N.11 WELLFILE

EXPLORATORY WELL PROGNOSIS

UNION

8/4-1

FEBRUARY 1977

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ILLUSTRATIONS

GENERAL

Prospect Name		8/4-1
Location		Shotpoint 150, Line 8/4-76-7
		Latitude 03° 00' 5.38" E
		Longitude 57° 44' 49.79" N
Distance from Shore		180 km 112 miles
Water Depth		62 m (203 ft)
Proposed T.D		2850 m (9351 ft)
Objectives	Primary	Middle Jurassic Sandstone Depth 2430 m (7973 ft)
	Secondary	Upper Cretaceous Chalk Depth 1661 m (5450 ft)
Trap		Structural, Fourway Closure
Area of Closure		39.1 sq.km (9668 acres)
Estimated Reserves	Jurassic	484 million barrels (Recoverable)
	Upper Cretaceous	478 million barrels (Recoverable)

Values ~~used~~ ?

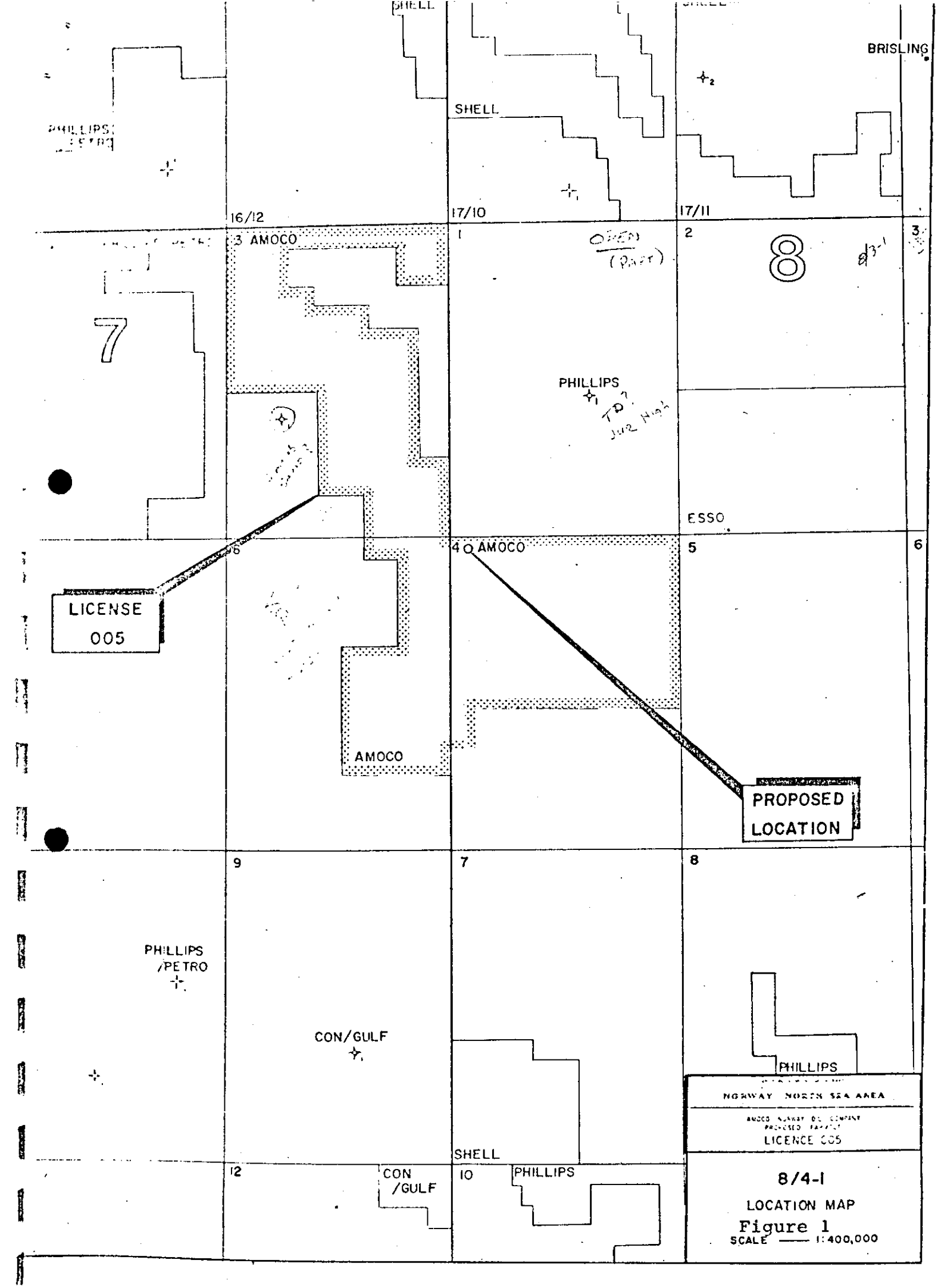
AFE 1X?

JUR: 334 $/AF

CRET 201 $/AF

$ 2.6
+
$ 3.2

25 Days


SHELL
BRISLING
PHILLIPS
SHELL
16/12
17/10
17/11
3 AMOCO
1
2
3
7
8
PHILLIPS
ESSO
6
4 AMOCO
5
6
LICENSE
005
AMOCO
PROPOSED
LOCATION
9
7
8
PHILLIPS
/PETRO
CON/GULF
PHILLIPS
SHELL
12
CON
/GULF
10
PHILLIPS
NORWAY NORTH SEA AREA
LICENCE 005
8/4-1
LOCATION MAP
Figure 1
SCALE —— 1:400,000

GEOLOGY

INTRODUCTION

The area covered by Licence 005 is approximately 803 sq.km (310 sq. miles) situated on Blocks 7/3, 7/6 and 8/4 in the southern area of the Norwegian North Sea (Fig.1).

The target horizon is the Middle Jurassic sandstone which is capable of oil production at the Bream and Brisling Fields to the northeast in Block 17/12. The Upper Cretaceous chalk is considered to be a secondary target, having oil production from the Ekofisk complex 120 km to the south.

Four structures have been outlined in the Farmout Report May 1976* of which the D structure, which straddles the corners of Blocks 7/3, 7/6, 8/1 and 8/4 is considered the most prospective.

GEOLOGY

The Licence area lies within the Norwegian-Danish basin on the east flank of the Vestland Arch. Sediments of early Jurassic age were probably restricted to the central part of the basin, and only during the Late Jurassic did a marine incursion establish connections between the Central trough to the west. It is difficult to place the depositional limit of the Middle Jurassic sediments, without considerably more reliable well information. However, based on the dating of the sands encountered in the 7/3-1 well we might expect that zero edge to fall between the 7/1-1 and 7/3-1 wells. It is anticipated that over the License area, the Middle Jurassic sands thin towards the west, but could be absent locally owing to early salt doming and subsequent post Middle Jurassic erosion.

Published data on the Esso 8/3-1 well provides the only reliable well information in the area. The well encountered the Middle Jurassic Dogger Sand at 2040 m consisting of a thin basal conglomerate overlain by fine to medium grained sandstones, silty with minor shale interbeds and an uppermost sand interbedded with thin coal stringers. A typical Middle Jurassic sequence. The basal conglomerate rests unconformably on sands and reddish brown shales of questionable Triassic age.

The Amoco 7/3-1 well penetrated Upper Jurassic shales, questionable Middle Jurassic sands resting on Zechstein salts and anhydrites, whereas the Phillips 8/1-1 well penetrated both Middle and Lower Jurassic sands and shales and Triassic sands. The correlation of the Middle Jurassic section observed in these two wells is inconclusive. Middle Jurassic oil production has been established to the northeast in block 17/12, and has been rumoured to the southwest in block 7/12 (7100 BOPD and 4.2 mmscf/d). The Bream Field, 17/12-1 well tested 1300 BOPD from a 4.9 m (16 ft) zone. However, judging from the lack of follow-up wells, these two fields must be noted as non-commercial.

"D" PROSPECT

This faulted dome structure (Fig.2) exhibits four way dip, although it has a somewhat peculiar shape. Seismic data indicates that the principle stages of growth were during Late Cretaceous and early Tertiary time. The northern area is intersected by a series of NW-SE faults possibly the result of Tertiary salt collapse, whereas the southern north-south extension does provide some indication of early Cretaceous growth. The closing contour of 2.300 secs on the Middle Jurassic 'J' Horizon encompasses an area of 39.1 sq.km (9668 acres) and the structure has vertical closure of approximately 365.8 m (1200 ft). The Middle Jurassic interval map suggests an average gross section of 122 m (400 ft).

Late Cretaceous and Early Tertiary growth may have enhanced the reservoir quality of the uppermost chalk by fracturing and weathering and it is therefore considered a secondary target. 58.7 sq.km (14,500 acres) of closure is developed on the top chalk 'T' Horizon with a vertical closure of approximately 200 m (656 ft). (Fig.3).

CONCLUSIONS

The hydrocarbon potential of this Middle Jurassic structure will be tested by the well 8/4-1 drilled at sp 150 on line 8/4-76-7 (Fig.4). It will also test a possible Upper Cretaceous accumulation. It is anticipated that the well will encounter 122m (400 ft) of Middle Jurassic section at a drill depth elevation of 2430 m (7973 ft) of which approximately 45.7 m (150ft) will be oil bearing. The well will be T.D'd in the Zechstein at 2850 m (9351 ft) subsea.

* Lindsell, Gray, Metre, Wells, May 1976 : Amoco Norway Farmout Proposal Licence 005, London Report File No. G.1.01-10j

EXPECTED SECTION

*KB-MSL = 24.4 m (80 ft)

MEASURED DEPTH *		AGE	LITHOLOGY
METERS	FEET		
86.4	283	Upper Tertiary (Sea Floor)	Clays. Olive grey, carbonaceous, micaceous with thin limestone stringers.
1020	3345	Eocene	Clays. Grey brown, slightly micaceous, highly calcareous with intercalations of non-calcareous clays, tuffaceous and cherty in part.
1367	4484	Paleocene	Shale. Medium grey, glauconitic, slightly micaceous, increasingly calcareous, grading to marls.
1661	5450	Upper Cretaceous	Chalk. White, soft, cherty, decreasing with depth.
2193	7195	Lower Cretaceous	Clays/Shales. Medium grey, calcareous, silty, slightly micaceous.
2369	7773	Upper Jurassic	Shales. Dark grey to medium brown, carbonaceous, silty with interbeds of thin limestones and dolomites.
2430	7973	Middle Jurassic	Sandstones. Light to medium grey, fine to medium grained, friable, variable porosity, possibly thin coal beds in the upper sands and a basal conglomerate.
2552	8373	Trias	Sandstones/Shales. Fine grained reddish sands with interbedded red brown and green shales with thin limestones and dolomites.
2805	9203	Zechstein	Anhydrites. Grey, mottled, thick sequence of salt.
2850	9351	T.D.	

SAMPLING AND MUD LOGGING PROGRAM

Sampling intervals will be decided by the Union wellsite geologist based on rate of penetration and lithological variation, but will normally be 10 m down to the ~~Upper Jurassic~~ 13⅜ Shoe, 5 m down to the ~~Middle~~ Jurassic and 2 m within the ~~Middle~~ Jurassic. The geologist who describes the sample should sign the description pad.

The service company's geologists will :

Collect composite ditch samples at regular intervals from shoe of the 30" casing to total depth. Sample cuts and distribution are detailed below.

Present an objective log of cutting lithology and estimated porosity from ditch samples at a scale of 1:500.

Record continuous log of total combustible gas.

Record on composite log any indication of hydrocarbons from ditch samples such as staining, fluorescence, odour or cut.

Maintain composited (spliced) original mud log on location and mail three (3) prints of individual sheets to London Office as completed or partial sheets as warranted. Union geologists will secure composited original at well completion.

Record : drilling rate in mtrs/hr, pit level, pump strokes, bits, deviation surveys and mud data.

Assist on coring runs.

The above remarks on the sample and mud logging program are intended as a guide only and it is emphasised that the Union wellsite geologist is fully authorised to use his discretion and own judgement in operational aspects of the mud logging program.

DITCH CUTTINGS SAMPLE DISTRIBUTION

A. Bulk Samples

1. Paleo set : 1 large Hubco bag, unwashed and drip-dried.
2. Cut set : 1 large Hubco bag, unwashed and drip-dried.
3. Norwegian Petroleum Directorate set : Unwashed, wet sample of at least 1 pound (½ kg) weight shall be packed in a leak-proof plastic bag and placed in a separately marked plastic or cloth bag. The samples will be placed in wooden boxes with hinged lids. The boxes will be separated longitudinally into two compartments and have the overall dimensions as follows :

   Height 14 cm
   Width 27 cm
   Length 90 - 100 cm

   Ship all three sets to shorebase (SB) at timely intervals. Notify SB and London office by telex of shipment date and interval. SB will organise transport to contract paleo company and Norwegian Petroleum Directorate.

B. Envelopes

Washed sample in strip closed envelope for :

1. Rig : Company geologist will remove at end of well.
2. Norwegian Petroleum Directorate : Packed in plastic bags or standard waterproof sample bags and delivered in suitable cardboard boxes.

Union geologist will organise transport to :

Oljedirektoratet,
Lagardsveien 80,
N.4001, Box 600,
Stavanger, Norway

Attention : Herr Egil Bergsager, Head of Exploration

Tel : 045.33-160

LOGGING PROGRAM

Run 1. 20" casing depth 427 m

1. BHC-Sonic-GR
   GR Sonic run through casing to sea floor.

Run 2. 13 3/8" casing depth 1371.5 m

1. ISF-Sonic-SP-GR
2. Compensated Formation Density-GR

Run 3. T.D 2850 m or into Triassic.

1. ISF-Sonic
2. FDC-CNL-GR
3. DLL-RXO (if hydrocarbon shows observed)
4. HDT (over Middle Jurassic)
5. Sidewall Cores
6. Well Velocity Survey.

Run 4. Correlation logs if 9 5/8" set high.

Scale 1:200 and 1:500 in meters.

All logs will be recorded on magnetic tape.

Transmission to ~~London~~ SANDNES will be made of all logs after each run, if required.

6 Field prints will be made of each log on board rig.

5 Field prints of each log will be flown to ~~London~~ SANDNES at first possibility.

1 Field print of each log will remain on board care of the Company geologist and/or Company drilling engineer.

~~London~~ SANDNES office will send 1 field print of each log to Los Angeles and ~~Stavanger~~ LONDON offices as soon as possible.

~~London~~ SANDNES office will retain 3 field prints of each log, 2 for Exploration and 1 for Operations.

Schlumberger will retain the films for compositing and magnetic tape for computer processing in Paris and further playbacks when so requested.

CORING PROGRAM

Oil and gas shows will be analysed by the wellsite geologist and interpretations submitted with recommendations to the ~~London~~ Edmonton office. Representative full hole core of the objective Dogger Sandstones are required if shows and hole conditions warrant recommending coring. After review of these conditions, conventional core will will be cut at the discretion of the Managing Director.

DISPOSITION OF CORE SAMPLES

1. Photograph core.
2. Take core chip at each fracture plane not to exceed one chip per foot. Divide into two parts and bag one chip for paleontology. The second chip will be Union's sample to be kept with the dry cut.
3. In oil core take representative sample, about one every ten feet, for special analysis as described in 5 below. No special analysis for gas cores.
4. Encase remaining core in plastic sleeve and ship with waxed cores to Core Lab, Mitcham for routine analysis every foot.
5. Samples for Special Analysis, Core Lab, Mitcham - sample size about 4".
    1. Do not wash, leave mud on.
    2. Wrap in Aluminium Foil.
    3. Tape with masking tape.
    4. Write on tape Union, well number, depth, core number, arrow for top.
    5. Tie string round core leaving enough to hold.
    6. Lower core into molten wax in old tin. Keep temperature of wax just above congealing.
    7. Repeat till all foil is adequately covered in wax.
    8. Place core in Hubco bag with sample number.

Need Sump for core handling

6. Samples for Norwegian Petroleum Directorate.

1. Core Lab will divide the core into three complete longitudinal slab sections. Each of the slab sections will contain not less than one fourth of the core. The section for the Norwegian Petroleum Directorate shall be supplied in properly marked wooden boxes divided longitudinally into three to five compartments and with a hinged lid. Overall dimensions shall be as follows :

Height	10 cm
Width	40 cm
Length	90 - 100 cm

SUPERVISION AND REPORTING

There will be on board ship at all times, at least one Union Oil Company Drilling Supervisor, responsible for overall drilling operations, safety and logistics. The Service Company's personnel are responsible to the Drilling Supervisor on administrative matters and scheduling of personnel relief.

The Union geologists and the Service Company geologistss' are administratively responsible to the Union Oil Company Drilling Supervisor aboard the drill ship. In addition, they are specifically responsible to the Drilling Engineer for all matters concerning safety. Technically, all the above geologists are responsible, as in the normal case, to the ~~Exploration Manager~~ Chief Geologist, ~~London~~ Sandnes.

Union geologists will transmit daily telex reports either ~~directly or via Stavanger~~, to ~~London~~ Sandnes, summarising ditch cuttings, lithology*, petroleum indications and penetration rates. Reports should also be given even when no new geological data have been acquired, and then the daily report should state, "Nil Geology". At each opportunity, an up-to-date copy of lith log and sample descriptions should be sent to Stavanger by charter aircraft for mailing to London office.

*Lithologic Log

Scale 1:500

The lithological log will be kept up to date by the Company geologist, if continuous wellsite surveillence is required and he will be responsible for delivery of original lithlog to ~~London~~ Sandnes office at well completion.

3 prints will be made of each completed sheet of the lithlog and - if warranted - 2 prints of the uncompleted sheet in time to send them ashore by first transportation. Shorebase will forward the prints to London. 1 print will remain with the company wellsite geologist, 1 print will be retained by ~~London~~ Sandnes office and 1 print forwarded to Los Angeles by ~~London~~ Sandnes office.

WELL 8/4-1

DRILLING PROGRAM

A. PREPARATION

1. Tow, position, and anchor rig on location using satellite navigation equipment.

2. Ballast rig and run anchors.

3. Pre-tension anchors to a minimum of 250,000 lbs.

B. 36" HOLE AND 30" CASING INTERVAL

1. Pick up 17½" bit and D.P.

2. Tag bottom at slack tide and drill 17½" hole to approx. 450' (120' below mudline) using sea water.

3. Open 17½" hole to 36" to T.D.

4. Circulate bottoms up and make wiper trip.

5. Displace sea water with approx. 500 bbl. hi vis mud (see note).

6. Pick up approx. 120' - 30" x 1" wall grade "B" casing w/float shoe.

7. Run 30" casing complete with permanent guide base.

8. Pick up 30' drill pipe, 30" housing running tool, and run 30" casing to approx. 450' using drill pipe from mud line to surface.

9. Land 30" casing (w/guide base at approx. 10' above mudline) and cement same.

10. Use 250 sx cement w/ 3% hydrated gel and 2% calcium chloride (12.4 ppg) followed by 450 sx class "G" w/2% calcium chloride (15.6 ppg). Mix all cement w/sea water.

11. Displace cement to 400' leaving 50' cement above float shoe.

12. Suspend casing with drill pipe until initial set is exhibited by surface samples, then release from running tool.

NOTE: Mud properties for this interval should be:

weight	:	native (approx. 9.0 ppg)
viscosity	:	120 sec/qt.
water loss	:	no control.
type	:	sea water gel

C. 26" HOLE AND 20" CASING INTERVAL

1. With a 26" bit drill out cement and shoe.

2. Run marine riser complete with diverter lines and K.F.D. bag. Check functioning of all aspects of riser and diverter system.

3. Displace sea water with drilling mud.

4. With a pendulum hook-up and a 17½" bit, drill to approx. 1400'. Take inclination surveys at 500', 1000' and at T.D.

4a. Run gyroscope.

5. Open 17½" hole to 26" using 17½" bit and 26" under-reamer.

6. Make wiper trip with 17½" bit and 26" under-reamer.

7. Spot viscous "Pill" (approx. 70 sec/qt.) drilling mud prior to running 20" casing.

8. Pull to mudline and displace drilling mud with sea water. Observe well to establish "No Flow".

9. If hole remains dead, pull marine riser.

10. Run casing, complete with float shoe, float collar, and centralizers, to 1400' (using drill pipe from running tool to surface and one joint as a stinger below running tool) circulate casing and hole capacity.

11. Cement casing using 1500 sx class "G" cement with 2.5% prehydrated gel + 2% calcium chloride (13.2 ppg) followed by 500 sx class "G" cement with 2% calcium chloride (15.6 ppg). Mix all cement with sea water.

12. Observe cement returns to sea bed by use of T.V. camera.

13. Check for back flow and back out running tool. Wash out 20" housing.

NOTE: Mud properties for this interval are:

weight	:	9.0 - 9.3 ppg
viscosity	:	40 - 45 sec/qt.
water loss	:	no control.
type	:	sea water gel

D. 17½" HOLE AND 13 3/8" CASING INTERVAL

1. Run marine riser and 10.000 psi BOP stack. ✓
2. Pressure test BOP's per standard test procedure.
3. Install wear bushing and drill out 20" casing shoe using 17½" bit.
4. Drill approx. 10' new formation and pressure test shoe to 12.0 ppg equivalent or "bleed off".
5. Drill 12¼" hole (using conventional pendulum hook-up) to approx. 4500'.
6. Take deviation surveys every 300' or less; the first to be such that azimuth and inclination can be determined. and each succeeding to indicate angle only, until such a time that the sum of the measured deviations becomes greater than 52 feet; when the azimuth would again be checked.
7. Make conditioning trip and run logs (per attached logging program.)
8. Open 12¼" hole to 17½" from 1400' to 4500'.
9. Run casing to approx. 4500', utilizing float shoe, float collar, and 8 centralizers.
10. Circulate hole or casing capacity (whichever is greater) and cement conventionally using 1900 sx class "G" cement with 2.5% pre-hydrated gel (13.2 ppg) followed by 500 sx class "G" cement. (15.6 ppg). Thinners and retarders to be added, if necessary, based on laboratory testing.
11. Bump plug and check for flow back. Back out of running tool and L.D. excess 13 3/8" casing.
12. Run annular pack-off; prior to installation P.T. 13 3/8" x 20" annulus with 1500 psi. Install annular pack-off and pressure test same with 1100 psi.
13. If necessary run D.V. tool at 2500' with centralizers above and below.
14. Circulate hole or casing capacity (whichever is greater) and cement first stage using 600 sx class"G" cement with 2,5% prehydrated gel (13.2 ppg) followed with 500 sx class "G" cement (15.6 ppg).
15. Bump plug and check for flow back.
16. Open D.V. tool and circulate 4 hrs. cement second stage using 650 sx class "G" with 2.5% prehydrated gel (13.2 ppg) followed by 300 sx class "G" (15.6 ppg).
    Close D.V. tool with 1500 psi and check for flow back.
17. Cement top behind 13 3/8" casing will be checked with a temperature or cement bond log.

A D.V. tool will be used only if it is deemed absolutely necessary at the time the casing is run.
If possible, the casing will be cemented in one stage only.

NOTE: Mud for this interval of the hole shall be:

weight	:	10 - 11.0 ppg.
viscosity	:	40 - 45 sec/qt.
water loss	:	10 - 12 cc.
type	:	KCl - polymer

E 12¼" HOLE AND 9 5/8" CASING INTERVAL

1. Pressure test BOP stack per standard procedure.
2. Drill out cement and float collar.
3. Pressure test casing with 2000 psi.
4. Drill out float shoe and 10 feet formation.
5. Pressure test "shoe" to 13.5 ppg. equivalent.
6. If unable to obtain test. Set squeeze tool at approx. 4400' and squeeze with approx. 250 sx class "G" cement. (Quantity to be determined by "break down" pressure).
7. Drill out cement and retest "shoe" to 13.5 ppg equivalent.
8. Drill 12¼" hole to approx. 9351' (T.D.) Condition hole for logging.
9. Deviation surveys are to be taken every 300' or less; the first of which will include azimuth and inclination. Subsequent surveys will include inclination only until the sum of the measured inclinations exceeds 52 feet. At this time an azimuth and inclination would be run; after which, a repeat of the above would ensue.
10. Run logs per separate logging program and if indicated by evaluation run 9 5/8" casing.
11. If no "zone of interest" exists, the well will be plugged and abandoned per program.

NOTES:

A. Mud for this interval shall conform to the following properties:

weight	:	11 - 12 ppg.
viscosity	:	45 sec/qt.
water loss	:	5 - 10 cc.
type	:	KCl-Polymer

B. If 9 5/8" casing is run, a float shoe and float collar will be utilized. Also approx. 10 centralizers will be installed near the shoe casing. A quantity and type cement will be used to allow a fill up of at least 600' above the upper most zone of interest and will have a minimum compressive strength of 1500 psi after 24 hours. Procedure utilized will be similar to 13 3/8" cementing operation.

C. If testing is desired, a separate testing program will be submitted.

F. ABANDONMENT PROCEDURE

1. Assuming no 9 5/8" casing run:

A. In open hole, equalize cement plug across any hydrocarbon bearing zones such that top of cement is 600' above zone.

B. Place cement retainer at 4400' and squeeze with 250 sx cement. Sting out and spot 50 sx on top of retainer.

C. Cut 13 3/8", 20" and 30" at approx. 20' below mud line.

D. Retrieve casing, well head and marine riser.

E. Equalize cement plug 750' - 330' (mud line).

F. Inspect sea floor to insure that it is free of obstructions.

G. Release rig.

2. Assuming that 9 5/8" is run.

A. Set cement retainer at approx. 150' above each set of perforations.

B. Squeeze each set independently (assuming spacing is such that it is impractical to squeeze any two sets of perfs at one time).

C. Equalize 100 sx cement on top of uppermost retainer.

D. Equalize cement plug in 9 5/8" casing from approx. 4550' to 4450'.

E. With drill pipe and pressure lubricator installed, perforate 9 5/8" at approx. 600'. Bleed off any pressure that might be trapped behind the 9 5/8" casing.

F. Cut the 9 5/8", 13 3/8", 20" and 30" casing at approx. 20' below mud line.

G. Pull marine riser, well head and casing.

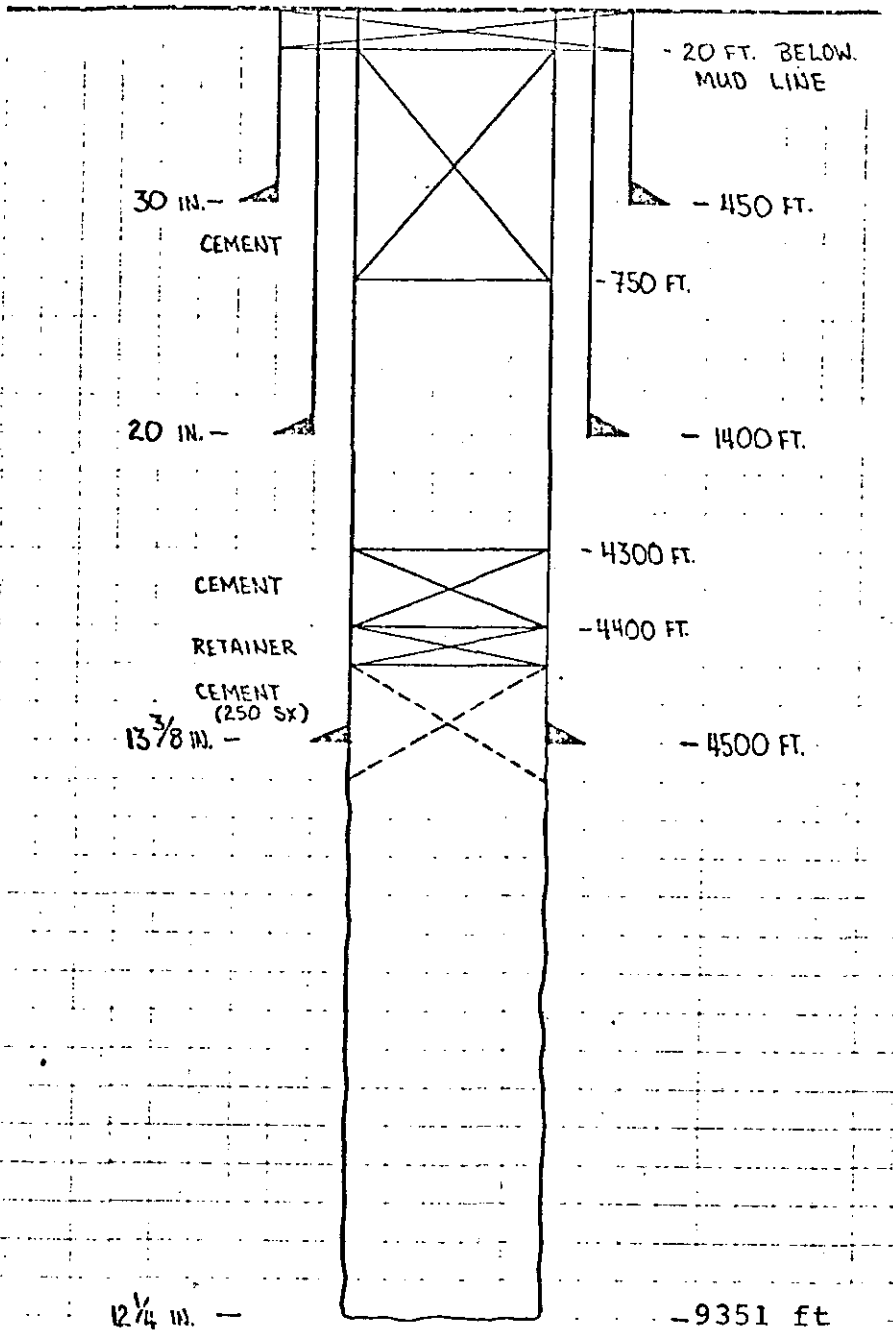
H. Equalize cement plug 750' - 330' (mud line).

I. Inspect bottom so that no obstructions are left on sea floor.

J. Release rig.

WELL 8/4 - 1

WELL ABANDONMENT SCHEMATIC
LAST CASING SET - 13 3/8"

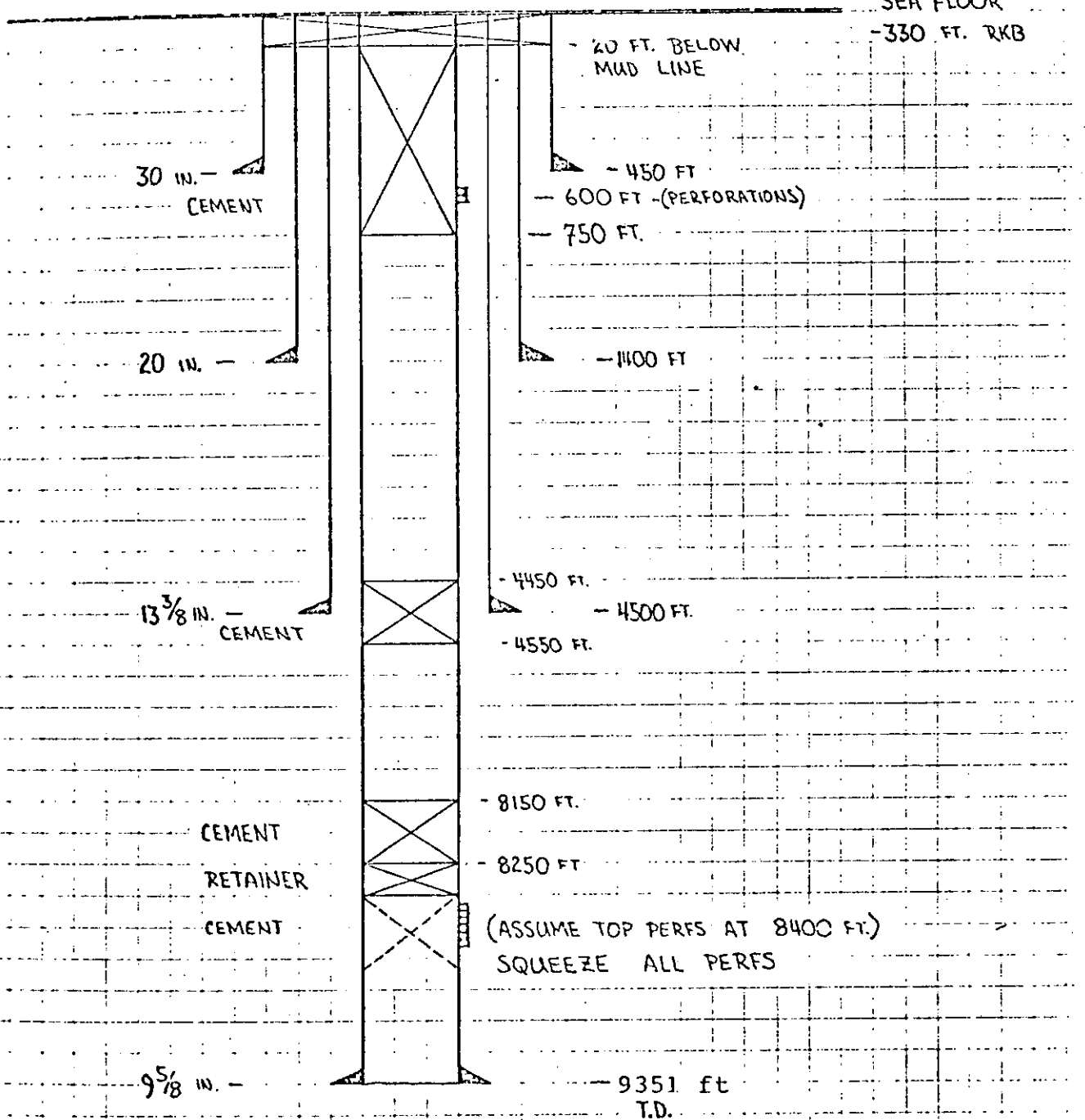


CEMENT PLUG(S), NOT SHOWN, WILL BE EQUALIZED ACROSS ANY HYDROCARBON BEARING ZONES SUCH THAT TOP OF CEMENT WILL BE 600 FT. ABOVE ZONE.

NORWEGIAN SCOTT

WELL 8/4-1

WELL ABANDONMENT SCHEMATIC
LAST CASING SET - 9 5/8"



CASING DETAIL

Well 8/4-1

[illegible]	INTERVAL	LENGTH (FEET RKB)	DESCRIPTION
[illegible]"	330-450'	120'	1"W.T. Grade B w/ATD Connectors
[illegible]"	330-1400'	1070'	94 lbs. K-55 Buttress
13 3/8"	3500-4500'	1000'	72 lbs. N-80 Buttress
	0-3500'	3500'	68 lbs. K-55 Buttress
9 5/8"	0-9351'	9351'	47 lbs. N-80 Buttress

Assumptions for Casing Design:

[illegible] Weight,ppg	Depth,RKB ft.	Gradient,psi/ft.
9.0	1400'	0,465
10.5	4500'	0,546
12.0	9351'	0,624

for collapse; consider that: the casing string is 80% evcuated of mud

for burst; consider "void" behind casing

Use;

a-Safety Factor Collapse - 1.0

b-Safety Factor Burst - 1.0

c-Safety Factor Tension - 1.8

CASING DESIGN

30" : 120 ft. 1" wall, Grade "B".

20" : 1070 ft. 94 lbs. K-55 Buttress.

Fluid gradient inside 20" - 0.546

Fluid gradient outside 20" - 0.465 (sea water - 0.452)

Collapse:

Casing strength - 520 psi + 153 psi (673)

Max Collapse Pressure - 498 psi + 149 psi (647)

Safety Factor	- 1.04

Burst:

Casing strength (80% of 100%) - 1400 psi

Max Burst Pressure - 764 psi

Safety Factor	- 1.83 (636 psi)

Tension

Casing strength, body - 1,480,000 lbs

joint - 1,479,000 lbs

Max load - 100,580 lbs

Safety Factor	- 14.7

13 3/8"

: 1000' - 72 lbs N-80 Buttress

3500' - 68 lbs K-55 Buttress

fluid gradient inside 13 3/8" - 0.624

fluid gradient outside 13 3/8" - 0.546

Collapse:

Casing strength, 72 lbs - 2670 + 562 (3232)

Casing strength, 68 lbs - 1911 (98% of 1950) + 562 (2473)

Max Collapse Pressure 72 lbs - 2457

Max Collapse Pressure 68 lbs - 1911

Safety Factor	72 lbs	- 1.32
Safety Factor	68 lbs	- 1.29

Burst:

Casing strength (80% of 100%)	72 lbs	- 4917 psi
Casing strength (80% of 100%)	68 lbs	- 3153 psi
Max Burst Pressure	72 lbs	- 2808 psi
Max Burst Pressure	68 lbs	- 3153 psi

Safety Factor	72 lbs	- 1.75 (2109 psi)
Safety Factor	68 lbs	- 1.44 (969 psi)

Tension:

Casing strength body 72 lbs - 1,661,000 lbs

Casing strength joint 72 lbs - 1,693,000 lbs

Casing strength body 68 lbs - 1,069,000 lbs

Casing strength joint 68 lbs - 1,300,000 lbs

Max Load,	72 lbs	- 72,000 lbs.
Max Load	68 lbs	- 310,000 lbs.

Safety Factor	72 lbs	- 23.10
Safety Factor	68 lbs	- 3.45

9 5/8" :

9351' 47 lbs N-80 Buttress

fluid gradient outside 9 5/8" - 0.624

fluid gradient inside 9 5/8" - 0.624

Collapse:

Casing strength - 4750 psi + 1167 psi (5917 psi)

Max Collapse Pressure - 5835 psi

Safety Factor	- 1.01

Burst:

Casing strength(80% of 100%) - 6279 psi

Max Burst Pressure - 5835 psi

Safety Factor	- 1.08 (444 psi)

Tension:

Casing strength , body - 1,086,000 lbs

Casing strength , joint - 1,161,000 lbs

Max Load - 439,500 lbs

Safety Factor	- 2.47

APPENDIX

CEMENTING PROCEDURE

Unionoil does not have a "cementing procedure" as such. This is normally left to the individual supervisor on the rig at the time.

Typical examples of cementing programmes are -

A. For 20" Casing :

1. Calculate cement volume based on guage hole size.
2. Assuming no caliper exists (which is normal) a factor, based on knowledge in the area, will be applied to this theoretical volume - normally 1.5 - 2.0.
3. The volume of hole is displaced prior to cementing and cement is then mixed per specifications.
4. The cement is then displaced with drilling mud and the float is checked for back flow.
5. Assuming the float holds, the casing is then disconnected from the running tool and nippling up is initiated.

B. 13 3/8" Casing :

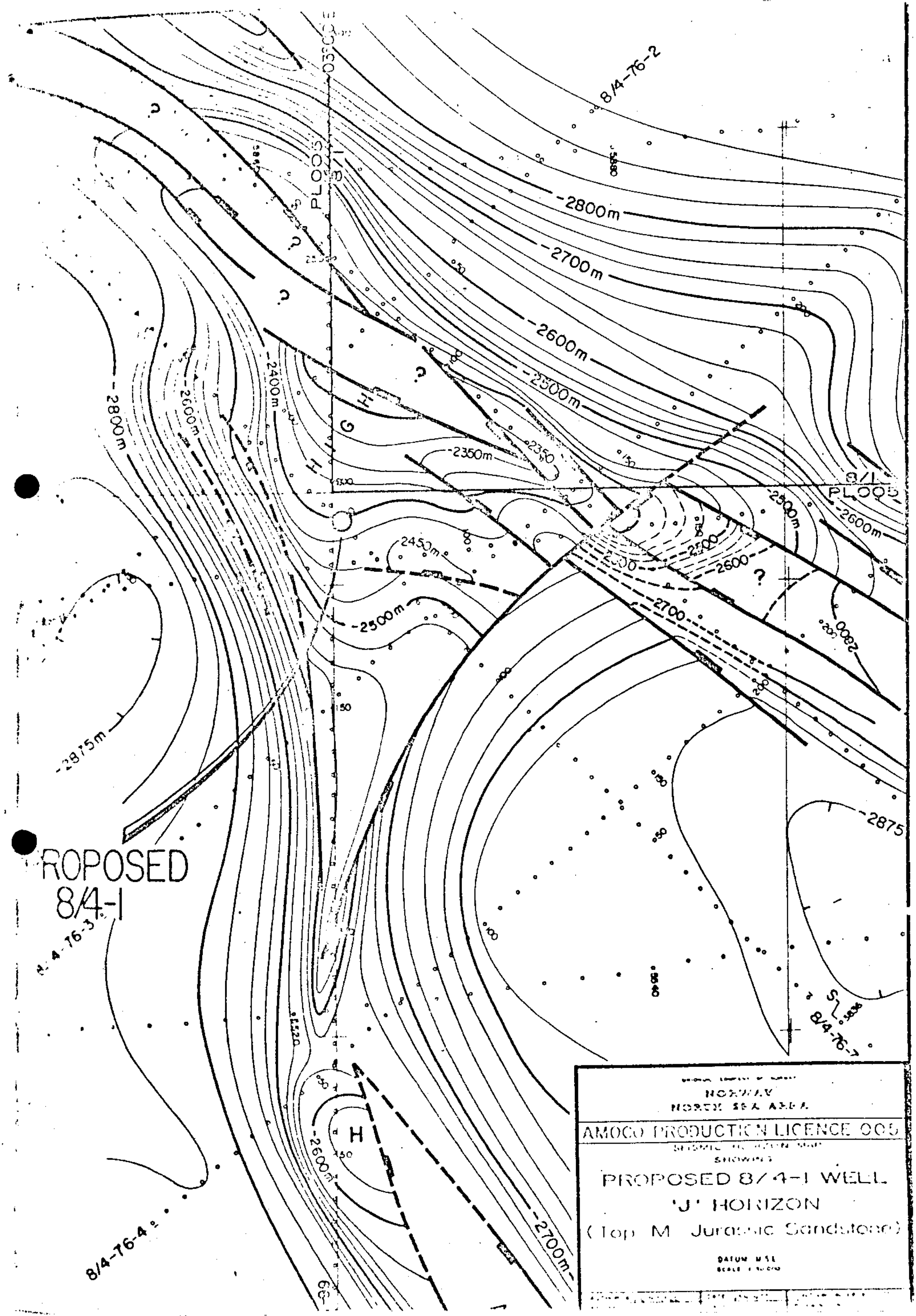
1. Calculate cement volume based on guage hole. Apply "experience factor" for pre-planning.
2. Adjust this volume based on caliper log using a 25% excess above caliper log calculations. (This replaces the "experience factor" referred to above).
3. Circulate hole or casing capacity whichever is greater.
4. Cement using the adjusted volume of cement from step 2 2 above.
5. Displace with rig pump until plug is bumped. Pressure to 2000 psi and check for flow back.

6. If float is holding, back out of running tool and prepare to test the seal and BOP stack.

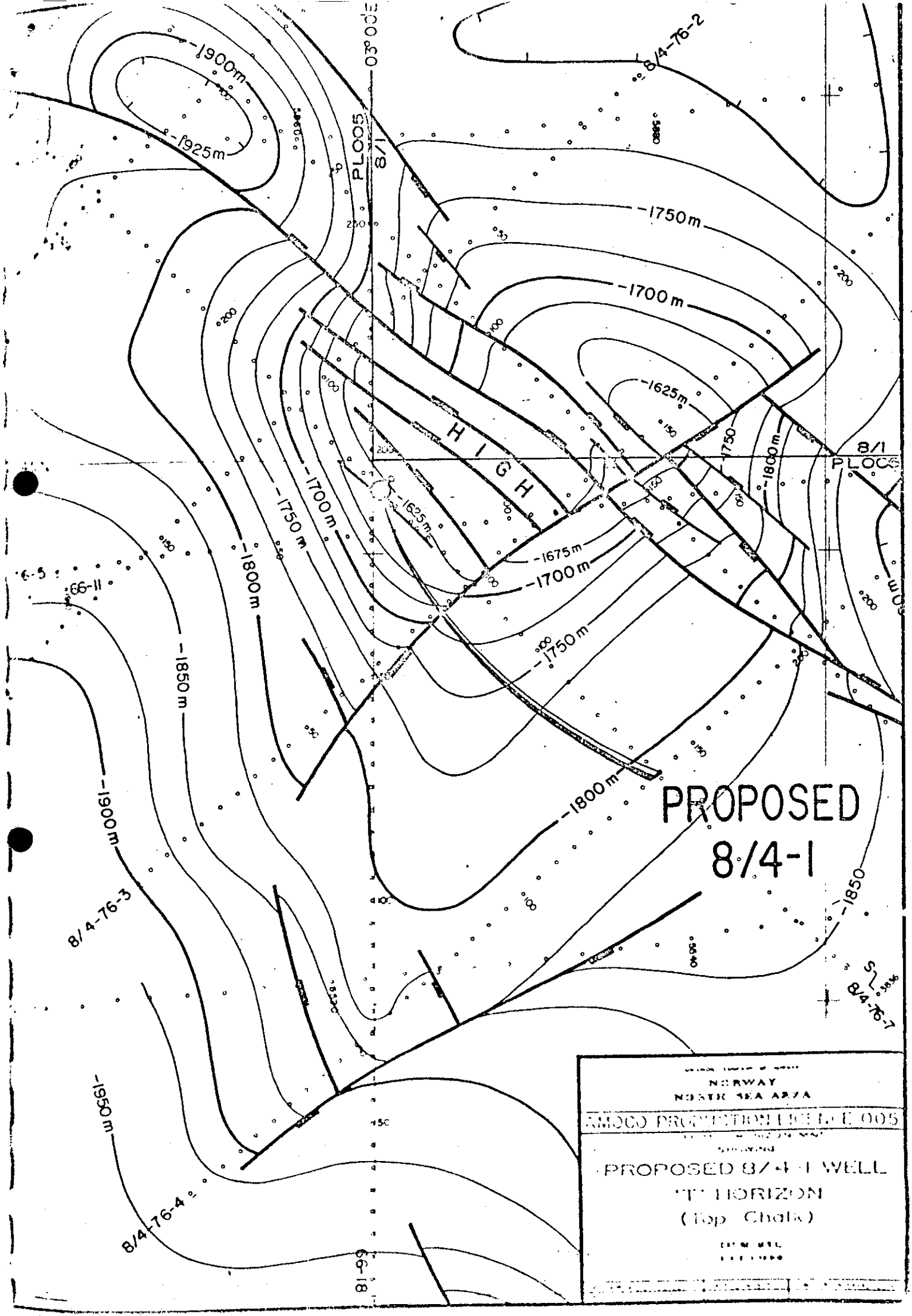
It should be pointed out that the Drilling Supervisor on the rig checks the cement quantity, the mix water quantity, the displacement volumes and all other aspects of the cement job.

An experienced Drilling Supervisor (or Foreman) will :-

1. Always check the pump and lines for pressure integrity.
2. Decide whether or not to precede and follow cement with a quantity of water.
3. Pump the plug when feasible with a pressure that is compatible with the casing design.



NORWAY
NORTH SEA AREA
AMOCO PRODUCTION LICENCE 005
SHOWING
PROPOSED 8/4-1 WELL
'J' HORIZON
(Top M Jurassic Sandstone)
DATUM MSL
ROPOSED
8/4-1
8/4-76-2
8/4-76-3
8/4-76-4
8/4-76-7
-2800m
-2700m
-2600m
-2500m
-2400m
-2350m
-2450m
-2875m
-2875
PL005
8/1


-1900m
-1925m
-1750m
-1700m
-1625m
HIGH
-1675m
-1700m
-1750m
-1800m
-1850m
-1900m
-1950m
PROPOSED
8/4-1
8/4-76-2
8/4-76-3
8/4-76-4
8/4-76-1
8/1
PL005
NORWAY
NORTH SEA AREA
AMOCO PRODUCTION EUROPE
PROPOSED 8/4-1 WELL
"T" HORIZON
(Top Chalk)