TECH TRANSFER IS CRITICAL FOR RESERVOIR MANAGEMENT

BOTTOM LINE

By sharing successful reservoir management approaches, including reservoir descriptive techniques and methods for applying recovery technologies, operators of turbidite reservoirs in California can increase their production and reduce costs. All operators benefit by the decreased "learning curve" for recovering oil resources remaining in these reservoirs.

PROBLEM ADDRESSED

Turbidite reservoirs in California (e.g., those in the Wilmington, Torrance, Huntington Beach, Elk Hills-Stevens, Ventura, Yowlumne, Paloma, and Carpinteria fields) are geologically complex. Low recoveries of less than 20% of original oil-in-place (OOIP) from primary production methods are common. As a result, these reservoirs, which are increasingly being operated by independents, have substantial amounts of OOIP remaining. A better understanding of reservoir management techniques and careful applications of technology are needed to economically recover the remaining resource. However, operators have been left on their own to develop and select the appropriate technologies and techniques to employ. A practice of sharing critical information on reservoir management is needed.

KEY WORDS:
Reservoir Management
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Waterflooding
Drilling Practices
Technology Transfer

TECHNOLOGY OVERVIEW

Efficient and effective reservoir management is essential for turbidite reservoirs. It requires a development plan that looks at each reservoir in a field to assess its individual performance and the prevailing and anticipated impacts of new technologies and changing economics. The plan, which should be reviewed or renewed every three to five years, includes drilling and production issues, surface facilities, monitoring and operational concerns, and economic evaluation components.

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Because turbidite reservoirs have a number of common characteristics and problems, cooperative efforts to share successful reservoir management practices should benefit all operators. Detailed descriptions of a reservoir's internal structure and stratigraphy are central to reservoir management plans.

Turbidite reservoirs vary in size, morphology, and lithology, and are characterized by a commingling of water-bearing and oil-bearing zones. These elements often lead to premature abandonment of reservoir zones because of high water cuts.

A detailed reservoir description addresses many important factors, including facies control on productivity, distribution of heterogeneities in grain size and permeability, and the type and distribution of clays present. These factors determine where the remaining oil-in-place is located and will aid in selecting appropriate programs for recompletions, drilling, or improved oil recovery implementation.

Optimally drilled wells cost an average of 22% less than the average well. By choosing appropriate technologies and applying them with know-how, turbidite well operators can minimize problems and increase rates of penetration. In any region, however, a learning curve must be overcome before success can be

consistently achieved. By sharing successful drilling and completion practices, both operators and suppliers of drilling services will benefit.

LESSONS LEARNED

In general, reservoir management practices are poorly understood. However, operators who learn the basic techniques of formulating reservoir development plans should improve overall profitability.

In a region with numerous reservoirs of similar depositional origin, such as the turbidite reservoirs in California, it is beneficial for operators to share their reservoir management experiences (both successes or failures). This process of technology transfer between and among operators can benefit all by shortening the trial and error process in learning best practices.

FIELD RESULTS

At the Carpinteria field, 3-D geological modeling and reservoir simulation methods were used to target reservoir intervals to be addressed by workovers, redrills, and sidetracks. A cooperative arrangement with the provider of the geological modeling software enabled two independents to share a software license over the Internet, making the sophisticated software affordable and cost-effective for both operators.

The study at Carpinteria yielded two new vertical wells accompanied by modern logging suites and four horizontal redrills. Horizontal wells used measurement while drilling technologies and geosteering, coupled with one-trip whipstock systems to minimize rig time and completion costs. Slotted liners helped reduce sand problems characteristic of turbidite reservoirs. In the operator's part of the field, production increased by 850 barrels of oil per day (bopd). (Total pre-project production for the entire field was 2,700 bopd.)

At the Huntington Beach field, an independent operator re-evaluated a plan developed more than a decade ago by a previous major-oil-company operator and successfully implemented a waterflood. The key elements of the plan were verified and appropriate modifications were made. Eighteen producing wells and six injection wells now produce approximately 2,500 bopd. This represents a doubling of production from the operator's properties in the field.

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