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Research on Daqing Changyuan Peripheral Oilfield Fracturing Network Candidate Selection Standard

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In hydraulic fracturing process, if fracture extension net pressure is greater than the difference of two horizontal stresses at both ends of the fracture and greater than the sum of the tensile strength at both side of rock soil, a main fracture will be converted into multiple split fractures which are considered as fracture network, a system formed by such interleaving. Technology which is used to realize such fracture network effect is hereby called as "fracture network" fracturing technique.

Improved development result can't be achieved due to bad effects caused by poor reservoir property and exploitation, refracturing and other conventional measures conducted for tight reservoir in peripheral oilfield of Daqing placanticline in this year. Hence, "fracture network" fracturing technique research and field test were carried out from 2011 to 2014 and the overall result was good. "Fracture network" fracturing technology is an emerging technology, thus, a systematic study on standard of candidate selection for petroleum reservoir engineering under applicable process condition at present is still unavailable. This also leads to various differences made from test well results. Therefore, it is necessary to carry out researches on the standard of well and formation selection with "fracture network" fracturing technique.

1 Impact of Static Parameters on "Fracture Network" Fracturing Effect

Impact of static parameters on fracturing network effect could be determined through researches on reservoir's porosity, permeability, oil saturation, development scale, formation capacity (kh) and other aspects.

1.1 Impact of Formation Capacity on "fracture network" fracturing Effect

By effect evaluation conducted to 93 fracturing network well in 2011~2014, it was found that the impact of formation capacity has a great impact on fracturing network effect. Greater in kh value, better effect acquired. When kh value is lower than 6, a relatively poor effect is caused to the fracturing network.

1.2 Impact of Oil Saturation on "fracture network" fracturing Effect

A relationship drawing between oil saturation and daily oil increase at different stages is made. With the increase of oil saturation, the effectiveness of measures could be improved gradually.

1.3 Impact of Sands development Scale on "fracture network" fracturing Effect

Study on impact of sands development scale on fracturing effect could be conducted through sand body distribution width and well point sand body development thickness. As the development width is greater than the number of 300m of sand body increase, the effect could become better.

2 Impact of Dynamic Parameters on Fracturing Effect

Researches shall be focused, before measures are taken, on the oil situation, connectivity status, water injection status of connected wells and formation pressure recovery level of the service shaft to determine the impact of dynamic parameters on fracturing effect.

2.1 Impact of cumulative oil production on fracturing effect

The implementation of "fracture network" fracturing well at Grape-A Block is studied. The result shows that the poor measure effect is caused with the increase of cumulative oil production. According to the experimental well's exploration status, a relevant formula is adopted to

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calculate the recovery rate from each test well before measure is conducted to acquire the remaining recoverable reserves. To analyze the impact of remaining recoverable reserves brought to the fracturing effect, a relationship chart is made between remaining recoverable reserves and fracturing effect. It can be found that the fracturing effect could become better with the increase of the remaining recoverable reserves from a single well.

2.2 Impact of water content on "fracture network" fracturing effect

The comprehensive water cut classification is carried out to 93 wells prior the measure, among with 76 medium and small wells contain lower than 80% water content and 17 wells contain more than 80% water content. It is clear from post-measure result that wells containing more than 80% water content have a relatively poor effect.

2.3 Impact of Formation Pressure Recovery Level on "fracture network" fracturing Effect

A relationship chart can be made between cumulative oil increase and formation pressure recovery level prior to the measure according to pressure measurement data conducted to service shaft. It could be found that the measure effect has a significantly increase with the growth of the formation pressure recovery level.

3 Research on the Standard of Well and Formation Selection with "Fracture Network" Fracturing Technique

3.1 Evaluation parameter optimization principle

To make sure reasonable parameters assessment and establish evaluation parameter optimization principle to contribute exact physical meanings and reservoir quality differences reflection, as well as the quantitative characterization to the parameters. According to the evaluation parameter optimization principle, cluster analysis method is adopted to preferably select eight evaluation parameters including formation factor (kh), oil saturation, pre-pressure water content, remaining recoverable reserves and others.

3.2 Comprehensive evaluation of grey correlation method

Comprehensive evaluation of grey correlation method is conducted to the eight assessment parameters after optimized assessment is made. Construction of eight parameters to grey analysis of sub-sequence matrix X and mother sequence matrix Y of oil increment to 93 wells. Gray correlation analysis is adopted to calculate the relationship Lt (I, o) between each factor and oil increment,determin the relevance level of all factors, get the weight coefficient ai of all factors and calculate the single well comprehensive evaluation index by using weight. Then, a comprehensive evaluation index cumulative probability analysis is carried out to overall determine that the index scope of R should be greater than 0.26.

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