Texas Panhandle Granite Wash Formation: Horizontal Development Solutions

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Abstract

The Granite Wash formation in the Texas Panhandle is an active horizontal drilling trend where high initial gas rates combined with rich condensate yields create a rewarding investment opportunity for operators. The Granite Wash formation has been a drilling target for over 30 years but development accelerated rapidly after November 2004 when 20-acre downspacing was approved in the Buffalo Wallow field. In the years 2004-2008, vertical infill development was actively pursued with operators using an "assembly line" methodology that concentrated on cost reduction to achieve economic success. When soft gas prices made vertical wells economically challenging, operators turned to horizontal wells to improve the trend's economics. Previous papers [Edwards (2010), Ingram (2006)] have explored optimizing completion technology in the Granite Wash so this paper's objective is to find solutions to questions about initial production, rate decline, and liquid yields by examining the reservoir and fluid properties. The paper uses techniques developed for generalized tight gas sand reservoirs and applies Granite Wash formation data to create focused solutions. The data presented show the horizontal wells' high initial rates can be correlated to the offset vertical well performance and the initial production declines are defined by linear flow. In addition, a technique for optimizing the number of completion stages is presented and the condensate yields are explained using an Equation of State (EoS).

Introduction

The Granite Wash formation is a complex mineralogy stacked-pay gas-condensate reservoir located on the Texas-Oklahoma border. This play was originally drilled with vertical wells to contact as many of the stacked-pay horizons as possible, with emphasis placed on reduction of well cost. Fig. 1 shows the vertical and horizontal completions by year in Hemphill and Wheeler County, Texas along with the Henry Hub natural gas price (2011). Vertical well development accelerated rapidly from 2003 through 2008 as 20-acre downspacing was approved. Vertical well counts dropped from 472 in 2008 to 129 in 2009 as a result of the drop in gas price. Advances in horizontal drilling and completions however, have made single horizon laterals the preferred development option due to the ability to drill into preferential zones. As a result, horizontal well counts have increased from one in 2005 to 159 in 2010. The current completion technique for these wells is to perform a large multi-stage hydraulic frac in order to connect as much pay as possible. Laterals completed in this manner typically have high initial gas production rates and high liquid yields combining for total initial production rates as high as 45 MMcfE/D. This paper uses readily available data such as production logs and surface fluid analysis to explain and optimize initial production rates and decline, completion design, and liquid yield.