CASE HISTORIES DEMONSTRATE PROPPANT FLOWBACK CONTROL REDUCES POST STIMULATION COSTS BY OVER 60%

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ABSTRACT

Wolfcamp producers in Howard County, Texas have to be fracture stimulated to be economical. However, the low frac gradient and bottomhole reservoir pressures make formation closure slow and proppant retention in the created fracture during initial production difficult. This has led to many of the wells requiring wellbore cleanouts and in some cases multiple cleanouts. Various methods are available to overcome this problem.

Methods of proppant flowback control vary from materials added to a proppant pack to provide physical stability, forced closure techniques, tail-in with curable resin coated proppants, etc. The most extensively used method in most areas of West Texas is the tail-in with curable resin coated proppant. Resin coated proppants consist of a substrate of sand or ceramic particle coated with multi-layers of phenolic and other specialty resins. These resins provide grain to grain bonding and additional particle strength.

Presented are case histories of Wolfcamp producers fracture treated using 20/40 Mesh, White Sand and using a tail-in of curable resin coated sand comprising 15% of total proppant pumped. The case histories show that use of a resin coated proppant added an additional $25000 to $30000 to treatment costs, however, a single wellbore cleanout of sand costs $24000 to $27000. Making the cost of running a resin coated proppant tail-in 'break-even". The case histories show that wells requiring more than one clean out, may result in costs of over $80000. This means that usage of proppant flow back control could save $50000 to $55000 per well (62.5 to 68.75%).

INTRODUCTION

The Wolfcamp formation in Howard County, Texas is primarily a dirty limestone (Table 1) with some sand stringers embedded within the production interval.[1] The Wolfcamp formed in the Permian Period of the Paleozoic era which stems back about 235 million years ago and is classified as a structural trap. It is an alluvial fan carbonate debris flow, which originated from the eastern shelf of the Permian Basin and is detrital clastic sediment. The average porosity range is 9 to 13% with the permeability +/- 20 md.

The production interval is usually from 7,800 to 8,300 feet depending on the elevation in that part of the county. The average bottom hole static temperature is around 150 °F and has subnormal bottom hole pressures around 1,500 to 2,000 psi with a fracture gradient around .62 psi/ft. Oil is the primary hydrocarbon produced with some gas from a solution gas expansion reservoir. Typical production is 70 BOPD, 14 MCFD and 3 BWPD.

For these wells to be economical they must be stimulated using a propped fracturing technique. This type of treatment and the resultant production success depends on the proppant concentration in pounds per square foot of created fracture surface area to close to that designed through the use of fracture models.[2] Many times these models are used to simulate various designs to achieve the best Net Present Value to optimize the pumped quantities. Failure to achieve placement of these proppant schedules or the flowback of the placed proppant quantity results in a less than optimum state and therefore poorer production response. Various methods over the years have been developed for the control of proppant flowback, one of which is the use of a resin coated material that once placed sets up in a rigid network to prevent the proppant pack movement.[3] An additional benefit to such a method of treatment is that the cleanup of wells with proppant flowback issues is eliminated, creating a significant operational cost savings.

This paper presents the results of a study of wells treated with a resin coated proppant to control proppant flowback. It compares the cost differential of using this product to wellbore cleanouts.

CASE STUDY

This study looks at 8 wells in the Signal Peak Field of Howard County, Texas (Figures 1 and 2). The first 2 wells are listed in Table 2 and were fracture treated using approximately 415,00 pounds of Ottawa 20/40 sand on average, carried in a 70 quality carbon dioxide foamed 30 pound gelled water system. Both of these wells required the wellbores to be cleaned out within 1 to 3 months after the well had flowed back the load water. These initial cleanouts with coiled tubing cost approximately $25,850 average per well. However, the second well required subsequent cleanouts on two more occasions after the well had been producing, resulting in additional costs of $14,650 and $38,400 respectively. These cleanouts are noted on the production graph for this well, Figure 3.

The next 6 wells listed in Table 3 were all fracture treated using the same procedure as above for the first 2 wells, with the exception that each treatment was tailed in with a curable resin coated proppant at approximately 15% of the total proppant pumped (approximately 53,951 pounds). In all 6 of these cases no wellbore cleanouts have been required to date. The oldest of these has been producing nearly 2 years, Figure 4. A comparison of the first twenty months of production of the Martin 20 #1, which required 2 wellbore cleanouts during this time period, to the Martin 29 #1 and #2, which required no cleanouts, shows that the latter produced approximately 1.4 times the oil and 1.2 times the gas.

CONCLUSIONS

1. Curable resin coated proppants can prevent proppant flowback.
2. Wells which exhibit proppant flowback can have production losses and require expensive wellbore cleanouts.

REFERENCES

1. BJ Services Internal Report: "Analysis of Rotary Sidewall Coreplugs," report 07-03-0233, April 2007, by Vestal, L.
2. Huffman, C.H., Harkrider, J.D. and Thompson, R.S.: "Fracture Stimulation Treatment Design Optimization: What Can NPV vs X_f Plot Tell Us?," paper SPE 36575 presented at the 1996 SPE Annual Technical Conference and Exhibition, Denver, Oct. 6-9.
3. Johnson, D.E., McWilliams, J.L., Nelson, S.G. and Blount, J.S.: "Proppant Flowback Prevention – A New Technology for Low BHST Applications," paper SPE 97161 presented at the 2005 SPE Annual Technical Conference and Exhibition, Dallas, Oct. 9-12.

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Table 1
Typical Mineralogy

Depth, ft	Quartz, %	Feldspar, %	Carbonate, %	Clays, %
8001	20	5	65	9
8052	4	3	92	Trace
8290	31	3	13	52
8306	33	3	3	60

Table 2
Wells treated without Curable Resin Coated Proppant

Well No.	Perforations, ft	20/40 Ottawa, lbs	No. Cleanouts	Cleanout Cost, $	Proppant Fill, lbs
Bond 21 #3	7804 - 7994	339000	1	24300	3756
Martin 20 #1	7910 - 8088	490540	3	80450	6311
			Average Cleanout Cost	$26187.50	

Table 3 Wells treated using Curable Resin Coated Proppant					
Well No.	Perforations, ft	20/40 Ottawa, lbs	20/40 Resin Coated, lbs	Rate, BPM	STP, psi
Martin 29 #1	7943 – 8121	310000	27100	46	2800
Martin 29 #2	7951 – 8189	306800	55666	47.6	2560
Marchbanks 28 #1	7883 – 8069	308020	53252	47	3200
Martin 29 #3	7987 – 8214	308020	52586	47	2800
Martin 29 #4	7943 - 7986	308020	54250	47.8	2938
Bond 21 #1	7899 - 7952	306000	54000	50	2600

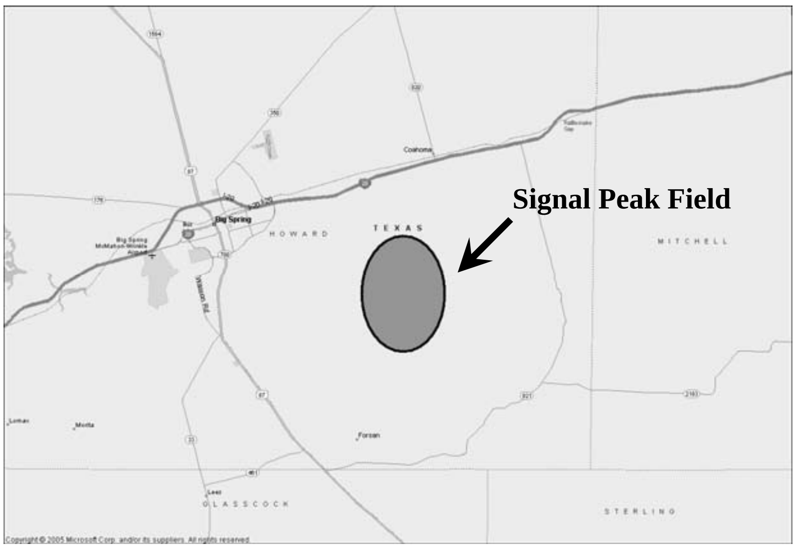

Figure 1 – Signal Peak Field

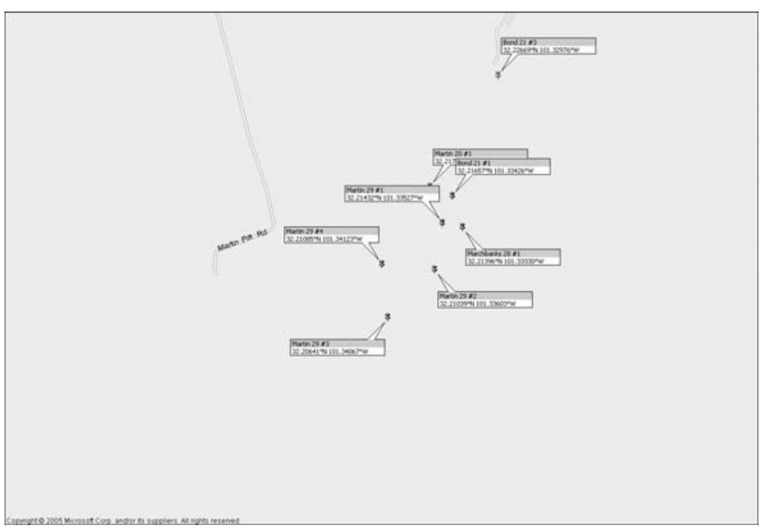

Figure 2 –Well Location Details

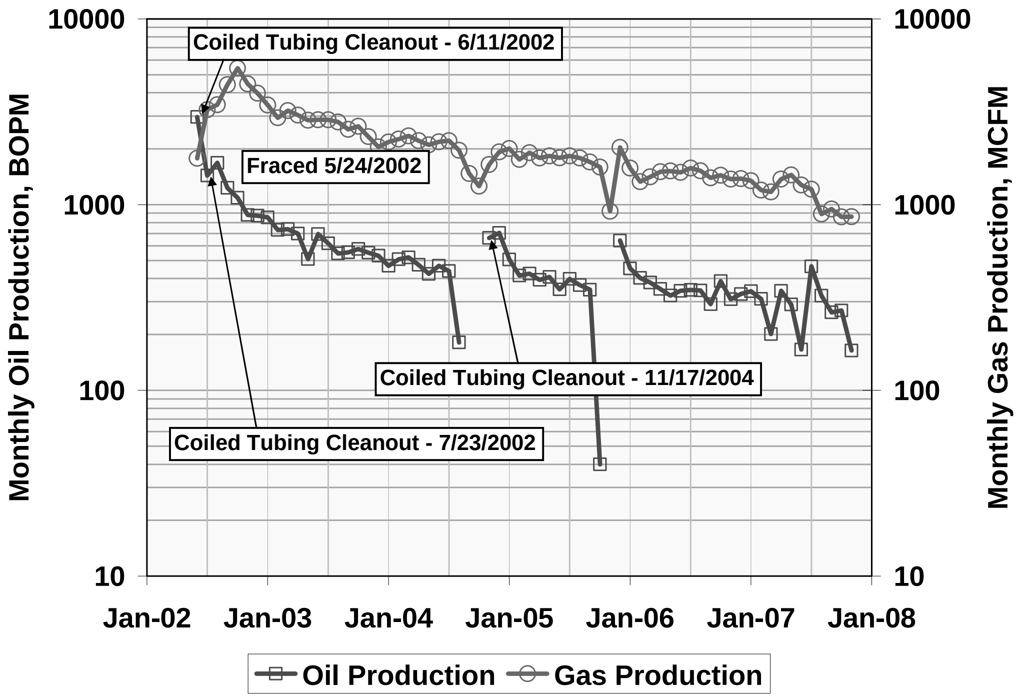

Figure 3 – Production history with wellbore cleanouts labeled for the Martin 20 #1.

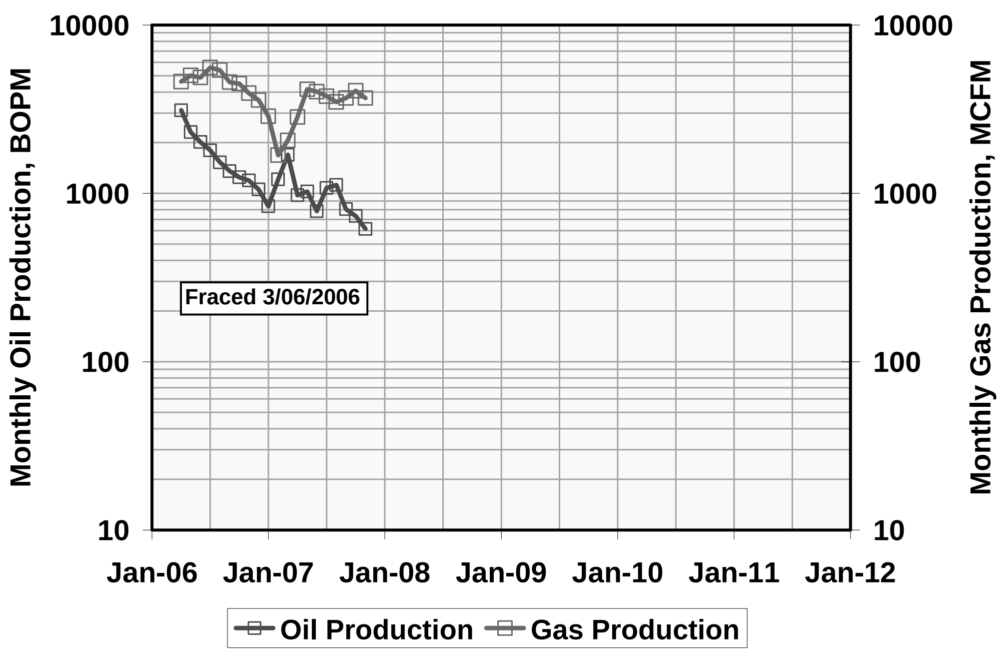

Figure 4 – Production history for the Martin 29 #1