

Application of fine injection production technology in water drive reservoir

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Abstract: As the basic condition for ensuring the stability of oil extraction in the development process of oil extraction in our country, some areas have entered the stage of high water cut development. It is very difficult to develop water drive reservoirs in the high water cut development stage, especially under the background of low oil price industry. How to ensure the orderly promotion of the beneficial development of water drive reservoirs and optimize the comprehensive quality of development has become the core of the development process of the industry and enterprises. The core of this is how to use fine injection and production technology. Therefore, the oil production plant needs to integrate different types of water drive reservoir requirements, take it as the core orientation, start based on the water quality source, place the target on good water injection and effective water injection, optimize and innovate fine injection and production technology in an all-round way, so as to achieve the high efficiency of the entire regulation process, improve the quality of water drive, and achieve the development goal of water drive reservoir benefits. Based on this, this paper analyzes this problem, and puts forward some suggestions on the application of technology for reference.

Keywords: water drive reservoir; Fine injection and production; Injection-production technology; Technology application.

1. Introduction

After more than 40 years of development, oil field A has entered the stage of high water cut and extra high water cut, with prominent interlayer contradictions and high recovery degree. In view of this situation, A oilfield has continuously increased the adjustment of injection and production system, optimized the injection and production system, gave full play to the role of water injection, and improved the degree of water drive reserves control. However, due to the long-term high-speed water injection development, the water drive control degree has declined, and the water absorption capacity of some inter-injection Wells is poor and the water absorption imbalance has become increasingly serious. In order to further improve the development level, maintain the reasonable configuration of injection-production well pattern and balance water injection, a lot of research work has been carried out in the field of fine injection-production technology of water drive reservoir, and a set of fine injection-production technology system suitable for ultra-high water cut reservoir has been formed, which has effectively improved the development effect of water drive [1].

2. Research on application of water drive reservoir fine description

With the increasing intensity of oil reservoir exploration and development in the new period and the deepening of development degree, oil field exploration and development data also began to show a dynamic development trend. Therefore, it is necessary to construct a specific geological model based on the actual situation of development data, and carry out fine processing of reservoir description, so as to form a new understanding of reservoir exploration conditions and improve the comprehensive productivity of oil Wells. At present, oil field A has entered the middle and late stage of development. The middle and late stage is the core stage of reservoir exploration and development, and the reserves produced can reach 50%. The refined reservoir description can more clearly and intuitively reflect the rule changes displayed in different planes between oil and gas reservoirs, so as to help enterprises more clearly and intuitively understand the reserves changes, status quo and remaining oil amount of the reservoir, and provide more comprehensive and refined geological reference data basis for subsequent well layout and reservoir adjustment. However, in the process of exploration and development of the oilfield, the reservoir clay minerals

are more complicated, which seriously affects the comprehensive recovery rate. The basic forms of clay minerals and their potential damage are shown in Table

Table 1 Basic forms and potential damages of clay minerals in reservoir

Clay type	Structure type	Occurrence type	The main form of occurrence	Potential form of reservoir damage
kaolinite	1:1type	Cluttered, worm-like	Intergranular porosity	Speed sensitive, alkali sensitive, acid sensitive
chlorite	2:1:1type	Foliate, laminated	Intergranular, granular surface	Acid sensitive, alkali sensitive, speed sensitive
Yi/Meng interlayer	Mixed type	Reticulate, honeycomb, lamellar	Granular membrane liner type	Water sensitive, alkali sensitive, acid sensitive
illite	2:1 type	Lamellar, bridged	Intergranular, granular surface	Alkali sensitive, speed sensitive, water sensitive
montmorillonite	2:1 type	Honeycomb, lamellar, tired	Granular membrane liner type	Water sensitive, salt sensitive, alkali sensitive

3. Application of water drive reservoir fine description technology

3.1 The development of rhythm zone subdivision in thick oil reservoir is carried out

Taking the rear reservoir unit of the oilfield as an example, this unit is a relatively typical delta front opposite rhythm sedimentary layer, and has realized the complete development of intercalation. At the same time, by analyzing the geological condition of the interlayer and the actual situation of the rhythm layer, the original four small and fine layers can be further subdivided into ten rhythm layers. According to the basic principle of organic combination of similar opening conditions, the production oil and gas intervals are further optimized, and the parts with relatively more rhythm layers, relatively thick reservoirs and complete development of interlayers are selected, and the well pattern is further restructured and divided into two different well patterns. Through the reorganization of rhythm layer, the overall improvement of injection-production well pattern can be realized, the comprehensive control level of water drive reservoir can be optimized, and the comprehensive oil and gas recovery efficiency can be improved [2].

3.2 Optimize the well pattern of multiple sandstone reservoirs

The reservoir fault block is relatively developed, and the development middle block is relatively small, so the problem of imperfection of injection-production well pattern is obvious. The thickness of oil layer is large, there are many small layers, and there is obvious interference between layers. In the face of the current situation of reservoir description, it is necessary to further analyze the distribution of remaining oil, subdivide the stratigraphy, well pattern and water injection system, and carry out successive adjustment and continuous improvement. For the closed fault block reservoir, it is necessary to use the method of combined production to carry out comprehensive development. In the face of the characteristics of relatively high permeability reservoir development degree, relatively low permeability reservoir, and relatively rich remaining oil, it is necessary to reconstruct the reservoir with similar physical properties and development status but not adjacent, and optimize the well pattern structure, so that the low permeability and high permeability reservoir can be classified management, water injection and development, and improve the comprehensive development effect.

3.3 Improve low permeability reservoir development efficiency

Combined with the refined requirements of water drive reservoir, it is necessary to establish a sound and perfect drive system by means of infecting well pattern and optimizing water injection conditions under the condition of analyzing nonlinear seepage mechanism, starting pressure gradient and rationality of well pattern, so as to optimize the comprehensive development level of permeated oilfield. In the process of development, the oil and gas resource richness of low permeability reservoir is relatively poor, and there are obvious constraints on stratigraphy and well pattern. If the high permeability reservoir is still used, it is likely that under the influence of the starting pressure gradient, the driving pressure difference of water drive development can not reach the ideal situation, and the exploration and development of the stored oil and gas resources can not be carried out. Under such conditions, it is only necessary to carry out further description and analysis of the reservoir, and it can be found that the low permeability reservoir has relatively high well pattern density to the limit. At the same time, the amount of oil and gas resources controlled by a single well will decrease significantly. As a result, the well spacing can be further reduced and the remaining oil potential can be further explored using the infill well pattern. Therefore, the well pattern of this oil production plant can be encrypted, and the old oil area can be optimized and adjusted. For the new development area of low permeability reservoir, well pattern development with high density and small landscape distance can be carried out to improve the comprehensive total oil and gas recovery in low permeability reservoir [3].

4. Future prospect of fine injection production technology in water drive reservoir

4.1 Strengthen the research on water quality stability technology along the way to ensure the good water injection of water drive reservoir

In the future, to overcome the difficulties of water drive reservoir technology, it is necessary to take increasing efficiency of oil storage and creating efficiency as the core goal, and continue to strengthen the research of fine injection and production technology. Specifically, to strengthen the research and development of technology, we need to start from two levels:

First of all, it is necessary to strengthen the implementation and implementation of the new water quality standard of reservoir water injection, and improve the comprehensive quality and benefit of water drive development. According to the requirements of China's new regulations, the water quality parameters of different water drive units are optimized and improved, and the adaptation level of the existing water treatment process is objectively evaluated to improve the matching produced water treatment level, and the comprehensive effect of water treatment is comprehensively optimized to meet the needs of the reservoir and achieve a high degree of consistency between the treatment process and the reservoir demand. Improve the comprehensive quality of water drive development and increase its benefit. The target of the technology is to focus on zero corrosion and qualified wellhead water quality, seize the source, ensure the quality of wellhead work, and improve the comprehensive quality of water injection. The second is to improve the research level of surface alloy polarization solubilization and scale inhibition technology in an all-round way, and to truly solve the problem of injected water scaling in the wellbore. The scale formation of the waterflood string will lead to the failure of the exploration operation. Therefore, it is necessary to strengthen technical research, focus on non-polluting and low-cost technologies, actively develop electrochemical solution-enhancing scaling inhibition technology, and improve the core key devices, so as to truly achieve the long-term effective goal of downhole pipe string use and achieve effective scaling prevention and descale.

4.2 Deepen the research of long life injection and production technology, and make every effort to improve the beneficial development of water drive reservoir

In the high water cut development stage, the water-oil ratio will show a sharp growth trend, which will also lead to the gradual rise of development costs, oil prices will remain at a low level for a long time, and the overall development benefits will not reach the ideal goal. Therefore, it is necessary to actively improve the life of injection-production string, further reduce the operation times of oil and water Wells, and reduce cost input, which plays a very important practical role in realizing healthy

and stable sustainable development of oil fields and improving its long-term benefits. To be specific, we can start from the following aspects:

First, it is necessary to actively overcome the long-life separation injection technology of high temperature and high pressure deep Wells to meet the standards and requirements of different stratified water injection. Its content is the research on the prediction technology of dynamic effective life of separate injection string. Moreover, the column structure with rich and diverse functions is designed. Strengthen the analysis of key tools for long-term injection at the wellhead and job processing techniques. In terms of practical technical objectives, it is necessary to successfully develop a release anchored balanced pipe string to effectively inject different media, and its service life should be more than 5 years [4].

Second, it is necessary to place the technical difficulties in the online plugging removal technology with low corrosion and less cost, and further extend the validity and rationality of single-well single-layer water injection. During the 14th Five-Year Plan period, China needs to focus on optimizing the surface active agent pressure reduction growth rate system, in order to continue to promote the development and research of long-term process technology adaptability, improve the comprehensive use parameters of the field process, reduce cost input, but also improve the comprehensive utilization effect, and truly realize the scale promotion and use of pressure reduction and injection technology in various regions. And comprehensively improve the pressure reduction and injection management system of surface active agents. For example, the use of an oil displacement agent with a permeability of less than 3MD can be promoted in all directions. At the same time, it requires its technical level to be green. In addition, it is also necessary to strengthen the parameter research of process adaptability and field technology application research, such as deepening the research of the injection process technology, the surface activator process technology, and the pulse injection, production increase and income process technology research.

Third, it is necessary to focus on the research on the supporting technology of the oil well anti-erosion and long-lived rod pipe pump, improve the comprehensive anti-corrosion performance and anti-fatigue level of the lifting system, and improve the working condition of the pipe pump in the water-bearing period. It is necessary to strengthen the use of new materials and new technologies, rationally use metal materials in them, develop new anti-corrosion pump valve core technology, and build a technical system that can effectively support lifting and meet the needs of different displacement. And strengthen the research on the innovative technology of new materials in the long-life pump valve structure to form a more comprehensive long-life pump system to ensure that its life can be more than five years.

The fourth is to strengthen the research on the long-term intelligent stratified injection and production technology in the oilfield to meet the needs of the intelligent transformation and fine development of the oilfield. Specifically, it is necessary to carry out technical research based on two different levels of injection and mining.

Specifically, injection mainly refers to the use of long-term injection technology in sandstone reservoirs, including multiple layers, mostly balanced structural design. For example, the supporting compensator further reduces the creep of the pipe string, strengthens the use of modular sealing technology, and performs stratification treatment to form a sealing structure, and solves the shortcomings of the traditional oil field bottom valve that is easy to leak. And install the bottom valve leakage plug, carry out the technical test, solve the failure problem caused by the leakage of the traditional bottom valve. Among them, the mining mainly refers to the use of Jin sleeve separation technology. That is, through the use of layered sand control technology, fusion sand control separators and sealing devices.

4.3 Continue to tackle the intelligent injection and production efficient development technology to improve the recovery efficiency of water drive reservoir

In the reservoir development plane, it is necessary to mobilize the flow line and realize the injection and production coupling based on the longitudinal level. This requires the rational utilization of intelligent injection and production technology, real-time control of the single layer, more stratified production data information, model simulation, to achieve the stratified promotion of the entire description system, and then provide strong guidance for the development and construction of smart oil fields. First, it is necessary to focus on technology research and development on intelligent stratified injection-production linkage technology, truly realize the intelligence and coupling of the entire injection-production process, and comprehensively adjust its process. Second, we need to focus on the future, take a forward-looking perspective, and use big data smart oilfield technology to achieve the refinement of the entire oilfield development process. Dynamic real-time data can be taken as the basic condition and the reservoir as the focus, so as to establish and improve the regulation system that integrates different analysis technologies, can carry out intelligent diagnosis and analysis of oil sugar development process, make timely decisions, and ensure the optimization of data parameters in the entire production process, so as to truly realize the intelligence of oil and gas reservoir exploitation and improve the integrated recovery [5].

5. Conclusion

To sum up, in the middle and late period of reservoir development, the waterflood development effect becomes worse, the injecting-production contradiction is prominent, the remaining oil distribution is scattered, and the water drive contradiction is intensified. Through the research of fine reservoir description, fine flood control and fine reservoir management technology, a series of optimization and adjustment measures can be implemented to improve the efficiency of water flood reservoir and the development effect of water drive. This paper takes A oilfield as an analysis case, and puts

forward specific methods in the use of technology, aiming at providing reference and reference for improving the efficiency and benefit of oilfield development in the new era.

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