

MINISTRY OF ENERGY AND ENERGY INDUSTRIES

DRAFT DOCUMENT

GUIDELINES

FOR

DRILLING

OIL AND NATURAL GAS WELLS

November 30, 1996

ACKNOWLEDGMENT

The following reference documents were useful in drafting the guidelines:-

1. Guidelines for Drilling, Danish Energy Agency, 1985.
2. Code of Federal Regulations 30 CFR 250, Mineral Management Service, 1991.
3. Information Requirements, Ministry of Energy and Energy Industries, 1993.
4. Code of Practice for Drilling and Production Rigs, Ministry of Energy and Energy Industries, 1990.

These guidelines apply to approval and supervision, which, in consequence of Chap. 62:01, have been delegated to the Ministry of Energy and Energy Industries.

These guidelines apply to the drilling of oil and natural gas wells. Some guidelines have specific relevance for offshore wells.

It must be noted that specifications are given as guidance and that other means of achieving corresponding conditions regarding safety and data acquisition might be approved.

1. PERMISSION TO DRILL

Prior to the drilling of a well, the operator shall submit a Well Drilling Programme (DRL 2 form) to the Ministry for approval. Drilling shall not commence until permission to drill has been granted.

2. DRILLING PROGRAMME

The drilling programme shall state unambiguously how the operations connected to the drilling of the well are expected to be carried out. Parts of the information required concerning the drilling programme may be forwarded as separate attachments. The well should be identified as part of a field development or enhanced recovery programme, if applicable.

- 2.1 Well drilling programmes (DRL 2) in triplicate and attachments in duplicate, shall be submitted at least 21 days before drilling is scheduled to start. The programme shall be completed in accordance with "The Instructions for the Preparation of Well Drilling Programme" (Appendix 'A'). The following shall be submitted along with

the Well Drilling Programme (DRL 2).

2.1.1 Well deviation programme including a deviation tolerance sketch showing azimuth and hole inclination, and procedures to achieve same.

2.1.2 Name of drilling rig and/or platform and date certified by the Ministry in accordance with Code of Practice for Drilling and Production Rigs (1990).

2.1.3 A description of the anticipated geological horizons.

(a) Stratigraphic column showing and describing anticipated lithology, as well as stating the planned casing points.

(b) Structure, contour, isopach and cross-section maps on the objective horizons showing the proposed well in relation to nearby wells.

In the case of exploration, new-field development and special wells:

(a) Representative, interpreted seismic sections through

the planned well.

- (b) Depth and time structure maps and cross-sections showing primary and secondary prospects.
- (c) The velocity functions used in the area.

2.1.4 Casing and Cementing Programmes

The programmes shall contain :

- (a) Procedure for setting surface string (drive pipe, conductor, stove pipe, structural pipe).
- (b) Programme for cementing of casing, including type of cement, estimated height of cement behind the casing, and necessary volumes of cement.
- (c) Casing design safety factors for tension, collapse and burst with the assumptions made to arrive at these values. The intent to install previously used casing should be indicated.
- (d) Procedure for testing the formation strength after drilling out each casing shoe, and precautions to be

taken if the required formation strength is not obtained.

(e) Procedures for testing casing, liners and liner laps.

(f) Contingency plan to reach objectives in the event of significant change to the proposed casing programme.

2.1.5 Drilling Fluid Programme, containing the following:

(a) A detailed description of the type of drilling fluid to be used during drilling, specifying density, viscosity, rheological properties etc.

(b) A detailed description of the components of the drilling fluid.

(c) A list of anticipated drilling problems and alterations to the mud system to overcome same.

(d) Procedure for monitoring the drilling fluid volume during tripping.

(e) Procedure for safe disposal of drilling fluids and cuttings.

2.1.6 Logging programme, containing details of types of logs to be run at various intervals. This should include MWD, LWD, mud logs, wireline logs and drill-pipe and coiled tubing conveyed logs.

2.1.7 Programme for taking geological samples, including a programme for core sampling during drilling.

2.1.8 Blowout Prevention Methods and Equipment

(a) A list of the blowout prevention equipment to be used for each hole size, specifying manufacturer, size, working pressure, and arrangement.

2.1.9 Abnormal pressures.

(a) An evaluation of the possibilities of overpressures in the well in question, based on seismic data and/or experience from neighbouring

wells.

(b) A description of methods and procedures to be used for detecting and combating any overpressure in the well.

2.1.10 An evaluation of the possibilities of encountering zones with poisonous gases in the well, including description of methods for detecting and handling of same.

2.1.11 An evaluation of the possibilities of encountering gas pockets and handling same, based on seismic data and experience from neighbouring wells.

2.1.12 A list of any other foreseeable drilling problems (if any) which may be encountered during the drilling of the well, and information on precautions planned in this connection. For example, drilling through gumbo shales or losing circulation.

2.1.13 A detailed sequence of all operations. The summary shall give a general description of the operations, including information on any special safety related requirements (caused by e.g. possible gas pocket or abnormal pressure).

An Operations Plan containing a detailed sequence of all operations. All of the above requirements may be included in this Plan.

Information regarding function, name, address and nationality of the contractor companies to be employed for the well in question.

2.1.14 Procedures for environmental remediation of the well site.

2.1.15 For exploration wells and wells which may contain poisonous gases, a contingency plan for use in the event of major accidents or emergency situations regarding safety as well as environment.

2.1.16 Drilling time graph

2.1.17 Cost details

2.1.18 Reserves expected.

2.2 Amendment to Drilling Programme

If any major changes to the originally approved drilling programme are planned, an amended programme or a written request must be submitted to the Ministry of Energy for

approval.

3. DRILLING ACTIVITIES

3.1 Notice of spudding a well (Form DRL3) must be sent to the Ministry.

During drilling operations, all necessary steps shall be taken to prevent explosion, blowouts, pollution, or other damage. The safety related drilling equipment shall be installed as required.

Apart from drilling prior to setting the conductor pipe, drilling must not

be carried out before blowout preventers/diverter system and related equipment have been installed and tested.

3.2 Casing strings and liners shall be installed in the borehole to prevent release of fluids from any stratum through the wellbore (directly or indirectly) into the environment, prevent communication between separate hydrocarbon-bearing strata, protect freshwater aquifers from contamination, support unconsolidated sediments, and otherwise provide a means of control of the formation

pressures and fluids.

A hardening test for each cement job shall be carried out.

(a) Drive/conductor/stove pipe (casing) shall be set at such a depth below surface such that unconsolidated formations are supported and a stable hole ensured for initial drilling operations.

Prior to drilling out from the drive/conductor casing, a diverter system shall be installed and tested operationally.

(b) Surface casing shall be installed in such a manner that a good anchorage of the blowout preventer is secured. Surface casing shall be cemented over its full length. The cement shall be given sufficient time to set before further drilling is carried out.

The conductor casing shall be set immediately prior to drilling into formations known to contain oil or gas or, if the presence of oil or gas is unknown, upon encountering a formation containing oil or gas.

Prior to drilling out surface casing, the blowout preventer equipment shall be installed and tested in accordance with the Ministry's Code of Practice for Drilling and Production Rigs.

- (c) Intermediate casing shall be installed in such a way that full control of the well is maintained at all times. Intermediate casing shall be cemented at least 200m into the previous casing but shall if relevant, for instance as protection for ground water, be cemented right to the surface. The cementing programme shall ensure that all zones containing hydrocarbons as well as all intervals

with abnormal pressures are isolated.

Prior to drilling out intermediate and subsequent casing, an adequate blowout preventer stack shall be installed and tested.

(d) Production casing shall be cemented to provide annular fill-up to a minimum of 200 m above all zones to be isolated or 200 m above the casing shoe in wells where zonal isolation is not required.

(e) A liner shall be lapped a minimum of 30 m and cemented over its full length.

3.3 Temperature surveys or cement bond logs shall be run after the cementing of surface and intermediate casing if these have not been cemented back to the sea-bed/surface with satisfactory quantity of cement returns. After cementing the production casing and liner, a cement bond log shall be run. If the evaluation indicates inadequate

cementing, remedial action shall be taken.

- 3.4 Casing strings shall be designed and installed in such a way that they can withstand any pressure which may be expected in the well during drilling, testing, and stimulation.

After the casing strings have been installed, they shall be pressure tested. All casings except drive/conductor/stove pipe shall be pressure tested to 70 percent of the minimum internal yield pressure of the casing. If the pressure test fails, remedial action shall be taken until a satisfactory pressure test is obtained.

Installation of used casing is not permitted unless it has been recently tested and inspected by an independent inspection company and satisfactory strength of pipe and connections are documented (certified).

Pressure testing of the formation strength below the

casing shoe shall be performed after drilling no more than 10 feet of new hole. A safe margin shall be maintained between the mud weight in use and the equivalent mud weight at the casing shoe. Drilling operations shall be suspended when the safe margin is not maintained.

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MUD PROGRAMME

4.1 The quantities, properties, use and testing of drilling mud shall be designed to prevent the loss of well control. Drilling operations shall be suspended in the absence of sufficient quantities of mud in order to maintain well control.

Sufficient amounts of materials for mixing of drilling fluid shall at all times be available on the well site so that loss of drilling fluid and need for an increase of the drilling fluid density can be handled immediately in a proper and safe way.

Drill pipe and downhole tool running and pulling speeds shall be at controlled rates so as not to induce an influx of formation fluids from the effects of swabbing nor cause a loss of drilling fluid and corresponding hydrostatic pressure decrease from the effects of surging.

4.2 Before starting out of the hole with drill pipe, the mud shall be properly conditioned by circulation with the drill pipe just off bottom to the extent that a volume of drilling mud equal to the annular volume is displaced.

The hole must be stable before pulling the drill string out of the hole.

4.3 When the drill string is being pulled out of the hole, the hole should be maintained full at all times.

When there is an indication of swabbing or influx of formation fluids, the safety devices and

measures necessary to control the well shall be employed. The mud shall be circulated and conditioned, on or near bottom, unless well or mud conditions prevent running the drill pipe back to the bottom.

4.4 During drilling, the drilling fluid reconditioning equipment shall be used to the necessary extent to separate gas and cuttings from the fluid.

4.5 Mud-testing equipment shall be maintained on the drilling rig at all times, and mud tests shall be performed once each tour, or more frequently, as conditions warrant. Mud quality shall be maintained for safe operations, prevention of downhole equipment problems, and for kick detection.

Mud monitoring equipment shall be installed and used when mud returns are established and throughout subsequent drilling operations in

accordance with the Code of Practice for Drilling and Workover Rigs.

- 4.6 Oil based mud or mud containing chemicals which can be detrimental to the health or environment, can only be utilized when special approval is given by the Ministry.

Mud-handling areas where dangerous concentrations of combustible gas may accumulate shall be equipped with ventilation systems and gas monitors.

5. ABNORMAL FORMATION PRESSURE DETECTION

- 5.1 The monitoring and recording of data for evaluation of formation pore pressures, and of hydrocarbon content and its relation to the drilling fluid density, drilling rate, etc. shall be started immediately after drilling out from the drive/conductor pipe and shall be continued until the well has reached total depth.

- 5.2 Recognized measuring methods, parameters, calculation methods shall be used at all times in evaluation of the possibility of encountering abnormal pressures.

6. SAFETY AND ENVIRONMENTAL MANAGEMENT

All drilling operations shall be conducted in accordance with local and international safety and environmental requirements with a view to protect people, plant, property and the environment.

7. SUPERVISION AND SURVEILLANCE

(a) The operator shall provide onsite supervision of drilling operations on a 24-hour per day basis.

(b) From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall maintain rig-floor surveillance continuously, unless the well is secured with BOP's, bridge plugs, packers, cement plugs or sub-surface safety valves.

8. SECURING OF WELLS

A downhole safety device such as a sub-surface safety

valve, cement plug, bridge plug, or packer shall be used to shut-in wells when drilling operations are interrupted by events such as those which force evacuation of the drilling crew, prevent station keeping, or require repairs to major drilling or well-control equipment.

9. INITIAL COMPLETION

Before initial completion of a well can be carried out all relevant logs shall be submitted to and the completion and test programme be approved by the Ministry.

10. ABANDONMENT OF WELL

Prior to the abandonment of a well, the hole shall be plugged according to procedures approved by the Ministry.

11. DAILY REPORTS

From the time the drilling rig is positioned at the well site or slot and until the rig is re-positioned, the

Ministry shall receive daily before 9.00 a.m., by telefax or other acceptable means, reports on operations and results during the last 24 hours. The reports shall at least cover the activities to 6.00 a.m. on the reporting day. The Ministry may establish special rules for reporting during weekends and holidays.

The reporting shall be in the format of the IADC Drilling Report and at least contain the information detailed in Appendix `B'.

The Ministry may prescribe more detailed rules for the presentation of the reports.

12. FINAL WELL REPORT

Within three months after the completion of a well, a final Well Report shall be forwarded to the Ministry in accordance with guidelines issued by the Ministry.

APPENDIX `A'

INSTRUCTIONS FOR THE PREPARATION OF WELL DRILLING PROGRAMME

GENERAL

Name of Form : Well Drilling Programme

Objective : To notify the Ministry of Energy and Energy Industries of Intention to drill a well/wells and to request approval of same as described on the programme. Additional documents may be appended as considered necessary.

Frequency : As occurs.

Due Date : At least 30 days before proposed date of commencement of drilling.

Cut-off Date : Drilling must commence within 90 days of approval of the programme by the Ministry. If drilling is not commenced within this period the Programme is invalid and must be resubmitted if necessary.

Copies : Original plus two copies.

Distribution : Director Operations, Ministry of Energy and Energy Industries, Box 142, San Fernando

INSTRUCTIONS FOR THE PREPARATION OF WELL DRILLING PROGRAMME

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- Lessee/Owner : Enter name of company or person holding lease.
- Operator : Enter the name of the company or person operating the lease.
- Programme No. : Well drilling programmes will be identified by a seven digit number. The first two digits will identify the company. The next three digits will be a sequential number assigned to each individual company for programmes from 1st January to 31st December of each year. The final two digits will represent the last two digits of the year in which the programme is submitted, e.g. 01-047-`66. This means that Oil Company No. 1 (01), is drilling its 47th well (047) for 1966 (`66).
- Field/Location : Enter the name of the Field in which the well is located or if no field, enter a short geographical description.
- Lease Number : Enter the lease number.
- Well Number : Enter the well number if known.
- Well Classification : Enter a brief description of the well classification; for example, injection, observation, or development; or if a Lahee well, describe according to the modified Lahee definition of wells, i.e. A1, A2a, A2b, A2c, or A3.
- Location identification :

Location Number :

Surface Objective : Enter the cadastral locations of the well
(top) Bottom Hole at the depths indicated, as accurately as
is possible at this time.

Co-ordinates (links) :

Surface Objective : Enter the location co-ordinates as the
Bottom Hole number of links north
and east of the base point.

ELEVATIONS :

R.T. above M.S.L. : Enter the height in feet of the Rotary
Table (R.T. above Mean Sea Level (M.S.L.)).

Ground level above : Enter the height in feet of the ground at
MSL this well site, above Mean Sea Level. For
marine wells quote mean water depth as
negative figure.

RIGHTS :

Surface rights Enter under each heading whether Crown or
Subsurface rights Private. If Private, state whether
Freehold or Leasehold.

Boundary Conditions: If the well is situated within 500' of
Relating to one or more boundaries
of adjacent Contiguous Lease/
leases/fields, enter from left to right

Fields : (i) the owner or lessee of such
other lease(s)/fields(s).

(ii) The names of the adjacent

lease(s)/fields(s) as the case may be,

(iii) the distance of the well
from such lease(s)/field(s).

Geological Forecast : Enter a description of the expected

stratigraphy of this well, noting drilled and subsea depths of each marker.

Programmed Depths: Enter the proposed vertical subsea and
Subsea Surface drilled depths in feet.

Drilling Deviation : Enter the acceptable variance from the
Tolerance planned axis of the well=bore.

Well Site Location : Enter where possible, a brief structural
and Accessibility description of the region in which the
well is to be located and comment on
accessibility to the well site.

Objectives and : Enter the objectives of this well in
Geological terms of horizon, sand, reservoir etc,
and justify the location of the well in terms
of geological information, both known and
expected.

INSTRUCTIONS FOR THE PREPARATION OF WELL DRILLING PROGRAMME

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Basis for Mud : Enter the basis for the mud programme.
Programme including : Where this depends upon the behaviour of nearby wells, enter a brief drilling history with particular reference to difficulties encountered.

MUD PROGRAMME:

Hole Depth : Enter for each depth interval the weight
Mud Weight Composition and type and composition of the mud to be Type and used. Depths to be given in feet, and the weights in pounds per cubic foot or pounds per gallon.

DISTANCES TO NEAREST
WELLS AT OBJECTIVE
HORIZON:

Horizon : For each important horizon, marker and
Well No. depth to be penetrated by the proposed
Direction well, enter in the appropriate columns:
Distance
(a) the well no. of each first line well;
(b) the approximate compass direction;
and (c) the approximate horizontal distance in feet of each adjacent well from the proposed well.

SUMMARY OF CASING
PROGRAMME:

Hole:

(i) Size : Enter the diameter of the drilled hole in inches.

(ii) Depth : Enter the depth in feet of the well in the indicated hole.

Casing:

(i) Size : Enter the outside diameter (O.D.) of the casing in inches.

(ii) Weight, Grade : Enter the weight in pounds per linear foot and the grade in standard symbols of the casing set.

(iii) Shoe at : Enter the depth in feet of the shoe of each string set.

INSTRUCTIONS FOR THE PREPARATION OF WELL DRILLING PROGRAMME

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Drilling and Sampling Programme : State here a detailed proposal of the drilling and sampling programme. The programme for setting and cementing the oil and string and for completing the well should also be cleared in advance with the Ministry of Energy and Energy Industries.

Proposed well head equipment : Enter a description of the proposed well head equipment.

Index of Attachment: to Well Programme : Give here a list of all supporting documents submitted with the Well Programme. For example, Cross Sections, Contour of horizons, deviation plans and encroachment plans.

Signature : Signature of person authorised to sign on behalf of the Company.

APPENDIX `B'

INFORMATION TO BE INCLUDED IN THE DAILY DRILLING REPORT

Reporting date

Well identification

Drilling platform/drilling rig

Operator

Total days on the drilling site

Present operation

Present well depth, including measured depth and true vertical depth.

Drilling progress during the last 24 hours.

Detailed description of operations during the last 24 hours, indicating essential results, as well as a description of operational problems encountered as well as problems anticipated.

When relevant, at least the following conditions shall be described:

- (a) Significant down hole loss or gain in drilling fluid system.
- (b) Problems with well stability.
- (c) Problems in controlling or monitoring well direction.

- (d) Substantial deviation from the anticipated geological conditions.
- (e) Substantial deviation from anticipated formation pressures, either at current depth or abnormal pressure predicted below the bit.
- (f) Casing operations, including casing data (diameter, weight and type, as well as setting depth), and cementing data (density, volume, expected top as well as indications, if any, of good or bad cementing quality).
- (g) Pressure tests of both equipment and formation.
- (h) Logging, indicating intervals logged and problems, if any.
- (i) Test production, listing principal results from the testing, including the volume of fluid and gas production as well as pressures and temperatures.
- (j) Plugging operations performed, including results from testing of the plugs.
- (k) Intervals perforated, perforation density and type.
- (l) Hydraulic and chemical treatment of formation performed, including information on the operations carried out.

Drilling Fluid rheology data, including density in and out of the borehole, viscosity, loss of water, pH, oil content, tracer concentration, and main components.

The gas content of the drilling fluid out of the borehole during drilling, connection and trip, indicating total gas and gas components, as well as background gas for circulated drilling fluid.

Hole size.

Last casing size.

Last casing setting depth.

Test pressure for formation below the casing shoe.

Maximum permissible surface pump pressure with actual drilling fluid density.

Wave height and direction.

Wind force and direction.

Barometric pressure and air temperature.

Directional surveys performed.

The well inclination and direction, as well as horizontal and vertical position, as calculated from the latest directional survey.

Description of the geological formations penetrated during the reporting period, indicating depth, lithology, colour, grain size, porosity and expected geological age, including detailed results from the preliminary core descriptions.

Hydrocarbon indications.

Drilling rate in the penetrated layers.

Costs for the last 24 hours.

Cumulative costs.

Safety meetings and drills held.

Accidents or pollution incidents.

All wireline logs, MWD logs, mud logs and computer-generated logs must reach the Director, Operations within one working day after their being run or generated.

Geolograph Charts

Any other relevant data.