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Improving Well Productivity and Profitability in the Bakken—A Summary of Our Experiences Drilling, Stimulating, and Operating Horizontal Wells

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Abstract

This case study will summarize the lessons learned during the stimulation and operation of horizontal laterals completed in the Middle Bakken formation of North Dakota and Montana. This paper will compare the production histories of these wells to offset wells completed with other techniques to evaluate best industry practices. Insight will be shared as to the effect of lateral length, wellbore azimuth and stimulation design on well production and overall well economics.

The Bakken formation of the Williston Basin is undergoing significant development in Manitoba, Saskatchewan, Montana, and North Dakota. Numerous operators are active in the area, with a wide variety of development approaches. The industry has not yet reached consensus on optimal drilling and stimulation strategies.

Results indicate significant progress in improving well production, while reducing the drilled lateral length and the treatment size. Efforts to improve diversion and optimize proppant type and size appear to provide more effective fracture treatments, while eliminating production problems related to the flowback of frac sand.

This paper will provide the following benefits to readers:

- Operators in the Bakken have experienced significant problems with flowback of frac sand, requiring frequent pump changes, conservative production strategies, and expensive cleanouts prior to restimulation. This paper will describe the steps taken to eliminate proppant flowback into the wellbore and the estimated economic impact.

- This paper will provide a case study comparing the production from wells completed with a variety of strategies.
- The results suggest many current laterals drilled in the Bakken are ineffectively stimulated and demonstrate that significant increases in well profitability are possible with more optimized treatments.
- Optimizing fracture treatment designs for horizontal wells requires an estimation of the fracture geometry – particularly a description of the intersection between the wellbore and the fracture. A fracture treatment designed under the assumption of a longitudinal frac will be entirely inadequate if the actual fracture propagates in a transverse orientation. This paper will describe our understanding of the fracture geometry and how that has affected treatment designs.

Introduction

The Middle Bakken play of the Williston Basin has generated significant interest, with over 45 companies completing wells in North Dakota and Montana and additional development activity accelerating in Canada (**Figure 1**).

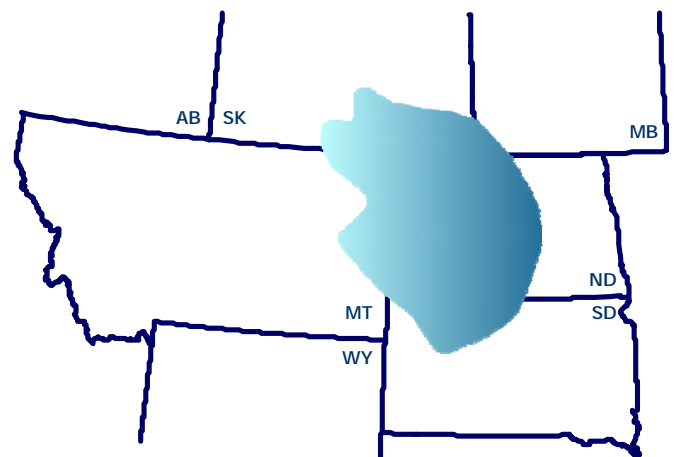


Figure 1 – Map of Williston Basin¹ (courtesy of Julie LeFever)

The Bakken formation comprises three members-- a lower and an upper shale, and a lithologically variable middle member which is the target of the current development. In North Dakota, this middle member typically consists of gray interbedded siltstones and sandstones and can reach 85 feet thick at depths of approximately 9,500 to 11,000 ft. Lesser