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Sakhalin-1: Chayvo Field Subsurface Development and Learnings, Sakhalin Island, Russia

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Abstract

The Exxon Neftegas Limited (ENL), an ExxonMobil affiliate, operated Sakhalin-1 Chayvo field is located off the northeast coast of Sakhalin Island, Russia in water depths of 15-25 meters.¹ Drilling began in 2003 and production commenced in 2005. As of January 2009, thirty-nine extended reach wells have been drilled and the field has been on production for over three years. Most initial reservoir assumptions have been confirmed and some have been modified. This paper describes the evolution of the reservoir description and the highly successful subsurface development plan for the Chayvo Field.

The major oil reservoir in the Chayvo Field is Zone XVII/XVIII. This sandstone reservoir was deposited in a shallow near shore marine environment. The reservoir is characterized by stacked prograding highstand delta clinoforms. Production behaviour indicates a high degree of lateral connectivity, something that was an uncertainty prior to development.

Zone XVII/XVIII has a ~100 meter thick oil rim overlain by a large gas cap and underlain by an extensive aquifer. The initial development plan called for the reservoir to be developed with extended reach horizontal drill wells and supported by high angle gas injection wells. The completion design commingled all the net pay in zones XVII/XVIII. Typical zone XVII/XVIII horizontal completion intervals are 2000 - 3000 meters in length. Inflow profiles were controlled by selective perforations in cased and cemented completions.

The initial completion design encountered problems while cementing the production liners. Consequently, the completion design was changed to open hole pre-perforated liners and sand screens with the production profile controlled by inflow control devices (ICD's) and external swell packers.

Oil production was generally consistent with pre-development forecasts. Because of the large overlying gas cap, gas-oil ratios (GOR) were expected to increase early during field life. However, the GOR in the field increased faster than forecast. A multi-functional team addressed this issue to understand the reasons for this increase and develop mitigating actions. Based on the available data, the team was able to develop most likely models to explain the GOR behaviour. As a result, completion interval optimization, a rigorous reservoir management program of choking and cycling wells, and drilling some additional production wells has mitigated the GOR performance.

The improved understanding of Zone XVII/XVIII was also possible because of a thorough data acquisition program that included MWD logs, permanent downhole pressure and temperature gauges, obtaining "pressures while drilling" in selected wells, and a key well production logging program.

Introduction

Early production from the Chayvo Phase-1 oil development began in 2005 from an interim processing facility (IPF) at rates of up to 50,000 barrels per day. Full production was initiated in December 2006 ramping up to full field plateau by March 2007 of 250,000 barrels per day. As of year end 2008, over 181 million barrels of crude and condensate have been produced. Production rates, as expected, have declined somewhat from that plateau, but have been maintained at about the 200,000 barrel per day range due to a combination of selective drilling of additional wells and careful reservoir management.

¹ Exxon Mobil Corporation has numerous affiliates, many with names that include ExxonMobil and Exxon. For convenience and simplicity in this presentation, those terms and terms like corporation, company, our, we and its are sometimes used as abbreviated references to specific affiliates or affiliate groups. Abbreviated references describing global or regional operational organizations and global or regional business lines are also sometimes used for convenience and simplicity.