

NUFIT™ SERVICE – SOUTH TEXAS

OPERATOR CHALLENGE:

A South Texas operator was faced with evaluating the completion of a well with **multiple Wilcox intervals**. In the past, the operator had completed all the sands individually and commingled production, yielding variable economic results. The operator was often left wondering which interval(s) contributed the majority of the production. Each of the 4 Wilcox intervals in the newest well appeared similar based on conventional logging responses (Fig. 1). However, the operator knew from past experience in the field that **these intervals would likely not have similar post-completion performance**. A means to **differentiate the intervals based on quality prior to fracturing** was needed.

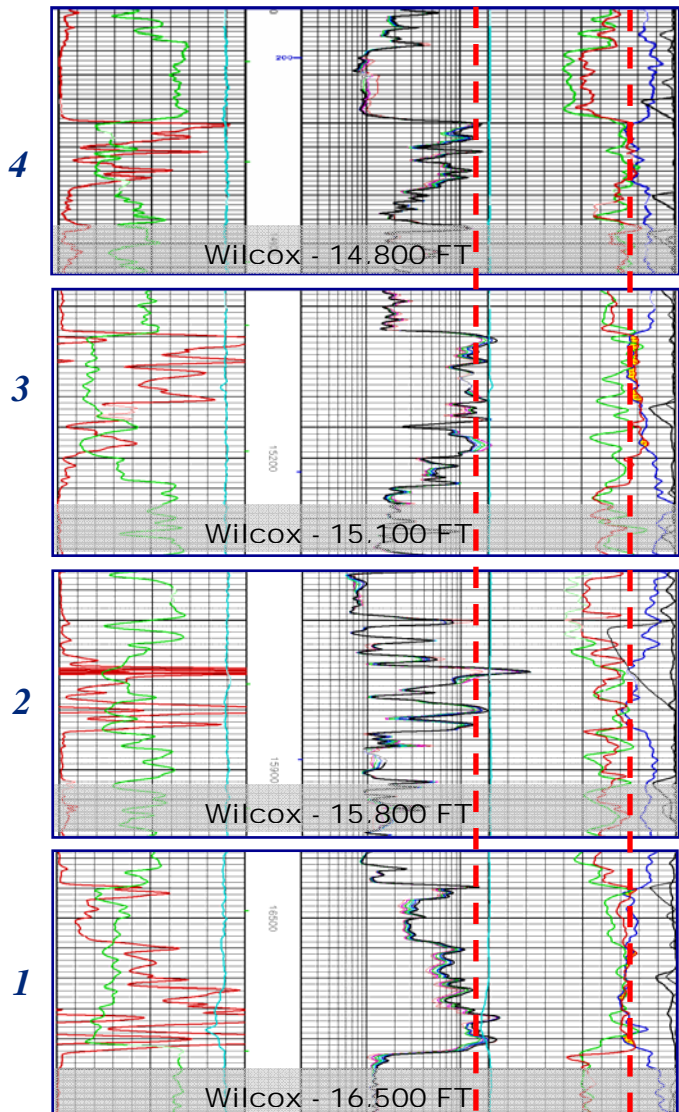


Figure 1: Conventional log data for four Wilcox intervals in the new well.

NUTECH SOLUTION:

NuTech Energy Alliance applied its **NuFIT™ (NuTech Fracture Injection Test) process** to the data set to properly evaluate each Wilcox interval and assist the operator in making an informed decision. Similar injections were designed and pumped in each of the intervals in place of the breakdown. After each injection, surface pressure data was recorded for a 24 hour shut-in period. This extended shut-in is necessary in order to obtain enough data to properly evaluate the reservoir properties.

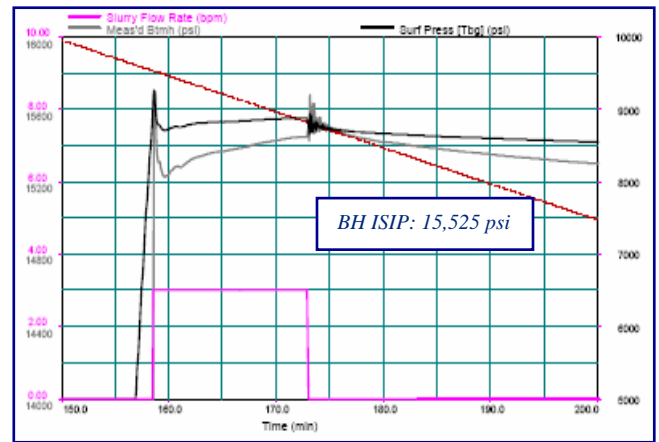


Figure 2: Job data plot for Stage #2, the 15,800 Ft Wilcox injection.

THE RESULTS:

From the results of each injection test (Fig. 3), it was determined that the intervals have **similar fracture and closure gradients**. All four intervals experienced significant leak-off in the first two hours of shut-in. This data alone, typical of what could be obtained from an FET, would lead one to believe that the intervals are, in fact, quite similar. *Which intervals would you complete?*

Stage	1	2	3	4
Wilcox Interval:	16,500 FT	15,800 FT	15,100 FT	14,800 FT
Frac Gradient:	0.93 psi/ft	0.98 psi/ft	0.97 psi/ft	0.96 psi/ft
Closure Gradient:	0.903 psi/ft	0.946 psi/ft	0.919 psi/ft	0.911 psi/ft
Initial Leak-off (2 hr):	607 psi	478 psi	615 psi	647 psi

Figure 3: Based on this data alone, which intervals would you complete?

The NuFIT analysis provided additional data about the reservoir, which illustrated the true **differences in the intervals**. As indicated below (Fig. 4), the first stage closed very quickly with an **effective kh of 62.5 mD-ft** (Fig. 5). This first stage was stimulated, and a post-frac **IP of 6 MMCFPD at 10,800 psi FCP** was observed.

Stage	1	2	3	4
Wilcox Interval:	16,500 FT	15,800 FT	15,100 FT	14,800 FT
Pore Pressure:	14,859 psi	14,578 psi	13,581 psi	12,981 psi
Closure Time:	3.8 min	2 hrs	7 hrs 49 min	3 hrs 24 min
Permeability Feet:	62.5 mD ft	1.6 mD ft	1.2 mD ft (max est)	0.4 mD ft (max est)

Figure 4: Comparison of NuFIT analysis results for all four Wilcox intervals.

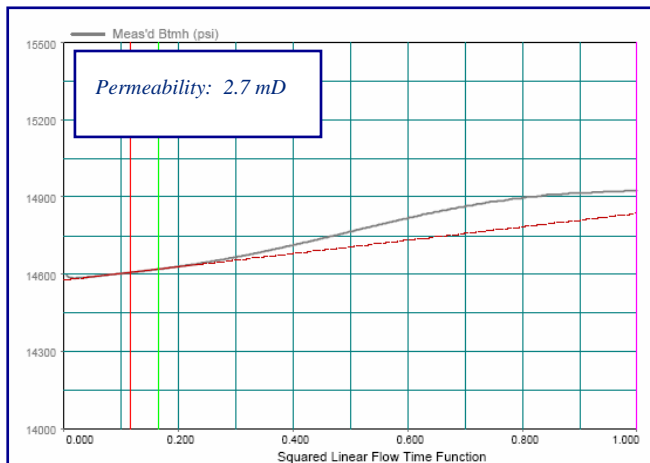


Figure 5: After closure analysis for Stage #1, the 16,500 FT Wilcox interval.

The second stage had a closure time of 2 hours, with a **substantially lower effective kh of 1.6 mD-ft**. This second stage was also stimulated and a **post-frac IP of 2 MMCFPD at 5,000 psi FCP** was observed. It should also be noted that this rate was declining quickly and was deemed a **marginally commercial completion** by the operator.

The third and fourth stages had much longer closure times of 7.8 hours (Fig. 6) and 3.4 hours, respectively. However, both zones had events happen prior to closure that would have been misdiagnosed as formation closure without the benefit of the longer shut-in time. Stage 3 has an effective kh of 1.2 mD-ft, while Stage 4 has an effective kh of 0.4 mD-ft. Both zones have an **average permeability of less than 0.05 mD**. Based on the results of the NuFIT analysis, the operator **elected not to stimulate either of these intervals** with an expensive massive hydraulic fracturing operation.

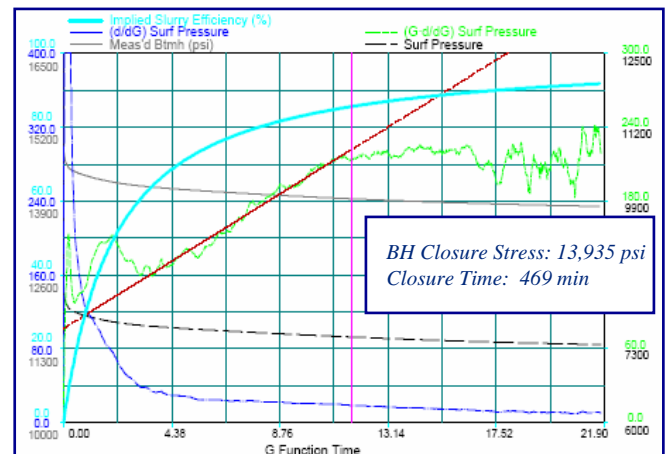


Figure 6: G-function plot indicating closure for Stage #3, the 15,100 Ft Wilcox interval.

CONCLUSIONS:

By utilizing the NuFIT analysis, the operator was able to identify the true characteristics of each interval. The **four Wilcox intervals**, which initially appeared to be of similar quality, were actually **shown to be quite different**. The NuFIT analysis provided **direct formation measurements** from each interval **prior to stimulation**, allowing the operator to properly evaluate the economics of each completion. By implementing the test into the breakdown, several days prior to the scheduled stimulation treatment, **time is allowed to tailor the stimulation treatments to match each zone's characteristics**, or, as in this case, to abort the treatment altogether. As a result, the operator avoided two unnecessary and costly stimulation treatments, **saving on the order of \$600,000**.

For more information about how NuFIT and NuLOOK TEXTURAL VISION can impact your bottom line, contact your local NUTECH representative.