AP44

Production Optimisation Through Simplification of the Well Patterns in a Fractured Carbonate Reservoir

M Darke* (Petroleum Development Oman), E. Follows (Petroleum Development Oman), J. Saluja (Petroleum Development Oman), M. Lawati (Petroleum Development Oman), K. Shuali (Petroleum Development Oman) & A. Busaidi (Petroleum Development Oman)

SUMMARY

In April 1967, this giant Field provided Oman's and Petroleum Development Oman (PDO) first oil production. Production is from the fractured Cretaceous Natih Limestone Formation. The complexly fractured reservoir was developed initially under depletion. With pressure decline there was a short period of water injection, prior to the establishment of a Gas Oil Gravity Drainage (GOGD) process in 1975. The development concept is essentially a fractured oil rim production supported by gas injection.

GOGD is both a relatively benign and stable process, which has served PDO for forty years and the expectation is that the field will continue to produce for another forty years.

Although benign, optimisation of the development has been a both necessary and a continuous process. The development history has been one to deliver wells to a final oil rim position, at or near the Oil Water Contact, in each of the producing GOGD horizons. Development of the Natih A and C reservoirs was essentially seen as broadly complete by the late 1990's with few new wells drilled post 1998.

By 2004 however, these developments consisted an ad hoc mixture of vertical and horizontal wells, short radius sidetracks and coiled tubing laterals. Well density within the oil rim was high, with a significant percentage of production from an increasing number of intermittent producers. Overall the average well and field GOR's was increasing.

In this context, production optimisation projects were initiated which included conventional WRM activities as well as seeking new opportunities.

In attempting to establish the long term future development, there was a significant creative tension between those who sought to maximise the value of existing wells versus essentially a new well redevelopment strategy. New wells were fairly challenged, as to whether, with clear interference, they actually added incremental reserves.

A case study illustrates how the internal heterogeneity (both fracture and lithology) of the sub reservoirs was exploited. Production has been stabilised with valuable incremental oil at a much lower GOR.

While operating changes played no small part in this production increase, there has been a 42% (Trough to Peak) improvement in production between August 2006 and August 2009. Operating GOR has decrease from 800 to 450. The new developments provide not less than 25% of that production improvement, and also contribute to additional gains through improved efficiency. Production has been stable for almost one year at rates last seen in 2003.

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