ABSTRACT

A Mathematical Model Considering The Effects Of Channelling For Predicting Thermal Oil Recovery In A Stratified Reservoir

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This thesis presents a mathematical model - "MARX. FOR" that describes a new approach to predictive oil production performance by enhanced recovery using steam injection processes. It incorporates the flow mechanism of channelling due to vertical permeability variation throughout a porous medium.

Channelling is now treated as a productive preheating mechanism to the overburden and underburden strata during movement of the steam fronts in a steam drive process.

The analysis is based on a computer programme in Fortran IV Language that considers two (2) extreme cases, a homogeneous stratified reservoir and a heterogeneous stratified reservoir. The programme uses the basic heat balance equations by J.W. Marx and R.H. Langenheim and also the method of H. Dykstra and R.L. Parsons.

The results deal with the effect of layer thickness and heat loss relationships on the basis of Marx-Langenheim heat balance equation; and the credibility of the model for future predictive production performance.

The Jeff-Jones model is used as the reference indicator since accurate documentation of past steamflood projects with relevant reservoir parameters are not available. The Jeff-Jones model is modified also and is named "Modified Jeff-Jones" in this thesis. "Modified Jeff-Jones" shows the limitation in the conventional Jeff-Jones when stratification is applied. Comparisons are shown using all three (3) models.

One major conclusion drawn is that the heterogeneous reservoirs have greater overall recovery efficiencies due to preheating in the model "MARX. FOR". However the degree of confidence placed in the results is heavily dependent on the vertical permeability variation and the degree of stratification in the particular case considered.

The final conclusion drawn is that sensitivity should be incorporated in decision analysis prior to implementation of large scale projects based on these predictive models.

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