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DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

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Mud specifications required before "drilling in" a prospective zone

by

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This record was prepared in the Petroleum Exploration Branch
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MUD SPECIFICATIONS REQUIRED BEFORE "DRILLING IN" A PROSPECTIVE ZONE.

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INTRODUCTION.

For some time now concern has been felt at the very poor standard of drilling mud control in Australia. In fact, on many wells there is virtually no mud control at all, simply because there is no person at well site with any proper training or experience in this highly specialised field, and the normal A.P.I. specified testing apparatus and reagents are not held there. Consequently, random additions of various mud chemicals are made, often at the whim of one of the drilling contractor's staff, without any pilot testing whatever. From the operator's own viewpoint, nothing could be technically more unrealistic than to vest the testing of the mud in circulation, and also the entire mud treatment, exclusively in the hands of a completely unsupervised drilling contractor. Such a contractor will obviously be strongly tempted never to report any adverse mud characteristic which actually exists, and not to add essential chemicals (if he can avoid doing so), because otherwise he will reduce his profit margin, under the terms and conditions of various current contracts.

It is certain that some potential pay sands in Australian wells have suffered irreparable damage for such reasons. Proper mud control is absolutely essential to protect the formation and its fluid content, to permit fast and efficient drilling, and to ensure that adequate electrical and other down-hole logging can be successfully carried out.

BASIC REQUIREMENT.

Before a well is "drilled in" to any prospective zone, the drilling mud in circulation must be a stable, matured, homogeneous, and properly constituted colloidal mixture. This is essential, in order to prevent adverse conditions of filtrate invasion, or blockage, or other formation damage from limiting or preventing subsequent production or formation fluids. If, for example, dry bentonite is added to circulation when the bit is at or near a pay sand, then such very small particles may enter the interstices of porous and permeable formation before this bentonite

can possibly be fully hydrated. The highly undesirable results of the hydration and swelling of such colloidal material, after it has been forced into a potential pay zone, may well be imagined.

In a conventional water-base drilling mud, only best quality bentonite must be used, because the filtration and wall-building characteristics of the mud must be maintained at optimum values. In this brief note, special muds such as for example highly saline ones, which may be necessary for certain particular circumstances, are not discussed.

BENTONITE.

Formerly the A.P.I. bentonite specification has prescribed the minimum Plastic Viscosity centipoise value, which a given suspension must provide. However, certain unscrupulous suppliers have been known to use poor quality clay and simply load it with cheap caustic soda, which certainly raised the Plastic Viscosity to the A.P.I. stated value, but made the Yield figure ridiculously high. In future, we believe that the new A.P.I. specification for bentonite will require that both the Plastic Viscosity and the Yield values must conform to satisfactory standards.

The March 1962 "A.P.I. Specification for Oil-Well Drilling - Fluid Materials (Tentative)"quotes, in part, the following standard for bentonite:

For a suspension of 21 gm. of bentonite in 350 ml. of distilled water -

(a) Plastic Viscosity must be 8.0 cp. minimum.

and (b) Filtrate must be 14 ml. maximum.

MUD STABILITY.

It is absolutely essential that a "drilling in" mud should have satisfactory filtrate and wall-building characteristics at relatively high pressures and temperatures, which are comparable with actual down-hole conditions. The filtrate should be of a chemically suitable type, and should give a reading in ml. as low as possible; and the filter-cake should be of thin, pliable, and firm consistency. For unproved mud chemicals, the normal laboratory A.P.I. filtration test, at a mere 100 p.s.i. applied pressure, may give no indication of these vitally important down-hole filtration characteristics. Muds have been tested at say

1 ml. filtrate A.P.I., and yet have given 80 to 90 ml. at say 2500 p.s.i. and 250 degrees Fahrenheit.

In general therefore, only fully tested and consistently acceptable mud additives may be used; and the resultant mud must then be maintained so that its standard laboratory A.P.I. test data remain within safe tolerances, thus providing a reasonable empirical control.

So too should the viscosities of a "drilling in" mud be satisfactory under increasing pressure and temperature conditions. One very useful indication of the stability of a mud may be obtained, under ambient pressure and temperature conditions, by plotting a Graph AB showing instrumental viscosities as the ordinate, against Viscometer R.P.M. as the abscissa. This Graph AB is plotted from left to right and then vice versa; and if completely superimposed, then the mud is probably stable. This mud mix is then "rolled" and aged, and re-tested; and, if the Graph AB is again closely reproduced, then the mud under test may be regarded as stable.

MUD TEST CHARACTERISTICS.

A conventional water-base "drilling-in" mud should normally conform to the following test characteristics :-

PROPERTY	DESIRED TOLERANCE
Weight (assuming barytes not required).	S.G.1.10 to 1.20 (68.4 to 74.8 lb/cu.ft., or 9.2 to 10 lb/gal.U.S.).
Viscosity M.F. A.P.I.	40 to 55 seconds.
Apparent Viscosity.	20 to 30 centipoise.
Plastic Viscosity.	15 to 30 centipoise.
Yield Point.	5 to 10 lb./100 sq. ft.
Gels. (Initial.	0 to 4 gm.
Gels. (Ten mins.	0 to 15 gm.
Water-loss A.P.I. (Filtrate.	Less than 4 ml.
Water-loss A.P.I. (Cake.	1/32 in.
PH.	9 to 11.
Solids.	10 to 20 per cent
Sand.	Less than 2 per cent.

REFERENCES.

A.P.I. 1962 (a)

A.P.I. Specification for Oil-Well Drilling - Fluid Materials (Tentative). A.P.I. Std. 13A, March 1962.

A.P.I. 1962 (b)

A.P.I. Recommended Practice Standard Procedure for Testing Drilling Fluids. A.P.I. R.P. 13B, November 1962.