DRILLING FLUID PROPOSAL

FOR

DEN NORSKE STATS OLJESELKAP A/S

STATOIL

BLOCK 15/9- 11

ANCHOR DRILLING FLUIDS AS

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SEPTEMBER 1981

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PREPARED FOR: MR. N. BLOMBERG
MR. A. VIGEN

INDEX

SEPTEMBER, 1981

ANCHOR DRILLING FLUIDS

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BLOCK 15/9

WELL 15/9-11

SUPERVISION AND MATERIAL SUPPLY

LABORATORY FACILITIES

Anchor Drilling Fluids maintain a fully equipped laboratory at Tananger base office which is available on a 24 hour basis. Facilities include all currently available testing equipment, including a Fann Model 50 Viscometer. Back-up stocks of all offshore equipment and testing chemicals are maintained at all times.

The laboratory staff consists of three qualified chemists, plus Technical Manager, all of whom have extensive experience of drilling fluid treatment, particularly related to the problems which can occur in the Norwegian sector of the North Sea. The laboratory staff conduct stringent quality control tests on all products used in our mud formulations and we shall also be pleased to offer non-routine testing and investigational work free of charge, upon request.

STATOIL

BLOCK 15/9

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OPERATOR'S PLAN

R.K.B. - Seabed - 100 m.

(1) Drill 36" hole to 152 m and set 30" casing.

(2) Drill 12 1/4"hole to 450 m. After logging open up to 26" hole and set 20" casing.

(3) Drill 17 ½" hole to 1170 m and set 13 3/8" casing.

(4) Drill 12 1/4" hole to 2665 m and set 9 5/8" casing.

(5) Drill 8 ½" hole to 2800 m.

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AREA PROBLEMS

(1) HYDRATEABLE CLAYS AND SHALES

The clays and shales encountered in the upper sections of the hole contain active Montmorillonite and Illite clays. These clays absorb water and cause swelling and dispersion. The results of this absorption can cause stabilizer balling, plugged flow lines, tight hole and high solids. Therefore it is essential that good hole cleaning, solids removal at surface and sufficient dilution is maintained.

(2) EXCESSIVE FORMATION PRESSURES

It is predicted that formation pressures will reach 1.40 specific gravity in this well. We intend following the guidelines shown in the Drilling Fluid Procedure section but at all times we will pay close attention to hole conditions and react accordingly.

(3) HIGH TEMPERATURES

Temperatures in excess of 120^{o}C should not be encountered in this well but in the event they are, the Lignosulfonate can be supplemented with a Chrome Lignite and CMC can be replaced with Drispac which is a temperature stable viscosifier and filtrate reducer.

(4) LOSS OF CIRCULATION

This should not be too much of a problem in this well. However, maintenance of the lowest practicable mud weights will aid in reducing the risk of lost circulation and aid in faster penetration rates.

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RECOMMENDED MUD SYSTEMS, HOLE VOLUMES AND ESTIMATED MUD CONSUMPTION.

RKB to 152 m :

36" Hole
30" Casing

Drill the 36" hole with sea water, allowing returns to go to sea-bed. Viscous slugs of pre-hydrated Bentonite will be circulated periodically to ensure hole cleaning. Before running the 30" casing we recommend displacing the hole with minimum excess of 100 bbls spud mud. An increase in mud weight might be necessary before running casing.

SECTION HOLE VOLUME : 223 bbls

EST. MUD CONSUMPTION : 1750 bbls

152 m to 450 m:

26" Hole
20" Casing

Drill this section with viscous pre-hydrated Bentonite to give proper hole cleaning and some fluid loss control.

Allowances for increase in weight up to 1.20 specific gravity have been taken into consideration in the costing and procedure section of this program, should the weight increase be required by current drilling regulations.

This is to be advised by company representative.

We would recommend slugging the hole with a 150 bbl high viscous pill prior to running 20" casing.

SECTION HOLE VOLUME : 665 bbls

EST. MUD CONSUMPTION : 2330 bbls

RECOMMENDED MUD SYSTEMS, HOLE VOLUMES AND ESTIMATED MUD CONSUMPTION cont'd ....

450 m to 1170 m:

17 ½" Hole
13 3/8" Casing

Drill this section with a Bentonite/CMC/ Lignosulfonate sea water system. Mud weight to be controlled as formation dictates but is expected to be in the 1.15 specific gravity range.

YP = 20-25
FL = + 15 cc
pH = 10-10.5
F.V. = 50-60 secs/quart

SECTION HOLE VOLUME : 1170 bbls
EST. MUD CONSUMPTION : 2135 bbls

1170 m to 2665 m:

12¼" Hole
9 5/8" Casing

Drill with a similar system as previous section. The mud weight is expected to gradually increase to 1.40 specific gravity towards the casing depth.

HPHT will be checked from 2000 m onwards, and should be in the 15 cc range. The test should be carried out at actual bottom hole temperature.

YP = 15
FL = 6-8 cc
pH = 10-10.5
F.V. = 45-55

SECTION HOLE VOLUME : 1160 bbls
EST. MUD CONSUMPTION : 2450 bbls

2665 m to 2800 m:

8½" Hole

Maintain similar system as above. Mud weight to be dictated by hole conditions but is expected to be 1.40 specific gravity.

FL = < 6 cc
YP = 12-15
pH = 10-10.5
HPHT = < 15 cc
F.V. = 45-55

SECTION HOLE VOLUME : 780 bbls
EST. MUD CONSUMPTION : 1080 bbls

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APPROXIMATE HOLE PROGRAM

ESTIMATED DAYS AND COSTS

HOLE SIZE	CASING SIZE	CASING DEPTH	EST.DRLG. DAYS	RECOMMENDED MUD SYSTEM	ESTIMATED COST
36"	30"	152 m	2	Drill with sea-water using pre-hydrated Bentonite Slugs.	$ 4.824,00
26"	20"	450 m	5	Drill with pre-hydrated Bentonite	$ 15.370,00
17½"	13 3/8"	1 170 m	7	Pre-hydrated Bentonite and Chrome Lignosulfonate	$ 27.174,25
12 1/4"	9 5/8"	2 665 m	26	Pre-hydrated Bentonite/Chrome Lignosulfonate/ CMC	$ 61.681,50
8 ½"	7"	2 800	8	Pre-hydrated Wyoming Bentonite/ Chrome Lignosulf./ Lignite.	$ 5.181,50
TOTAL EST. DRILLING DAYS			48	TOTAL EST. COST	$ 114.231,75

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DRILLING FLUID PROCEDURE

CONDUCTOR HOLE (36") TO 152 m

This section of the hole will be drilled without returns using seawater. Viscous slugs of high viscosity, pre-hydrated Bentonite (30 bbls.) can be spotted at each connection or as conditions require to provide a clean hole.
Prior to running casing the hole should be displaced with sufficient high viscosity fluid (approx. 325 bbls.) to enable approx. 100 bbls. to be circulated out. It could well be necessary to weight up this final displacement to 1.15 specific gravity to ensure stable hole conditions for running casing. This weighting up will be confirmed by the Statoil representative on the rig.

Prepare the pre-hydrated Bentonite as follows :

(1) Fill surface tanks with the required volume of water.

(2) Adjust the pH with Caustic Soda to a 10.0 - 10.5 range (approx. 0.75 lbs/bbl.).

(3) Add 30.0± lbs./bbl. Wyoming Bentonite.

SURFACE HOLE (26") TO 450 m

After drilling out the 30" shoe with seawater, the marine riser will be run and a 12 1/4" pilot hole drilled using viscous prehydrated Bentonite to give some filtration control.

After logging the 12 1/4" hole the hole will be opened up to 26".

When T.D. for this section is reached we would recommend the following procedure:

DRILLING FLUID PROCEDURE (cont'd)

SURFACE HOLE (26") TO 450 m cont'd...

Pump 660 bbls. of high viscous mud down the hole to enable a check trip to be made. The mud weight might have to be increased in order to stabilize the hole. Should the trip show the hole to be in good shape then the 20" casing could be run. However, should the hole dictate that a further trip be necessary then we suggest a further 660 bbls. be pumped to ensure maximum hole cleaning.
The procedure for mixing this fluid will be identical to that in the previous section, any fluid remaining will be utilized in the 17 ½" hole section.

INTERMEDIATE HOLE (17 ½") TO 1170 m.

This section of the hole will be drilled with a Bentonite/ CMC/Lignosulfonate mud.

While W.O.C. condition any remaining mud and utilize this in preparing the surface system. The make up of the Bentonite/ CMC/Lignosulfonate mud is as follows :

(1) Utilize any fluid from previous section.

(2) Calculate one half of the final volume required and add to this volume of Drill water 1.5 lbs/bbl. Caustic Soda.

(3) Pre-hydrate 40 lbs/bbl. of Wyoming Bentonite into this make up water.

(4) After allowing the above to pre-hydrate, dilute the slurry with seawater.

(5) Add 2 lbs/bbl. of Lignosulfonate.

(6) Weight system up to 1.10 specific gravity.

(7) Add CMC to give a fluid loss below 15 cc (Hi-vis CMC if needed).

Desired properties of initial mud are :

MUD WEIGHT : 1.10-1.20 specific gravity. M.B.T. 20-25 lbs/bbl.

VISCOSITY : 50-60 sec/quart.

FLUID LOSS : 15 cc range

pH : 10-10.5

YP : 20-25

DRILLING FLUID PROCEDURE cont'd...

INTERMEDIATE HOLE (17 ½") TO 1170 m cont'd...

Drill out the cement and casing shoe with seawater. Confirmation from the Statoil representative will be given to displace with the drilling fluid and drill ahead.

It is essential that all solids removal equipment be kept operating at maximum efficiency in order to keep drill solids to a minimum. The build up of drilled solids will result in the dumping and dilution of the system and subsequently result in higher mud costs.

INTERMEDIATE HOLE (12 1/4") TO 2665 m

This section of the hole will essentially follow a similar system as the 17 ½" section. Variations, however, will be necessary in the filtration control and specific gravity together with tighter control on rheology. Also HPHT will be checked as from 2000 m onwards at the relevant temperature. Fluid loss should be below 15 cc.

The concentration of Lignosulfonate will be a minimum of 6 lbs/bbl. to enable complete dispersion and stability. This concentration will be necessary through this section.

The filtration control will be maintained at 6-8 cc for the initial stage of this section, however, we will commence reduction to 6 cc or less approaching the reservoir. This will assist in obtaining a thin, firm filter cake thereby giving stability to the hole.

During the drilling of this section the following properties will be our guide :

WEIGHT	:	Anticipated up to 1.40 specific gravity.
VISCOSITY	:	Control at 45-55 with a YP of 12-15. Endeavour to keep P.V.-Y.P. in 1-1 ratio.
FLUID LOSS	:	Control at 6-8 cc and reduce to 6 cc or below approaching reservoir.
pH	:	Control 10.0-10,5
MBT	:	20-30 ppb.

Once again full use of mechanical solids removal equipment must be utilized.

DRILLING FLUID PROCEDURE cont'd..

8 ½" HOLE TO 2800 m

During the period spent running 9 5/8" casing and cementing all surface mud will be treated to reduce solids to a minimum. Any additional volume required will be built during this period. However, it is hoped that cement displacement etc., will afford sufficient surface volume and no additional volume should be required.

The mud from the previous section will be kept and maintained with the following properties :

MUD WEIGHT	:	Expected to be maintained at 1.40 specific gravity.
VISCOSITY	:	Funnel viscosity at 45-55 with a YP of 12-15.
FLUID LOSS	:	Fluid loss will be maintained below 6 cc and HPHT fluid loss at below 15 cc. The HPHT will be checked at the relevant hole temperature.
pH	:	10 - 10.5 range.
MBT	:	20 - 30 ppb.

ANCHOR DRILLING FLUIDS

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MATERIAL ESTIMATES AND SECTION COSTS

	NO.OF UNITS	UNIT SIZE	UNIT PRICE	TOTAL
36" HOLE TO 152 M.				
OCMA Bentonite	10	M/T	324.00	$ 3.240.00
Soda Ash	5	50kg	18.50	$ 92.50
Caustic Soda	8	25kg	19.00	$ 152.00
Barite	10	M/T	134.00	$ 1.340.00
		EST.SECTION COST		$ 4.824.00
26" HOLE TO 450 M.				
OCMA Bentonite	32	M/T	324.00	$ 10.368.00
Soda Ash	12	50kg	18.50	$ 222.00
Caustic Soda	40	25kg	19.00	$ 760.00
Barite	30	M/T	134.00	$ 4.020.00
		EST.SECTION COST		$ 15.370.00
17½" HOLE TO 1170 M.				
OCMA Bentonite	30	M/T	324.00	$ 9.720.00
Soda Ash	12	50kg	18.50	$ 222.00
Caustic Soda	80	25kg	19.00	$ 1.520.00
CMC L.V.	50	25kg	59.00	$ 2.950.00
Drispac Regular	20	50lbs	169.30	$ 3.386.00
Sodium Bicarbonate	5	50kg	19.25	$ 96.25
Chrome Lignosulfonate	150	25kg	17.20	$ 2.580.00
Barite	50	M/T	134.00	$ 6.700.00
		EST.SECTION COST		$ 27.174.25
12 1/4" HOLE TO 2665 M.				
A.P.I. Wyoming Bent.	600	50kg	17.70	$ 10.620.00
Soda Ash	10	50kg	18.50	$ 185.00
Caustic Soda	250	25kg	19.00	$ 4.750.00
Sodium Bicarbonate	4	50kg	19.25	$ 77.00
Chrome Lignosulfonate	550	25kg	17.20	$ 9.460.00
CMC L.V.	50	25kg	59.00	$ 2.950.00
Aluminium Stearate	10	25kg	80.00	$ 800.00
Drilling Detergent	10	200 l.	350.00	$ 3.500.00
Barite	200	M/T	134.00	$ 26.800.00
Drispac Regular	15	50 lbs.	169.30	$ 2.539.50
		EST.SECTION COST		$ 61.681.50

MATERIAL ESTIMATES AND SECTION COSTS (cont'd)

	NO. OF UNITS	UNIT SIZE	UNIT PRICE	TOTAL
8½" HOLE TO 2800 M.				
A.P.I. Wyoming Bentonite	60	50kg	17.70	$ 1.062.00
Soda Ash	1	50kg	18.50	$ 18.50
Caustic Soda	25	25kg	19.00	$ 475.00
Chrome Lignosulfonate	55	25kg	17.20	$ 946.00
CMC L.V.	10	25kg	59.00	$ 590.00
Aluminium Stearate	1	25kg	80.00	$ 80.00
Barite	15	M/T	134.00	$ 2.010.00
		EST.SECTION COST		$ 5.181.50

TOTAL MATERIALS				
OCMA Bentonite	72	M/T	324.00	$ 23.338.00
A.P.I. Bentonite	660	50kg	17.70	$ 11.682.00
Soda Ash	40	50kg	18.50	$ 740.00
Caustic Soda	403	50kg	19.00	$ 7.657.00
CMC L.V.	110	25kg	59.00	$ 6.490.00
Drispac Regular	35	50 lbs.	169.30	$ 5.925.50
Chrome Lignosulfonate	755	25kg	17.20	$ 12.986.00
Aluminium Stearate	11	25kg	80.00	$ 880.00
Drilling Detergent	10	200 l.	350.00	$ 3.500.00
Barite	305	M/T	134.00	$ 40.870.00
Sodium Bicarbonate	9	50kg	19.25	$ 173.25
		EST. TOTAL COST		$114.231.75

RESUME

NAME: C. BLANCHARD

BIRTH DATE: 1951

NATIONALITY: AMERICAN

EDUCATIONAL BACKGROUND

(1) BSc MANAGEMENT STUDIES
PURDUE UNIVERSITY

(2) IMCO SERVICES, 2 YEARS

(3) SANTA FE, 2 YEARS

MUD ENGINEERING EXPERIENCE

(1) BAROID 1973-76

(2) IDF 1976-79

(3) ANCHOR 1979

AREAS WORKED

(1) MIDDLE EAST

(2) GULF COAST

(2) NORTH SEA

TYPES OF MUD

(1) SATURATED SALT SYSTEMS

(2) LIME MUDS

(3) GYP/LIGNOSULFONATE

(4) KCL/POLYMER

(5) INVERT OIL EMULSIONS

(6) OIL BASED SYSTEMS

RESUME:

NAME: VICTOR WALLACE HESTER

BIRTH DAY: 22.11. 1952

NATIONALITY: BRITISH

EDUCATIONAL BACKGROUND:

(1) "O" LEVELS MATH, PHYSUCS, ENG. LANG., GEOGRAPHY
(2) "A" LEVELS MATH PHYSICS, ART
(3) B. SC. HONORS

MUD ENGINEERING EXPERIENCE:

(1) IMCO SERVICE 1974 - 75
(2) MAGCOBAR MUD SCHOOL 1977 - 78
(3) MILCHEM 1978 - 1980
(4) ANCHOR DRILLING FLUIDS AUG. 1980 - PRESENT

AREAS WORKED:

(1) NORTH SEA - UK AND NORWAY
(2) GHANA
(3) EGYPT
(4) IRAN
(5) PAKISTAN
(6) LIBYA
(7) OMAN

TYPES OF MUD:

(1) LIME MUDS
(2) LIGNOSULFONATE MUDS
(3) OIL MUDS
(4) SALT SATURATED
(5) NON DISPERSED SYSTEMS
(6) WORK OVER AND COMPLETION FLUIDS
(7) KCL POLYMER
(8) GYP MUDS

TYPES OF RIGS WORKED:

(1) JACK UP
(2) PLATFORMS
(3) SEMISUBMERSIBLE
(4) LANDRIGS

ANCHOR DRILLING FLUIDS

RESUME:

NAME: DAVID H. FORD

BIRTH DAY: 11.2. 1943

NATIONALITY: BRITISH

EDUCATIONAL BACKGROUND:

QUEENS COLLEGE, CAMBRIDGE, B.A. IN NATURAL SCIENCES, MAIN SUBJECTS GEOLOGY AND PHYSICS.

MUD ENGINEERING EXPERIENCE:

IMCO MUD SCHOOL 1975 - 1977
HIGHLAND MUD 1977 - 1981
ANCHOR DRILLING FLUIDS A/S 1981 -

AREAS WORKED:

IVORY COAST
MIDDLE EAST
ITALY
NORWEGIAN AND BRITISH SECTOR OF THE NORTH SEA.

COMPANIES WORKED FOR:

SHELL/STATOIL
ESSO
B.P.
AGIP
AMOCO
ADMA
BNOC

TYPES OF MUD:

GYP/LIGNOSULPHONATE
LIGNOSULPHONATE
KCL/POLYMER
INVERT OIL EMULSIONS
LOW LIME SYSTEMS

TYPES OF RIGS WORKED:

LANDRIGS
PLATFORMS
SEMISUBMERSIBLE
JACK UP

ANCHOR DRILLING FLUIDS

R E S U M E

NAME	:	JOHN HANNAN
DATE OF BIRTH	:	24.11.37
NATIONALITY	:	BRITISH

EDUCATIONAL BACKGROUND:

St. Patricks, Junior & Senior Secondary Standard

MUD ENGINEERING EXPERIENCE:

1. I.D.F. MUD SCHOOL 1975
2. XANCO FLOW DYNAMICS SCHOOL
3. ANCHOR FROM 1981 and onwards

AREAS WORKED:

1. U.S.A.	: West Texas Land Rigs
2. NORTH SEA	: British, Norwegian,Danish and Dutch Sectors
3. NIGERIA	: (West Africa)
4. CANADA	: Alberta Land Rigs

TYPES OF MUD:

1. SEA MUD - GYP/LIGNO. LIGNOSULFONATE, LIME/DRISPAC, POLYMER, KCL/POLYMER SALT SATURATED.
2. FRESH WATER, LIGNOSULFONATE.
3. LIMITED INVERT MUD EXPERIENCE.

TYPES OF RIGS WORKED:

1. SEMI-SUBMERSIBLES
2. PLATFORMS
3. JACK-UPS
4. LAND RIG

ANCHOR DRILLING FLUIDS

RESUME:

NAME: STEIN AKSNES

BIRTH DAY: 28.04.51

NATIONALITY: NORWEGIAN

EDUCATIONAL BACKGROUND:
(1) REALSKOLE 1969
(2) YRKESSKOLE, MEKANISK 1971
(3) TEKNISK FAGSKOLE 1977
(4) ANCHOR DRILLING FLUIDS A/S, MUD SCHOOL, STAVANGER 1981

MUD ENGINEERING EXPERIENCE:
(1) DRILLING FLUIDS ENGINEER, ANCHOR 1981

AREAS WORKED:
(1) NORTH SEA - NORWEGIAN SECTOR

COMPANIES WORKED FOR:
(1) ESSO
(2) STATOIL

TYPES OF MUD:
(1) CHR. LIGNOSULFONATE

TYPES OF RIGS WORKED:
(1) SEMISUBMERSIBLE
(2) PLATFORMS

ANCHOR DRILLING FLUIDS

RESUME:

NAME: INGBERT TORGERSEN

BIRTH DAY: 10.01.49

NATIONALITY: NORWEGIAN

EDUCATIONAL BACKGROUND:
(1) EXAMEN ARTIUM 1968
(2) 2.ENG.SCHOOL
(3) 1.ENG SCHOOL 1969 - 1972
(4) CHIEF ENG. SCHOOL
(5) ANCHOR DRILLING FLUIDS A/S, MUD SCHOOL, STAVANGER 1981

MUD ENGINEERING EXPERIENCE:
(1) DRILLING FLUIDS ENGINEER, ANCHOR 1981

AREAS WORKED:
(1) NORTH SEA - NORWEGIAN SECTOR

COMPANIES WORKED FOR:
(1) STATOIL
(2) NORSK HYDRO

TYPES OF MUD:
(1) CHR. LIGNOSULFONATE
(2) POLYMER/GYP.

TYPES OF RIGS WORKED:
(1) SEMISUBMERSIBLE

ANCHOR DRILLING FLUIDS

RESUME:

NAME: ANSGAR AASE

BIRTH DAY: 02.10.45

NATIONALITY: NORWEGIAN

EDUCATIONAL BACKGROUND:
(1) EXAMEN ARTIUM 1968
(2) BODØ LÆRERSKOLE 1973
(3) ANCHOR DRILLING FLUIDS A/S, MUD SCHOOL, STAVANGER 1981

MUD ENGINEERING EXPERIENCE:
(1) DRILLING FLUIDS ENGINEER, ANCHOR - 1981

AREAS WORKED:
(1) NORTH SEA - NORWEGIAN SECTOR

COMPANIES WORKED FOR:
(1) STATOIL
(2) NORSK HYDRO
(3) PHILLIPS

TYPES OF MUD:
(1) CHR. LIGNOSULFONATE
(2) POLYMER/GYP
(3) DESCO/DRISPAC/SEAWATER

TYPES OF RIGS WORKED:
(1) SEMISUBMERSIBLE
(2) PLATFORMS

ANCHOR DRILLING FLUIDS

RESUME:

NAME: EINAR KORSVOLD

BIRTH DAY: 13.10. 1952

NATIONALITY: NORWEGIAN

EDUCATIONAL BACKGROUND:
(1) EXAMEN ARTIUM 1972
(2) ROGALAND REGIONAL COLLEGE, DEPARTMENT OF PETROLEUM 1978
(3) ANCHOR DRILLING FLUIDS A/S, MUD SCHOOL, STAVANGER 1981

MUD ENGINEERING EXPERIENCE:
(1) DRILLING FLUIDS ENGINEER, ANCHOR 1981

AREAS WORKED:
(1) NORTH SEA - NORWEGIAN SECTOR

COMPANIES WORKED FOR:
(1) STATOIL
(2) PHILLIPS

TYPES OF MUD:
(1) CHR. LIGNOSULFONATE
(2) DRISPAC/DESCO/SEAWATER

TYPES OF RIGS WORKED:
(1) SEMISUBMERSIBLE
(2) PLATFORMS