

AVAPOLYSIL

An Inhibitive System to Drill Reactive Clays



*Operator in the
Adriatic Fore
Deep
successfully
drills highly
reactive Pliocene*

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INTRODUCTION

The following case study is a report on the performance of AVAPOLYSIL, a new product for WBM systems, designed to drill highly reactive clays.

The experience refers to the drilling of a highly deviated well located in the Adriatic fore deep in September 2000. Final depth was 3,200 m.

The main problems expected were related to drilling the reactive clay of the Pliocene" formation, with the possible occurrence of bore hole instability and low inhibition of cuttings.

A test of the cuttings showed a cationic exchange capacity (CEC) of 25 - 35 meq/l. The most suitable drilling fluid would have been an Oil Based Mud (OBM) due to minimal interaction between fluid and formation, although requiring an expensive haul off and treatment of waste.

OBJECTIVES

The Operator's objectives were:

- to minimise drilling costs in compliance with environmental constraints, thus reducing dilution volumes and related costs (new mud, disposal, transport);
- to save time avoiding hole instability problems (bit balling, tight hole, clay plugs).

ACTIONS

To reach the goals, AVA proposed the AVAPOLYSIL system mixed with Potassium Carbonate.

AVAPOLYSIL is a balanced blend of silicate and organic compounds; soluble silicate invades shales and readily reacts with available polyvalent ions in the shale pore fluid (mainly Ca²⁺ and Mg²⁺) to form insoluble precipitates. Moreover, the neutral to acidic pH of pore fluids can trigger silicate gellation, providing a further barrier against

shale swelling. Organic compounds increase the filtrate viscosity reducing filtrate invasion. The combination with Potassium Carbonate provides a strong K⁺ ion source that increases the osmotic pressure effectively dehydrating shale. The system contains no polluting compounds.

Concentrations during drilling were as follows:

AVAPOLYSIL	10.5-12.25lb/bbl
Potassium Carbonate	12.25-14.0lb/bbl



Figure 1. Cuttings at shakers during 16" section

RESULTS

Drilling operations were performed in 55 days vs. 65 planned. Total drilling hours were 426 with a resulting average rate of penetration of 8 m/h with peak values of 20 m/h. During drilling, no problems due to mud or hole instability were reported. Dilution rate was as low as 2.57.

Results clearly showed the effectiveness of AVAPOLYSIL and Potassium Carbonate system; the proposed system, used for the first time in Italy to drill very reactive clay formations gave performances similar to those of an OBM, but at lower cost and bearable environmental impact (Table I).

Table I. Cost/m³ comparison of mud built shows the noticeable cost reduction achieved.

	OBM LT	AVAPOLYSIL & K ₂ CO ₃
COST/M ³	\$1,192	\$246

CASE STUDY