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High Water Cut Period Oilfield Fine Water Flooding Development Countermeasures

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Abstract: The current oil field production decline rate is high and stable yield face a serious challenge. Oil fields in recent years do a lot of work in technology and management. Especially ,under the premise of zonal injection gradually expand the scale of adjustment section. But still did not change the trend of water cut rise speed and natural decline rate high fundamentally. Improving the oil recovery have also been restricted. For achieving the goal of production don't decline in high water cut development stage, Need on the basis of geological survey, detailed understanding, further analysis the factors of influencing the water flooding recovery. Formulate reasonable technical countermeasures to improve water drive recovery factor. In this paper, through the fine geologic description, find out the key factors affecting water drive recovery factor, provide a certain basis for oilfield sustainable development.

Keywords: high water cut; water flooding; decreasing; sand body; heterogeneity

1 INTRODUCTION

Domestic old oil field after water injection development for 30 years, because of the influence of the reservoir degasification, injected water, the entire block of crude oil viscosity is generally higher, colloid and asphaltene content increased, especially the structure of edge, has reached the limits of ordinary heavy oil [1]. The blocks in the development process, show the dramatic decrease of production is low, the production characteristics. How to improve the development effect and improve the block recovery efficiency, is the key to the next step development. This article mainly research oilfield water injection development characteristics, formation structure, divided into series of strata between the physical parameters change rule and influence factors, combined with the dynamic production data, which provide

technical countermeasures for improving water flooding development effect [2].

2 THE GEOLOGICAL FACTORS

2.1 Stratigraphic correlation

Based on coring Wells by core calibration logging, by the standards of well logging curve calibration out of the well logging curve, based on sequence stratigraphy theory, according to the principle of cycle comparison and decentralized control, combining with the regional strata, sand for the division and correlation of the group; Stratigraphic correlation to classify the sand group boundary and layer, and then to the division of each small layer [3]. Each time unit for the single phase river sedimentary cycle, to ensure that achieve plane microfacies study vertical units.

2.2 Single sand body partition method

Identification and description of the single sand body is a major step planar fine description of reservoir, is also the goal of subdivision microfacies. The sedimentary discontinuity surface was mainly used single sand body.

2.3 single sand body vertical division method

Sedimentary discontinuity refers to the issue of continuous stability in the vertical sedimentary sequence deposition over to the next phase of the continuous and stable sedimentary start is different from the upper and lower adjacent layer is formed between the characteristics of lithology, there are mainly argillaceous interlayer intercalation, calcareous layer and physical properties or superposition of uniform sandstone layer of three types of electric logging curve mutations.

3 SAND BODY FACTORS

Judging by the discontinuous sand and abandoned channel: the channel sand body and flanking abandoned channel sand body is the most reliable evidence of different monomer river boundary. Channel flank electric logging curve characteristics of low-rising toothed, abandoned channel electric logging curve characteristics for the finger, at the bottom of the upper flat.

Sand layer of differences between adjacent Wells: the same single channel of sand layer on the lateral basic quite or gradient, if the hole in the horizon of big differences, there are different monomer river boundary.

From transverse section on sand body thickness and the change trend of petrophysical judgment: rivers from center to edge thickness of sand body and property is gradually thinning, variation, so from thick to thin and thick sand body thickness in the process of river boundary exist different monomers [4]. Logging curve characteristics of combination form, the rhythm of judgment: curve shape and the rhythm is the direct reflection of hydrodynamic conditions, if the curve shape and change of rhythm is bigger, the river boundary exist different monomers.

On the basis of small layer on the composite channel sand body of single channel sand issue, will be subdivided into 25 single sand body in henan oilfield.

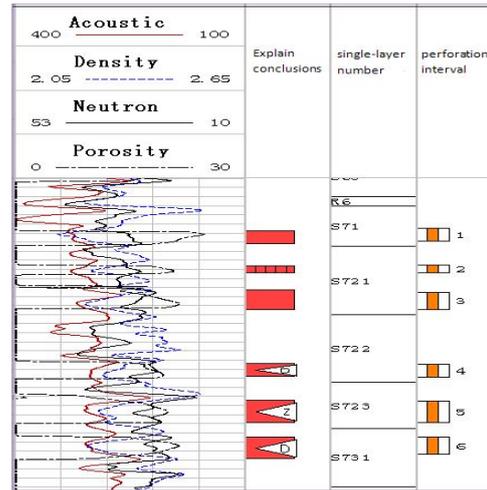


Fig. 1 The single sand cervix well curve diagram

4 IDENTIFY THE FACTORS OF WATER FLOODING

The main factors influencing the moisture content of crude oil viscosity, the underground reservoir water saturation. Viscosity of crude oil in a shorter development time won't have obvious change, the main factors influencing composite water cut is underground water saturation. In henan oilfield, water cut of 95% in 2010, up to 96.8% in 2010, the underground water saturation increased from 55% to 58%, the equivalent of oil production rate reaches 1.4%. Oil production rate is only 0.47%, but in fact this block, it shows that the injection water not to crude oil displacement, but the invalid loops [5].

$$f_k = \frac{1}{1 + \frac{K_o}{K_w} \frac{\mu_w}{\mu_o}} = \frac{1}{1 + \partial e^{-bSw} \frac{\mu_w}{\mu_o}}$$

Ko- permeability to oil
Sw- Water saturation

4.1 Strong reservoir heterogeneity

In henan oilfield is mainly delta distributary plain river sedimentary, reservoir in plane, interlayer and layer are shows the strong heterogeneity.

4.1.1 Plane heterogeneity is serious

Plane large difference of permeability distribution, planar differential permeability to more than 50, the anisotropy of injection-production unit. Low yield of low permeability area adjustment Wells fluid of low water cut, high permeability zone adjustment Wells and high yield, high water cut, invalid water cycle.

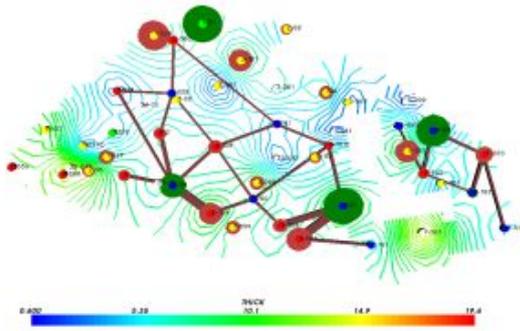


Fig. 2 Flow relations between oil and water wells

4.1.2 Intraformational heterogeneity

Henan reservoir layers of positive rhythm characteristics significantly, at the bottom of the single sand body strong washing; Multiple superimposed sand bodies, single sand bodies in thin interbedded layers of blocking effect and interaction in different water levels of the layer, the bottom water is serious. Internal dynamic response: thick layer suction is a piecewise water absorption characteristics of layer within the interlayer of blocking effect.

4.2 Separate interval fine enough

Henan reservoir sedimentary characteristics is delta distributary plain river sediment, sand body vertical superimposed, thick oil layer can be subdivided in multiple single sand body [6]. Conventional layering water injection technology can't meet the demand of single sand body of fine water injection.

For example in henan oilfield of west 20 block 10 injection Wells in 60 water injection interval have 31 multilayer injection, thick oil reservoir and can identify multiple single sand body. West22 well water injection interval of 19 points and 10 natural layer, thick layer subdivision single sand body, water injection interval of 15 single sand body can be identified. [7]Layer, interlayer inside the large difference of physical properties of the single sand body, the condition of water, water absorption, conventional layering water injection is difficult, is currently the main contradiction.

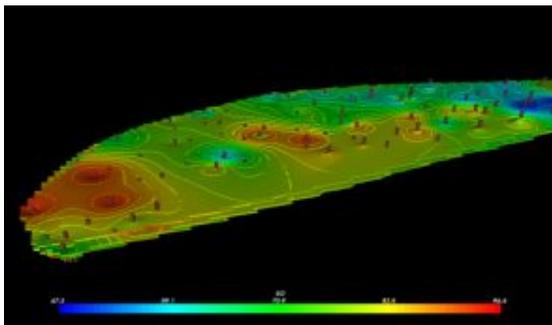


Fig. 3 Single sand body model for the water flooding

Dynamic response: period of note, the layers of large difference of suction, the main suction interval only one sand body; Suction is uneven in the single layer water injection interval. As part of the sand body or the different parts of the sand body seriously uneven water, lead to local suction strength, cause invalid water cycle. Statistical analysis of injection profile data, as invalid water cycle, degree of water drive by only about 60%, 40% is not used effectively.

4.3 Reasonable injection rate control is an important means of improving water flooding effect

Injection ratio is an important factor affecting oil displacement efficiency[8]. In henan oilfield injection-production development adjustment injection multiples with gradually increasing, developed by water injection in the early 0.05 pv to the comprehensive adjustment of 0.086 pv. According to core displacement test section calculation of different oil displacement efficiency corresponding cumulative injection multiples. When injection needed to increase oil displacement efficiency, same ratio increase gradually.

Improve the water flood sweep coefficient of physical examination is the main way of improving water drive recovery factor. Calculate according to the core test calculation is reasonable in henan oilfield injection ratio should be above 0.10 pv, in the actual injection ratio between 0.07 to 0.09 pv. From the statistical analysis of henan oilfield injection ratio and water cut water flooding affected check-up coefficient is only about 60%, 50 core sample test also come to similar conclusions.

5 CONCLUSION

Because of water flooding layer exists in high permeability channel, after years of water flooding layer within the contradiction is obvious. At the bottom of the positive rhythm deposition, high permeability, from adjust inoue, bottom water, the remaining oil is mainly distributed in the small layers upper lithologic difference parts. Need to seal the lower cover, water flooding potential on the upper.

6 SUGGESTION

Present condition of well pattern, water flooding direction of oil and water Wells is a single, shortening of row spacing factor increases the oil and water Wells is communication skills; Natural and artificial fracture, secondary advantage factors such as the big hole formed fracture - pore type dual medium seepage features, water flooding swept volume decreases, the rate of formation water, low development contradictions. In order to realize the fine water injection, vertical extension

of cracks cannot segment of injection Wells implementation in the layer reservoir seal completely, reselect perforation interval, the implementation of layered water injection.

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