ABSTRACT

A Numerical Model Study of Gravitational Effects and Production Rate on Solution Gas Drive Performance of Oil Reservoirs. (May 1969)

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Results are presented of an investigation of the effect of oil production rate on solution gas drive performance of a thin, horizontal reservoir. Numerical model simulation of a producing reservoir included the effects of gravity and capillary forces. This work is concerned with performance of the reservoir free of effects of selective withdrawal within producing wells. It was found by comparison of results from one and two dimensional models that one dimensional models were entirely adequate for performance calculations for the conditions of the study. At very high production rates, gravitational forces have a negligible effect on solution gas drive performance. At low production rates, however, vertical segregation of oil and gas occurs throughout the reservoir. This segregation has a very marked effect on the pressure and gas-oil ratio performance as well as ultimate oil production. Performance of the model was

simulated for a five hundred fold range of producing rates. Up to fifty percent change in ultimate oil production was observed over this change of producing rate; lower rates of production yielding lower oil recovery to depletion.

Scaling theory, confirmed by simulation runs shows that, for a given fluid system, sensitivity to producing rate is controlled by the ratio of production rate to vertical permeability of the reservoir. Thus, simulation results using a range of rates and one permeability can be extended to represent performance for a range of permeabilities. Such extension shows that, for the range of producing rates and permeabilities of natural oil reservoirs, significant variation in solution gas drive oil recovery will result from different production rates.