



## **DRILLING SPECIALTIES COMPANY TECHNICAL SERVICES DIVISION**

### **LABORATORY REPORT # M664-832-84TSD**

#### **EFFECT OF DRISPAC<sup>®</sup> POLYMER MUD FILTRATE ON RETURN OIL PERMEABILITY OF BEREA SANDSTONE**

#### **INCLUDES RETURN PERMS FOR CF DESCO<sup>®</sup> DEFLOCCULANT AND SOLTEX<sup>®</sup> ADDITIVE TREATED MUDS**

**By**

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Note to reader this report was issued in 1984 prior to the advent of drill-in-fluids now used to drill many pay zones. Rewritten 2/28/07 for more information please visit us at our web site at [www.drillingspecialties.com](http://www.drillingspecialties.com).

Tests were made by an independent laboratory to determine the effect of filtrate from muds treated with Drispac<sup>®</sup> Polymer, Soltex<sup>®</sup> Additive and C.F. Desco<sup>®</sup> Deflocculant on the return oil permeability of Berea sandstone cores. Filtrates were used because it is well known that clay and barite in water based drilling fluids can cause significant damage to pay zones. Therefore, there is little that can be done to avoid damage from mud solids other than running low-solids polymer drilling fluids and doing remedial well treatments, such as with mud acid, if needed. Filtrate invasion can also be harmful. This work was done to see if mud filtrates containing Drispac<sup>®</sup> Polymer and either Soltex<sup>®</sup> Additive or C.F. Desco<sup>®</sup> Deflocculant, all of which are water soluble, cause formation damage as reflected by return oil permeability. Oil permeability is used as the test criteria as it is assumed that this is of most concern to the operator as opposed to air, gas or brine permeability.

## EXPERIMENTAL PROCEDURE

Following is the test procedure used by Keplinger Laboratories, Inc., Tulsa Oklahoma an independent laboratory.

1. The routine properties of the Berea sandstone test plugs were measured. Liquid porosity ranged from 19.1 to 19.8 percent, air permeability ranged from 291 to 305 millidarcies (md) and brine permeability ranged from 135 to 184 md.
2. The test plugs were saturated with 4.0 percent sodium chloride brine and the initial brine permeability measured. (Brine was used because Berea sandstone is sensitive to fresh water. Therefore, 4.0 percent brine muds were also used as the filtrate source.
3. The test plugs were flushed with heavy oil to near-irreducible water saturation and the initial oil permeability measured. It ranged from 155 to 206 md.
4. The test plugs were then back flushed with ten pore volumes of mud filtrate and statically aged for 24 hours.
5. Step No. 3 was then repeated to measure "return" oil permeability.
6. Initial and final brine saturations were also determined.

We prepared the base muds and furnished the filtrates for the core tests. A 14,000 ml base mud sample was prepared consisting of 10 ppb of prehydrated bentonite in 4.0 percent salt (NaCl) water. A portion was set aside as the base mud sample. To 10,500 ml of remaining base mud was added 45 grams of Drispac<sup>®</sup> Regular Polymer (1.5 ppb) and this sample split equally into three samples, two of which were further treated with typical mid-range concentrations of either Soltex<sup>®</sup> Additive (4.0ppb) or Chrome Free Desco<sup>®</sup> Deflocculant (0.5 ppb). Thus, there were four test muds including the base mud. These muds were filtered through Whatman 50 filter paper at 100-psi pressure (API water loss test) until one liter of filtrate was gathered. This took a considerable length of time for the fluids treated with Drispac Polymer. Mud properties are shown in Table II.

## RESULTS, DISCUSSION AND CONCLUSIONS

The purpose of these tests was to determine if the filtrate from the main constituents of a Drilling Specialties Company, low-solids mud system using Drispac<sup>®</sup> Polymer, Soltex<sup>®</sup> Additive and C.F. Desco<sup>®</sup> Deflocculant would cause formation damage. Ten pore volumes of filtrate were flushed through each core and the change in oil permeability measured. Results of the filtrates from the polymer muds should be compared to that of the control – the core flushed with ten pore volumes of filtrate from the untreated base mud (“Relative” return oil permeability). This was a severe test inasmuch as the water loss of the base mud was about ten times that of the treated muds (71.5 ml vs. ~ 7 ml). In other words, one would expect much less filtrate invasion in a well from the Drispac<sup>®</sup> Polymer muds. Nevertheless, the core test results were essentially the same:

**TABLE I RETURN PERMEABILITIES**

Mud Filtrate From:	Return Oil Permeability %		Brine Saturation %		
	Actual	Relative	Initial	Final	% Increase
Base Mud (BM)	92.7	100	21.3	28.7	35
BM + Drispac <sup>®</sup> Polymer	87.7	95	21.8	30.6	40
BM + Drispac <sup>®</sup> Polymer & Soltex <sup>®</sup> Additive	100.0	108	28.6	34.5	21
BM + Drispac <sup>®</sup> Polymer & C.F. Desco <sup>®</sup> Deflocculant	92.0	99	26.3	37.1	41

Higher final brine saturation would be expected to result in a return oil permeability that is lower than the initial oil permeability measured under the initial conditions of lower brine saturation. The conclusion in the independent laboratory report states: “Thus, test result indicates no appreciable oil permeability reduction resulting from injecting these mud filtrates.”

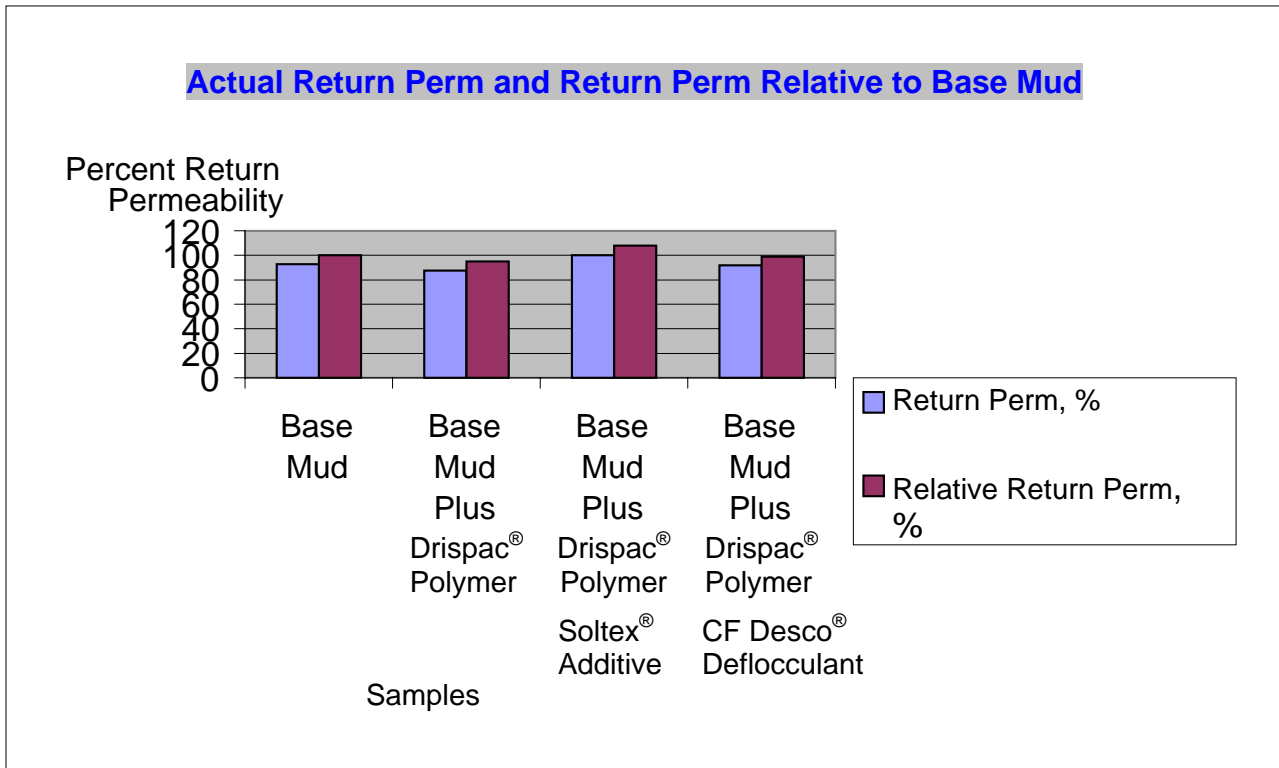
One might conclude from these data that Soltex<sup>®</sup> Additive in the filtrate improves return oil permeability (Table I). However the reader is cautioned that the differences in results could be within experimental error. A more valid conclusion is that there is little difference and no damage from the effect of the various filtrates in the oil permeability of Berea sandstone cores.

**TABLE II MUD PROPERTIES**

Description	Plastic Viscosity cp	Yield Point YP/100 <sup>2</sup> ft	Gel Strengths 10 sec/10 min	Water Loss ml/30 min
Base Mud (BM)*	2	4	3/4	71.5
BM + 1.5 ppb Drispac <sup>®</sup> Reg Polymer	17	9	1/3	7.8
BM + 1.5 ppb Drispac <sup>®</sup> Reg Polymer + 4.0 ppb Soltex <sup>®</sup> Additive	20	2	0/2	7.3
BM + 1.5 ppb Drispac <sup>®</sup> + 0.5 ppb C.F. Desco <sup>®</sup> Deflocculant	16	7	0/0	6.7

- Base mud consist of 10 ppb prehydrated bentonite in 4.0 percent NaCl water. Four hundred grams bentonite added to 13, 660 ml deionized water, stirred for one hour at high shear and aged, followed by the addition of 570 grams NaCl and additional stirring.

**RETURN OIL PERMEABILITY OF BEREA SANDSTONE CORES  
FLUSHED WITH 10 PORE VOLUMES OF MUD FILTERATE  
(BASE MUD IS 10 PPB PREHYDRATED BENTONITE IN 4% NaCl water)**



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