKALINITY Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ gpg	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE me/ml	METHYLENE BLUE lbs/bbl
24.6	2290	1.27	50	15	25	20	51	9.0	17	-	2	.1	.8	-	21k	360	1/4	13	-	87	6.0	30
25.6	2290	1.27	55	15	22	15	51	9.0	17	-	2	.1	.5	-	21k	360	1/4	13	-	87	6.0	30
26.6	2290	1.27	52	13	20	11	49	10.5	-	-	2	.5	1.1	-	21	240	1/4	13	0	87	6.0	30
27.6	2290	1.27	50	10	21	11	32	9.3	12	-	2	.2	.9	-	13k	120	1½	15	+	85	5	25
28.6	2290	1.15	42	12	11	1	15	9.4	9	-	2	.2	.6	-	18k	300	1	9	+	91	4	20
29.6	2290	1.15+	38	12	10	1	12	9.4	9	-	2	.2	.6	-	18k	300	1	9	-	91	4	20
30.6	2290	1.16	36	6	8	1	13	10.9	15	-	3	.3	.8	-	18	200	½	9	-	91	3.5	17.5
1.7	2290	1.27	44	18	10	1	12	11.1	8	-	2	.3	.6	-	18	200	½	12	-	88	3.5	17.5
2.7	2290	1.27	43	18	10	1	2	10.4	8.5	-	2	.2	1.0	-	18	200	½	13	-	87	3.5	17.5
3.7	2290	1.27	45	18	9	1	14	11.3	9.5	-	2	.4	.9	-	17	280	3/4	13	-	87	3.5	17.5
4.7	2380	1.3	44	19	10	1	13	11.3	13	-	2	.5	1.4	-	17	180	1	13	-	87	3.5	17.5
5.7	2429	1.3	46	11	10	1	15	11.3	9.8	-	2	.2	.9	-	17	200	3/4	12	-	88	4.5	22.5
6.7	2517	1.32	51	11	12	2	18	10.8	9.2	-	2	.2	1.0	-	17	260	1/4	12	2	86	5.25	261/4
7.7	2603	1.32+	53	12	18	3	25	10.5	9.0	-	2	.2	.9	-	17	260	1/4	12	2	86	6	30
8.7	2610	1.32	52	11	12	2	25	10.6	8.4	-	2	.2	.8	-	16	260	1/4	12	2	86	4.5	22.5
9.7	2701	1.33	54	13	13	2	25	10.3	7.8	-	2	.3	1.0	-	15	180	1/4	12	2	86	4.5	22.5
10.7	2783	1.34	54	11	15	2	27	10.9	7.9	-	2	.5	1.5	-	16	90	Tr	14	2	84	4.5	22.5

FORM 514

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2400 West Loop South, P. O. Box 22605
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

CASING	HOLE SIZE	NO. BITS	NO. DAYS
30" @ 458m	36"		
18 5/8" @ 893m	24"		
13 3/8" @ 2286m	17 1/2"		
@	12 1/4"		
@			

IMCO REPRESENTATIVE Shackleton/Chavez

TYPE MUD Ligno/Drispac

COMPANY: BP Norway
WELL NAME & NO.: 35/3-2
API WELL NO. | STATE | COUNTY | WELL | S/T
FIELD: WC | COUNTY: North Sea | STATE: Norway
CONTRACTOR: Sedco | Sec. | T | R

DATE 1980	DEPTH m	WEIGHT ☐ Mud ☐ SG / lbs/gal / lbs/cu ft	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	GEL STRENGTH 10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP °F	CAKE 32nd IN.	ALKALINITY Pf	ALKALINITY Mf	ALKALINITY Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ BPB	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE me/ml	METHYLENE BLUE lbs/bbl
11.7	2875	1.34	54	16	23	3	35	10.3	8.0	-	2	.1	1.6	-	15	240	1/8	14	2	84	5	25
12.7	2970	1.34	50	9	13	3	20	10.1	7.0	-	1	.3	1.2	-	19k	Tr	1/8	15	1	84	4	20
13.7	3036	1.34	50	11	9	2	18	10.2	6.8	-	1	.4	1.6	-	18	Tr	1/8	15	1	84	4.5	22.5
14.7	3090	1.34	50	10	10	2	28	10.2	6.4	-	1	.3	1.0	-	18	Tr	1/8	14	1	85	4.0	20
15.7	3166	1.34	52	10	9	1	22	9.5	6.6	-	1	.1	1.7	-	18	40	1/8	15	1	84	4.5	22.5
16.7	3206	1.34	52	10	11	2	21	11.1	7.0	-	1	.8	1.7	-	18	Tr	1/8	15	1	84	4.5	22.5
17.7	3282	1.34	52	15	10	2	27	12.4	7.0	-	1	1.4	2.7	-	18	Tr	1/4	16	1	83	5	25
18.7	3282	1.34	52	15	11	3	29	11.8	6.8	-	1	1.2	-	-	18	Tr	1/4	15	1	84	5	25
19.7	3345	1.36	52	12	14	5	30	10.8	7.2	-	1	2.1	-	-	18	Tr	1/8	15	Tr	85	4.5	22.5
20.7	3402	1.36	57	12	12	3	29	10.8	6.8	-	1	1.8	-	-	18	Tr	1/8	16	1	83	4.5	22.5
21.7	3437	1.36	54	16	12	2	23	11.0	6.0	-	1	2.0	-	-	19	Tr	1/8	15	2	83	5	25
22.7	3461	1.36	52	14	11	2	23	11.0	6.0	-	1	1.7	-	-	20	Tr	Tr	15	2	83	5	25
23.7	3490	1.36	54	15	12	3	23	11.0	5.8	-	1	1.8	-	-	21	Tr	1/8	16	2	82	4.5	25
24.7	3520	1.36	55	15	13	2	23	10.0	5.0	-	1	0.6	-	-	21	Tr	Tr	16	2	82	4.5	22.5
25.7	3557	1.39	55	13	10	2	16	10.0	5.2	-	1	.6	-	-	21	Tr	Tr	15	2	83	4	20
26.7	3575	1.42	54	13	9	2	15	10.0	5.5	-	2	0.6	-	-	21	Tr	Tr	15	2	83	4	20
27.7	3593	1.42	52	12	9	1	14	10.5	5.6	-	1	1.2	-	-	20	Tr	1/4	16	2	82	3 3/4	18 3/4
28.7	3611	1.44	53	13	12	1	12	10.5	5.2	-	1	1.3	-	1.5	20	Tr	1/4	16	2	82	3 3/4	18 3/4

FORM 512

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Houston, Texas 77027 A/C 713 671-4800

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CASING	HOLE SIZE	NO. BITS	NO. DAYS
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@	12 1/4"		
@			

COMPANY: BP Norway
WELL NAME & NO.: 35/3-2
API WELL NO. | STATE | COUNTY | WELL | S/T
FIELD: WC | COUNTY: North Sea | STATE: Norway
CONTRACTOR: Sedco | Sec. | T | R

IMCO REPRESENTATIVE: Shackleton/Chavez
TYPE MUD: Ligno/Drispac

DATE 1980	DEPTH m	WEIGHT ☐ lbs/gal ☐ kg/cu ft	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	GEL STRENGTH 10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP__°F	CAKE 32nd IN.	ALKALINITY Pf	ALKALINITY Mf	ALKALINITY Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ gpg	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE me/ml	METHYLENE BLUE lbs/bbl
29.7	3617	1.42	53	13	11	1	13	10.5	5.2	-	1	1.5	6.4	1.6	20k	Tr	1/4	16	2	82	33/4	83/4
30.7	3625	1.42	+50	12	12	1	10	10.5	5.5	-	1	1.1	5.6	2.0	20	Tr	1/4	17	2	81	3.8	19
31.7	3637	1.42	+52	13	9	1	11	10.5	5.8	-	1	0.9	5.2	1.7	20	Tr	1/4	17	2	81	3.8	19
1.8	3641	1.43	50	13	9	1	12	11.5	6.2	-	1	1.4	5.6	1.8	20	Tr	1/4	16	2	82	3.8	19
2.8	3686	1.43	50	13	10	1	14	11.5	6.0	-	1	1.2	5.2	2.0	20	nil	1/4	16	2	82	3.8	19
3.8	3702	1.43	55	12	12	1	13	11.0	5.9	-	1	.8	5.0	1.4	20	nil	Tr	16	2	82	3.8	19
4.8	3708	1.42	+51	13	10	1	13	11.0	6.0	-	1	1.0	5.5	1.5	21	60	Tr	15	2	83	3.8	19
5.8	3726	1.43	52	13	12	1	12	11.0	5.5	-	2	0.8	5.2	1.3	21	Tr	Tr	16	2	82	3.7	18.5
6.8	3751	1.42	+53	12	10	1	12	11.0	5.1	-	1	0.8	4.0	1.1	21	60	Tr	16	2	82	3.7	18.5
7.8	3760	1.42	+53	14	12	1	12	10.0	5.0	-	1	1.0	5.0	1.6	21	60	Tr	16	2	82	3.7	18.5
8.8	3780	1.43	55	15	12	1	13	10.0	5.2	-	1	1.0	4.4	1.4	21	40	Tr	16	2	82	3.7	18.5
9.8	3790	1.42	51	13	7	1	12	10.5	4.6	-	1	1.4	4.0	2.0	21	40	Tr	17	1	82	3.7	18.5
10.8	3804	1.42	+50	13	9	1	12	10.5	4.8	-	1	1.5	4.2	2.2	21	40	Tr	16	1	83	3.6	18
11.8	3833	1.45	+50	14	9	1	12	10.5	4.6	-	1	1.5	3.8	2.2	21	40	Tr	17	1	82	3.6	18
12.8	3833	1.45	50	13	9	1	11	10.5	4.4	-	1	1.4	3.6	2.2	21	40	Tr	16	1	83	3.6	18
13.8	3833	1.45	55	15	10	1	12	10.5	5.0	-	1	1.3	3.6	2.0	21	40	Tr	16	1	83	3.6	18
14.8	3833	1.47	+51	16	10	1	13	10.5	4.8	-	1	1.3	3.4	2.0	21	40	Tr	17	1	82	3.6	18
15.8	3833	1.47	50	15	10	1	12	10.5	5.0	-	1	1.4	3.6	2.0	21	40	Tr	17	1	82	3.6	18

FORM 514

IMCO SERVICES
A Division of HALLIBURTON Company
2400 West Loop South, P. O. Box 22605
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

CASING	HOLE SIZE	NO. BITS	NO. DAYS
30" @ 458m	36"		
18 5/8" @ 893m	24"		
13 3/8" @ 2286m	17 1/2"		
9 5/8" @ 3822m	12 1/4"		
@			

COMPANY: BP Norway
WELL NAME & NO.: 35/3-2
API WELL NO. | STATE | COUNTY | WELL | S/T
FIELD: WC — COUNTY: North Sea — STATE: Norway
CONTRACTOR: Sedco
Sec. | T | R

IMCO REPRESENTATIVE: C. Dunifer
TYPE MUD: Ligno/Poly Rx

DATE 1980	DEPTH m	WEIGHT ☐ lbs/gal ☐ lbs/ft³	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	GEL STRENGTH 10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP °F	CAKE 32nd IN.	ALKALINITY Pf	ALKALINITY Mf	ALKALINITY Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ %P9	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE me/ml	METHYLENE BLUE lbs/bbl
16.8	3833	1.47	51	15	10	1	11	10.5	5.2	-	1	1.2	3.4	2.0	21	40	Tr	17	1	82	3.6	18
17.8	3833	1.47	50	14	10	1	10	10.5	5.4	-	1	1.4	3.4	2.4	21	40	Tr	17	1	82	3.6	18
18.8	3833	1.47	51	15	10	1	10	10.5	5.2	-	1	1.3	3.4	2.2	21	40	Tr	17	1	82	3.6	18
19.8	3833	1.47	50	14	10	1	10	10.5	5.6	-	1	1.4	3.6	2.2	21	40	Tr	17	1	82	3.6	18
20.8	3833	1.49	50	14	10	1	10	10.5	5.4	-	1	1.4	3.8	2.4	21	40	Tr	18	1	81	3.6	18
21.8	3833	1.49	60	13	10	2	13	10.5	6.5	-	1	1.2	2.2	2.0	21	Tr	Tr	17	1	83	4	20
22.8	3833	1.49	60	13	10	2	13	10.5	6.5	-	1	1.2	2.2	2.0	21	Tr	Tr	17	1	83	4	20
23.8	3833	1.49	57	14	10	2	12	10.5	7.0	-	1	1.1	2.2	2.0	21	Tr	Tr	17	Tr	83	4	20
24.8	3833	1.49	57	14	10	2	12	10.5	7.0	-	1	1.1	2.2	2.0	21	Tr	Tr	17	Tr	83	4	20
25.8	3833	1.49	57	16	8	1	19	11.0	7.8	-	1	2.0	3.8	3.8	21	60	Tr	17	Tr	83	4	20
26.8	3833	1.5	54	12	6	1	14	11.5	7.6	-	1	3.1	-	7	21	40	Tr	17	Tr	83	4	20
27.8	3833	1.5	54	12	6	1	14	11.5	7.6	-	1	3.1	-	7	21	40	Tr	17	Tr	83	4	20
28.8	3833	1.5	54	12	6	1	14	11.5	7.6	-	1	3.1	-	7	21	40	Tr	17	Tr	83	4	20
29.8	3833	1.5	54	12	6	1	14	11.5	7.6	-	1	3.1	-	7	21	40	Tr	17	Tr	83	4	20
30.8	3833	1.5	51	12	5	1	6	12.5	7.3	-	2	2.6	-	7.5	21	80	Tr	17	Tr	83	4	20
31.8	3839	1.52	57	14	8	1	6	12.5	4.7	-	1	2.6	-	9.5	21	100	Tr	17	Tr	83	4.4	22
1.9	3858	1.57	52	15	6	1	5	12	5.3	-	1	2.0	-	7	21	120	Tr	18	Tr	83	4.4	22
2.9	3890	1.57	54	18	7	1	6	12	5.0	-	1	1.5	-	6.5	21	60	Tr	17	Tr	83	4.6	23

FORM 514

IMCO SERVICES
A Division of HALLIBURTON Company
2400 West Loop South, P. O. Box 22605
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

CASING	HOLE SIZE	NO. BITS	NO. DAYS
30" @ 458m	36"		
18 5/8" @ 893m	24"		
13 3/8" @ 2286m	17 1/2"		
9 5/8" @ 3822m	12 1/4"		
@ 4400m	8 3/8"		

COMPANY: BP Norway
WELL NAME & NO.: 35/3-2
API WELL NO. | STATE | COUNTY | WELL | S/T
FIELD: WC | COUNTY: North Sea | STATE: Norway
CONTRACTOR: Sedco | Sec. | T | R

IMCO REPRESENTATIVE: Bob Heard
TYPE MUD: Ligno/Poly Rx

Date 1980	Depth m	Weight ☐ Original ☐ lbs/gal ☐ lbs/ft³	Viscosity sec	Plastic Vis cps	Yield Value lbs/100 ft²	Gel Strength 10S	Gel Strength 10M	pH	Filtrate ml	HT-HP Filtrate 500 psi TEMP. °F	Cake 32nd IN.	Alkalinity Pf	Alkalinity Mf	Alkalinity Pm	☐ Salt ☐ Chloride ☐ ppm ☐ ppg	Calcium Ion ppm	Sand % Vol	Solids % Vol	Oil % Vol	Water Content % Vol	Methylene Blue mg/ml	Methylene Blue lbs/bbl
3.9	3903	1.57	55	18	7	1	5	11.5	5.2	-	1	1.4	-	6.0	21k	60	Tr	18	Tr	82	4.4	22
4.9	3950	1.57	52	22	8	1	4	11.5	4.7	-	1	1.2	-	4.0	21k	40	Tr	18	Tr	82	4.2	21
5.9	3973	1.57	50	18	7	0	4	11.5	4.8	-	1	1.5	-	4.5	21k	60	1/4	19	Tr	81	4.4	22
6.9	3998	1.57	54	18	6	0	5	11.2	4.4	-	1	1.2	-	4.0	21k	40	Tr	19	Tr	81	4.4	22
7.9	4010	1.57	58	20	7	1	6	11.4	3.8	-	1	1.6	-	4.5	21k	60	Tr	19	1/2	81	4.4	22
8.9	4010	1.57	55	19	7	1	5	11.2	4.2	-	1	1.7	-	4.5	21k	Tr	Tr	19	1/2	81	4.4	22
9.9	4126	1.57	56	20	7	0	4	10.8	4.8	-	1	1.6	-	4.5	21k	20	Tr	19	1/2	81	4.6	23
10.9	4126	1.57	58	20	7	0	5	10.7	5.1	-	1	1.6	-	4.5	21k	40	Tr	19	1/2	81	4.6	23
11.9	4162	1.57	55	19	6	0	4	11.2	4.6	-	1	1.7	-	4.5	21k	20	Tr	19	1/2	81	4.6	23
12.9	4205	1.57	56	19	7	0	5	10.8	4.4	-	1	1.6	-	4.0	21k	20	Tr	19	1/2	81	4.4	22.5
13.9	4220	1.57	55	19	6	1	4	11.2	4.8	-	1	1.8	-	4.5	21k	60	Tr	18	Tr	82	4	20
14.9	4254	1.57	55	20	7	1	3	11.3	4.5	-	1	1.7	-	3.5	21k	40	1/4	18	Tr	82	3.5	17
15.9	4309	1.57	54	18	7	1	3	11.2	4.7	-	1	1.8	-	3.1	21k	20	1/4	18	Tr	82	3.3	16.5
16.9	4355	1.57	55	19	7	1	3	11.3	4.1	-	1	1.8	-	3.6	20k	20	1/3	19	Tr	81	3.0	15
17.9	4355	1.57	55	19	7	1	3	11.3	4.1	-	1	1.8	-	3.6	21k	20	1/4	19	Tr	81	3.0	15
18.9	4355	1.57	55	19	7	1	3	11.3	4.1	-	1	1.8	-	3.6	21k	20	1/4	19	Tr	81	3.0	15
19.9	4400	1.57	58	23	8	2	5	10.6	4.2	-	1	1.6	-	2.6	21k	20	1/4	19	1/4	81	3.0	15
20.9	4400	1.57	58	23	8	2	5	10.6	4.2	-	1	1.6	-	2.6	21k	20	1/4	19	1/4	81	3.0	15

FORM 514

IMCO SERVICES
A Division of HALLIBURTON Company
2400 West Loop South, P. O. Box 22605
Houston, Texas 77027 A/C 713 671-4800

RECORD OF DRILLING MUD TESTS

IMCO REPRESENTATIVE: Bob Heard

TYPE MUD: Ligno/Poly Rx

CASING	HOLE SIZE	NO. BITS	NO. DAYS
30" @ 458m	36"		
18 5/8" @ 893m	24"		
13 3/8" @ 2286m	17 1/2"		
9 5/8" @ 3822m	12 1/4"		
@ 4400m	8 3/8"		

COMPANY: BP Norway

WELL NAME & NO.: 35/3-2

API WELL NO. | STATE | COUNTY | WELL | S/T

FIELD: WC — COUNTY: North Sea — STATE: Norway

CONTRACTOR: Sedco

Sec. | T | R

DATE 1980	DEPTH ft. / m	WEIGHT ☐ lbs/gal ☐ lbs/cu ft / sg	VISCOSITY sec	PLASTIC VIS cps	YIELD VALUE lbs/100 ft²	GEL STRENGTH 10S	GEL STRENGTH 10M	pH	FILTRATE ml	HT-HP FILTRATE 500 psi TEMP °F	CAKE 32nd IN.	ALKALINITY Pf	ALKALINITY Mf	ALKALINITY Pm	☐ SALT ☐ CHLORIDE ☐ ppm ☐ ppg	CALCIUM ION ppm	SAND % VOL	SOLIDS % VOL	OIL % VOL	WATER CONTENT % VOL	METHYLENE BLUE me/ml	METHYLENE BLUE lbs/bbl
21.9	4400	1.57	56	23	8	2	5	10.6	4.2	-	1	1.6	-	2.5	21k	20	1/4	19	1/4	81	3	15
22.9	4400	1.57	56	23	8	2	5	10,6	4.2	-	1	1.6	-	2.5	21k	20	1/4	19	1/4	81	3	15
23.9	4400	1.57	60	31	9	2	5	10,5	4.3	-	1	1.5	-	2.1	21k	20	1/4	19	1/4	81	3	15
24.9	3600	1.48	42	13	14	1	1	11.0	5.2	-	1	1.6	-	3.7	21k	20	Tr	16	Tr	84	3.3	16.5
25.9	3600	1.44	43	19	7	1	1	11.5	4.6	-	1	1.6	-	2.7	21k	20	Tr	15	Tr	85	3	15
26.9	3600	1.44	43	19	7	1	2	11.4	4.5	-	1	1.6	-	2.6	21k	20	Tr	15	Tr	85	3	15
27.9	3600	1.44	45	20	7	1	3	11.5	4.5	-	1	1.6	-	2.6	21k	20	Tr	15	Tr	85	3	15
28.9	3600	1.44	47	23	7	1	3	11.4	4.5	-	1	1.6	-	2.6	21k	20	Tr	15	Tr	85	3	15
29.9	3600	1.44	47	22	7	1	3	11.3	4.5	24	1	1.6	-	2.6	21k	20	Tr	16	Tr	84	3	15
30.9	3600	1.44	45	21	7	1	3	11.3	4.6	24	1	1.6	-	2.6	21k	20	Tr	16	Tr	84	3	15
1.10	3600	1.44	45	21	6	1	2	11.3	4.6	24	1	1.6	-	2.6	21k	20	Tr	16	Tr	84	3	15
2.10	3600	1.44	46	23	7	1	4	11.2	4.4	24	1	1.7	-	2.6	21k	20	Tr	16	Tr	84	3	15

FORM 514

BP Petroleum Development Norway

Well 35/3-2

Material usage

36" Hole

Product	Unit	Unit Cost		Total
Barite	210 sxs	$ 6.40	50 kg	$ 1.344.00
Gel	59 m/t	$330.00	m/t	$ 19.470.00
caustic	34 sxs	$ 14.58	26 kg	$ 495.72
Drispac Reg	5 sxs	$152.00	50 lb	$ 760.00
Soda Ash	9 sxs	$ 19.01	50 kg	$ 171.09
				$ 22.240.81

BP Petroleum Development Norway

Well 35/3-2

Material Usage

24" Hole

Product	Unit	Unit Cost	Total
Barite	197 m/t	$ 135.00 m/t	$ 26.595.00
Gel	142 m/t	$ 330.00 m/t	$ 46.860.00
Gel	306 sxs	$ 15.00 50 kg	$ 4.590.00
Drispac Reg	233 sxs	$ 152.00 50 lb	$ 35.416.00
Caustic Soda	149 sxs	$ 14.58 25 kg	$ 2.172.42
Soda Ash	48 sxs	$ 19.01 50 kg	$ 912.48
Bicarbonate	8 sxs	$ 25.00 50 kg	$ 200.00
CMC Lo Vis	64 sxs	$ 61.70 25 kg	$ 3.948.80
RD-555	8 sxs	$ 18.50 25 kg	$ 148.00
IMCO Thin	5 sxs	$ 20.50 50 lb	$ 102.50
Myca (c)	309 sxs	$ 18.00 25 kg	$ 5.562.00
Myca (f)	196 sxs	$ 18.00 25 kg	$ 3.528.00
Plug	3 sxs	$ 16.25 25 kg	$ 48.75
IMCO MD	1 drm	$ 430.00 55 gal	$ 430.00
			$ 130.513.95
10 m/t Barite written off as loss during transfer			$ 1.350.00
13 m/t Gel contaminated in bulk storage tank and dumped			$ 4.290.00
			$ 136.153.95

BP Petroleum Development Norway

Well 35/3-2

Material Usage

17 1/2" Hole

Product	Unit	Unit Cost		Total
Barite	195 m/t	$ 135.00	m/t	$ 26.325.00
Gel	15 m/t	$ 330.00	m/t	$ 4.950.00
Gel	497 sxs	$ 15.00	50 kg	$ 7.455.00
Drispac Reg	43 sxs	$ 152.00	50 lb	$ 6.536.00
Drispac SL	89 sxs	$ 158.07	50 lb	$ 14.068.23
RD-555	213 sxs	$ 18.50	25 kg	$ 3.940.50
IMCO Thin	215 sxs	$ 20.50	50 lb	$ 4.407.50
Poly Rx	12 sxs	$ 65.02	50 lb	$ 780.24
Caustic Soda	215 sxs	$ 14.58	25 kg	$ 3.134.70
Soda Ash	21 sxs	$ 19.01	50 kg	$ 399.21
Sod. Bicarbonate	12 sxs	$ 25.00	50 kg	$ 300.00
Lime	2 sxs	$ 4.75	25 kg	$ 9.50
Myca (c)	30 sxs	$ 18.00	25 kg	$ 540.00
Myca (f)	135 sxs	$ 18.00	25 kg	$ 2.430.00
CMC Lo Vis	10 sxs	$ 61.70	25 kg	$ 617.00
IMCO Spot	120 sxs	$ 45.00	50 lb	$ 5.400.00
Sapp	4 sxs	$ 91.31	50 kg	$ 365.24
Lubrikleen	3 drm	$ 627.00	55 gal	$ 1.881.00
IMCO MD	5 drm	$ 430.00	55 gal	$ 2.150.00
				$ 85.689.12

BP Petroleum Development Norway

Well 35/3-2

Material Usage

12 1/4" Hole

Product	Unit	Unit Cost		Total
Barite	438 m/t	$ 135.00	m/t	$ 59.130.00
Gel	27 m/t	$ 330.00	m/t	$ 8.910.00
Gel	55 sxs	$ 15.00	50 kg	$ 825.00
Caustic Soda	478 sxs	$ 14.58	25 kg	$ 6.969.24
RD-III	784 sxs	$ 18.50	25 kg	$ 14.504.00
Thin	47 sxs	$ 20.50	50 lb	$ 963.50
Soltex	90 sxs	$ 70.00	50 lb	$ 6.300.00
Poly Rx	488 sxs	$ 65.02	50 lb	$ 31.727.76
Drispac Reg	30 sxs	$ 152.00	50 lb	$ 4.560.00
Drispac SL	163 sxs	$ 158.07	50 lb	$ 25.765.41
Alm. Sterate	9 sxs	$ 81.00	20 kg	$ 729.00
Foamban	20 drm	$ 105.00	5 gal	$ 2.100.00
Defoamer	1 drm	$ 518.00	55 gl	$ 518.00
Soda Ash	17 sxs	$ 19.01	50 kg	$ 323.17
Sod. Bicarbonate	9 sxs	$ 25.00	50 kg	$ 225.00
Lime	24 sxs	$ 4.75	25 kg	$ 114.00
Lubrikleen	11 drm	$ 627.00	55 gl	$ 6.897.00
Plug	7 sxs	$ 16.25	25 kg	$ 113.75
Sapp	1 sxs	$ 91.31	25 kg	$ 91.31
				$ 170.768.14

BP Petroleum Development Norway

Well 35/3-2

Material Usage

8 3/8" Hole and completion of Well

Product	Unit	Unit Cost		Total
Barite	404 m/t	$ 135.00	m/t	$ 54.540.00
Gel	25 m/t	$ 330.00	m/t	$ 8.250.00
Caustic Soda	127 sxs	$ 14.58	25 kg	$ 1.851.66
Drispac SL	126 sxs	$ 158.07	50 lb	$ 19.916.82
Drispac Reg	39 sxs	$ 152.00	50 lb	$ 5.928.00
RD-555	385 sxs	$ 18.50	25 kg	$ 7.122.50
Poly Rx	309 sxs	$ 65.02	50 lb	$ 20.091.18
Soda Ash	13 sxs	$ 19.81	50 kg	$ 247.13
Alm. Sterate	1 sxs	$ 81.00	20 kg	$ 81.00
IMCO MD	2 drm	$ 430.00	55 gl	$ 860.00
Lubrikleen	15 drm	$ 627.00	55 gl	$ 9.405.00
				$ 128.293.29

Breakages

Plug	4 sxs x $16.05 =	$ 64.20
Myca (f)	1 sxs x $18.00 =	$ 18.00
Myca (c)	1 sxs x $18.00 =	$ 18.00
Bicarbonate	7 sxs x $25.00 =	$175.00
Soda Ash	2 sxs x $19.01 =	$ 38.02
		$313.02

BP Petroleum Development Norway

Well 35/3-2

Total Material Usage

Product	Unit	Unit Cost	Total
Barite	1244 m/t	$ 135.00 m/t	$ 167.940.00
Barite	210 sxs	$ 6.40 50 kg	$ 1.344.00
Gel	281 m/t	$ 330.00 m/t	$ 92.730.00
Gel	858 sxs	$ 15.00 50 kg	$ 12.870.00
Caustic Soda	1003 sxs	$ 14.58 25 kg	$ 14.623.74
Drispac Reg	350 sxs	$ 152.00 50 lb	$ 53.200.00
Drispac SL	378 sxs	$ 158.07 50 lb	$ 59.750.46
Soda Ash	110 sxs	$ 19.01 50 kg	$ 2.091.10
Bicarbonate	36 sxs	$ 25.00 50 kg	$ 900.00
RD-555	1390 sxs	$ 18.50 25 kg	$ 25.715.00
Thin	267 sxs	$ 20.50 50 lb	$ 5.473.50
Soltex	90 sxs	$ 70.00 50 lb	$ 6.300.00
Poly Rx	809 sxs	$ 65.02 50 lb	$ 52.601.18
Alm. Sterate	10 sxs	$ 81.00 20 kg	$ 810.00
Foamban	20 drm	$ 105.00 5 gal	$ 2.100.00
Deafoamer	1 drm	$ 518.00 55 gl	$ 518.00
IMCO MD	8 drm	$ 430.00 55 gl	$ 3.440.00
Lubrikleen	29 drm	$ 627.00 55 gl	$ 18.183.00
CMC LoVis	74 sxs	$ 61.70 25 kg	$ 4.565.80
Myca (c)	340 sxs	$ 18.00 25 kg	$ 6.120.00
Myca (f)	332 sxs	$ 18.00 25 kg	$ 5.976.00
Plug	14 sxs	$ 16.25 25 kg	$ 227.50
Lime	26 sxs	$ 4.75 50 kg	$ 123.50
Sapp	5 sxs	$ 91.31 50 kg	$ 456.55
IMCO Spot	120 sxs	$ 45.00 50 lb	$ 5.400.00
			$ 543.459.33