



Drilling Fluids for Water Well, Exploration and Mining

General Information and Basics

The Keys to your Success

- **Keep in mind drilling objective**
- **Establish a mud program before drilling**
- **Monitor drilling fluid properties**
- **Adjust drilling fluid properties to optimize performance or solve problems (lost circulation, severe torque and drag, stuck pipe etc.)**
- **Use Süd-Chemie specific non oil well drilling additives**

Introduction

This technical information is aimed to acquaint you with Süd-Chemie drilling fluids technologies that are being used for most drilling methods such as down-the-hole-hammer, rotary with air, mud or foam, core drilling etc. for:

- Water wells
- Soil engineering and soil sampling
- Mining and mineral exploration
- Seismic drilling

For the full success of your project, Süd-Chemie has developed a complete range of drilling fluid additives especially selected to fulfill the required mud functions of:

- hole cleaning
- hole stability
- avoid damage to productive zones

Routine mud properties tests can be made to check how effectively the mud will perform its functions. These tests are:

- **Density:** The pressure exerted by the fluid is directly related to its density.
- **Viscosity and Gel strength:** as high as necessary to improve hole cleaning, hole stability and to retard settling of cuttings. As low as possible to keep pump pressures at an economic level.
- **Filtration and Mud Cake:** Instant ability of the mud to form an impermeable mud cake on porous formations. It's intimately related to hole stability and expected return of permeability.
- **pH:** Overall chemical stability of the mud.
- **Sand Content:** To avoid abrasion if maintained at low value.

Comparing properties of the mud "in and out" is a simple control to furnish information on how efficient the mud will perform the required functions. Based on experience, low and high limits can be set for mud properties.

Drilling Program

A drilling program always takes into consideration:

- drilling objectives as:
coring, water production, electric logging
- geology
- site location and locally available supplies
- drilling equipment and parameters
- mud mixing and solid control equipment
- manpower experience

Mud Program

A mud program takes into consideration the specifics of the project and the required properties of the drilling fluid. A mud program would include details such as:

- → water based drilling fluid systems
 - "gel mud"
 - non damaging polymer mud systems
 - air & foam drilling
- recommended drilling fluids additives and average formulation
- mud volume estimation and product consumption including safety stock

Waste disposal takes into consideration local environmental regulations.

Süd-Chemie Drilling Fluid Systems

Water-based Mud Systems

Formulate a drilling fluid having the maximum hole cleaning characteristics (annular velocity above 30m/min for the biggest annular diameter is recommended) and to support unconsolidated formations, taking into consideration economics and environmental impact.

Bentonite-based Systems

Select from the right table the most appropriate bentonite, taking into consideration that shear thinning fluids with a high YP/PV ratio are ideal for bore hole cleaning.

Polymer-based Systems

Depending on the application and desired results, select for your mud program the most appropriate additives in the table right.

All these additives are versatile enough to enable you adapting with little changes to the ever changing drilling conditions or unexpected problems.

Air and Foam Drilling

Two main systems are used: air and stiff foam.

Air drilling is very simple and efficient but requires an annular velocity of approx. 1000m/min to lift cuttings to the surface and requires a great volume of air for larger diameters.

Furthermore it is very sensitive to water influx. When drilling with foam, the use of an appropriate polymer such as SC MUD L increases the stability and the performance of the foam.

BENTONIL®		CF	HR	THR	HDG
Yield	[bbls/shft]	90 – 100	120 – 140	150 – 180	240 – 300
Concentr.	[kg/m³]	50	40	35	25
AV	[cp]	10	15	12	13
PV	[lbs/cp]	5	8	6	5
YP	[lbs/100ft²]	10	15	12	15
Gel 0	[lbs/100ft²]	9	7	5	4
Gel 10	[lbs/100ft²]	9	7	9	8
Marsh-Funnel	[sec]	35 – 40	40 – 45	40 – 45	40 – 45
API filtrate	[ml]	14	16	20	25
YP/PV ratio		2	2	2	3

*Laboratory indicative properties using standard API mixing & testing procedures

Product	Purpose	Concentration [kg/m³]
SC Mud	Viscosifier/Shale stabilizer Borehole stabilizer	0.5 to 2
SC Vis HV	Biodegradable Viscosifier/ Filtrate reducer	2 to 4
BENTOCRYL 86	Thinner	0.5 to 3
SC EP 20	Extreme Pressure Lubricant For diamond coring	2 to 5
SC Det	Wetting agent	2 to 5

Injection of a special hammer oil to lubricate the bottom-hole-hammer is required at a rate of 20 liters/8 hours shift with air and 5 liters/8 hours shift with foam.

Stiff foam requires lower annular velocity of approx. 60 m/min and tolerates relatively high water influx and develops a better hole cleaning especially where large compressor systems are not available.

Typical slurry foam formulation:

- Water: 1000 liters
- SC Foam: 5 – 10 liters (all purpose foaming agent)
- SC MUD L: 0 – 2 liters (polymer to improve foam stability)

The air to slurry foam injection rate depends on the hole cleaning requirements and varies from 100:1 for low annular velocities to 300:1 for high annular velocities. Adjustment is made according to foam aspect at the flow line and drilling conditions.



Further informations under: www.bentonit.info

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