Discussion on the countermeasure of improving the development effect of oil well dynamic analysis

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Abstract: With the rapid development of society and economy, higher requirements are put forward for oil and gas exploitation. Therefore, effective measures to improve the development effect should be analyzed with oil and gas well dynamic analysis as the entry point. This paper first introduces the definition of oil and gas well dynamic analysis, then introduces the well dynamic analysis and measures to improve the exploitation effect, then introduces the injection well dynamic analysis, and finally explores through the analysis and study of each production link of oil and water Wells, analyzes and determines the actual situation of underground advantage. The aim is to find out the law of oil and water movement between each reservoir, and take corresponding adjustment measures constantly to ensure a higher recovery rate of oil and gas Wells.

Key words: oil-well dynamic analysis; Development effect; discuss

1. Introduction

Well dynamic analysis, also known as production dynamic analysis, includes water injection dynamic analysis and well dynamic analysis, and is also an important part of oilfield production engineering. Oil well dynamic analysis mainly uses a variety of detection types and production data of oil and gas Wells to analyze changes in output, pressure and water content. Through detailed data research and analysis, we can understand the water level of oil and water underground, judge the downhole technology, and determine the rationality of its production process and production technology. The dynamic analysis of water injection well mainly refers to the analysis and research when changes are found in the aspects of water injection and water absorption capacity and wellhead pressure, and to judge the actual situation of downhole operation. The main function of dynamic analysis of oil and water Wells is to discover possible problems through dynamic analysis and comparison of Wells and oil Wells in the production stage, and constantly adjust injection and production to ensure that Wells and oil Wells are in a relatively stable condition in oil production, water injection, pressure and water cut, so as to develop the reservoir reasonably.

2. Dynamic analysis of oil and water Wells

In general, a single well is mainly composed of the wellbore surface and underground, and the combination of production management and underground analysis, and then through the analysis of the ground, and then the actual situation of the wellbore, and finally explore the recent underground conditions, through the progressive method of layer by layer, can effectively improve the dynamic analysis and development level of oil and water Wells. Combining economic benefits with Wells and oil Wells, through analysis and research, strong rationality and feasibility measures can be put forward without affecting the overall mining efficiency and quality, which can maximize the productivity of oil Wells and improve the economic benefits of oil field enterprises. In the process of crude oil exploitation, oil Wells are the main way to extract crude oil from the surface [1]. The process involves oil being pressured through fractures in the rock into the well and then down the wellbore to the wellhead. Ultimately, the oil is delivered centrally to the gathering station, so the well production process also consists of wellbore, reservoir and surface phases to enable dynamic analysis to ensure reservoir quality and safety.

2.1 Ground management

In the production process of oil field enterprises, the management of oil well surface is mainly divided into wax removal, hot washing and casing pressure selection. The main function of paraffin removal is to ensure that the oil flow is unimpeded, so as to minimize the frequency of paraffin removal hot wash, and control the sleeve pressure, so that the dynamic liquid level is at a relatively level, in order to ensure the pumping force. When the casing pressure is too high, the dynamic liquid level in the annular gap of the casing will be reduced, which will lead to the exhaust gas into the deep well pump, resulting in

gas invasion, affecting the pump efficiency and reducing the production of the well. In severe cases, air locking may even occur. Therefore, based on the actual situation, part of the gas in the tube should be discharged accordingly, effectively reduce the casing pressure, raise the hydrodynamic level, and effectively avoid the waste gas into the pump.

2.2 Well shaft performance analysis

The change of wellbore dynamics can be caused by a variety of factors, the most common of which is (1) formation blockage, which is usually caused by damage to the formation around the bottom of the well, such as silt, or sand production, resulting in sand buried in the formation, which prevents the smooth flow of oil into the wellbore and ultimately leads to a decline in production. The wellhead pressure decreased significantly, and so did the casing pressure. By monitoring the bottom hole sand samples and sand surface, the main analysis objective is to determine whether there is a large well production and cementing of the reservoir, as well as changes in the characteristics of the drilling fluid, such as relative density coefficient, loss volume, permeability duration, leakage, etc., to ensure the safe operation of the newly commissioned well. In order to ensure the safe operation of the old working well, the level of operation, the performance of the kill fluid, and other possible causes of formation damage should be tested. For example, if the local formation of wax, glue, salt, scale, etc., may lead to perforation or reservoir penetration surface obstruction; (2) The size of the nozzle should not be too large, because too large nozzle will lead to the increase of gas-oil ratio and the increase of water content too fast, thus reducing the production, and may lead to sand and other problems when the oil reservoir pressure drops seriously [2]. As the wellhead oil and casing rise, sand and water in the reservoir rise, causing hydraulic pressure to drop and casing pressure to stabilize or decrease. If the nozzle becomes smaller, its ability to carry water becomes worse, which will cause water at the bottom of the well, so that the oil and casing pressure decreases, the production decreases, and the water content decreases. (3) Other factors. Because the oil supply capacity is not enough, oil well intermittent work, the condition is: when oil, oil pressure will drop sharply, and it makes oil well production capacity and pressure change dramatically, oil, casing pressure will rapidly reduce or improve, resulting in oil well production capacity greatly reduced.

2.3 Submergence (hydrodynamic level) analysis

In the production process of oil well, the moving fluid level mainly refers to the depth of the liquid level in the annular space of casing and tubing, while the subduction degree mainly refers to the difference between the moving fluid level and the depth of the pump. The analysis of the specific changes of the dynamic fluid level can further reflect the actual changes of the formation. Hydrodynamic level rise is mainly due to pump parameters smaller, reservoir pressure rise, pump frame change. Before the deep well pump can begin work, it is necessary to solve the screen, anchor, sand anchor and Vallhole under the pump equipment obstruction, and ensure adequate displacement. This requires the deep well pump to go deep enough below the liquid level to form a type of pressure head to reduce the obstruction to the pump and to avoid degassing the oil so that the well can be produced smoothly. Once the head is too small, it will affect the satisfaction coefficient of the pump; Once the head is too large, the wreck will be too large, affecting the smooth production of the well. The increase of the pumping unit's load will lead to energy consumption. Therefore, according to the successful experience of some oil fields at home and abroad, the sinking degree should be controlled within 200-300m for the oil well with thick oil, high water content and large production capacity, and the electric pump well should also be maintained within 200-300m, but the specific depends on the characteristics of the oil well.

2.4 Analysis of subsurface performance of oil well

Initial formation pressure is an important reference value before reservoir development. But when the well is shut down for a while, the pressure measured is no longer the same. In contrast, for Wells with heterogeneous multiple zones, the measured static pressure is uniform across the formation. The driving mode and mining rate are the key factors affecting the rock pressure in the waterflood oilfield. In a waterflood oilfield, water content changes obviously, and different water states will lead to different water increase rates. Generally speaking, in the middle and low water cut stage (before 60%), with the increase of water content, the water rise rate will gradually accelerate; However, in the high water cut stage (after 60%), the rate of water rise will gradually slow down with the increase of water content. By analyzing the water cut of the well, we can better understand the properties and distribution of the reservoir and understand the connectivity between the well and the water well. In addition, we can also determine the cause of water cut rise, and put forward timely adjustment suggestions and measures. The amount of fluid a well produces depends on its ability to extract fluid under certain water conditions and on the pressure difference it is subjected to. With the increase of water content of oil Wells, the liquid recovery index will also increase year by year [3]. However, when the reservoir pressure remains stable, the production pressure differential of the well will continue to increase, resulting in a gradual decrease of the production pressure differential. Therefore, in the middle and high water cut stage, although the fluid recovery index of the gusher well is increased, the fluid production is hardly increased or slightly decreased due to the decrease of working pressure.

3. Dynamic analysis of injection well

Water injection well is an important production technology, its main purpose is to inject water from the wellhead to the reservoir through the water distribution, in order to meet the needs of current oilfield development and achieve the balance of injection and production. Its

main function is to ensure the development of oil field, but also can reasonably improve the benefit of oil field. In order to effectively improve the quality of water injection, layered water injection can be used to ensure that different layers can meet the requirements, so as to achieve the effect of water absorption balance. However, during the actual operation, because of the different water injection volume changes, may lead to the completion of the mismatch of the injection volume. Therefore, the relevant personnel should analyze the changes of water absorption of each layer in real time, and compare the oil reservoir pressure, water cut changes in the surrounding production Wells and the production rate. Through dynamic analysis and research on various factors, timely optimization and improvement of water injection volume can effectively improve water injection efficiency. Fundamentally improve water drive recovery [4].

3.1 Analysis of reservoir condition of injection well

The physical properties of oil reservoir and petroleum are the key factors affecting the dynamic analysis of injection well. Therefore, it is necessary to fully understand the geological, natural and physical characteristics of oil reservoir, including lithology, infiltration rate, oil characteristics, pressure, as well as the number of perforated layers, thickness and perforation condition, so as to better grasp the water absorption status of oil reservoir.

As a result of unqualified quality, reservoir perforation and clay imbalance, percolation surface obstruction, biochemical sediment blocking reservoir gap, and bacteria propagation and blockage, resulting in a sharp increase in the water pressure of the well, a sharp decline in water absorption index, significantly reduced water injection, and even completely unable to fill. Tests should be carried out in time to determine the root of the problem and take appropriate measures. Drainage and stabilization of mudstone should be performed prior to the injection of Wells to ensure that the injected water quality is up to standard, which is the key to successful irrigation.

3.2 Variation of water injection

Due to the combined needs of reservoir injection-production balance and reservoir energy conservation, the injection allocation of each well must be strictly regulated. Overinjection or underinjection can lead to disruption of the injection-production balance. Therefore, during the analysis of injection volume, it is necessary to carefully check whether there is water nozzle obstruction, poor water quality, unreasonable selection of killing fluid and other reasons according to the system test resources measured in the previous injection well, so as to ensure the accuracy of injection volume. If the flow rate exceeds the normal range, a test should be performed to check if the downhole packer is faulty. There is no closure of the water base, there is no spout, etc. By analyzing the causes of overinjection and underinjection, propose effective solutions, such as adjusting the water volume, replacing the nozzle, reconfiguring the test or increasing the water volume, to ensure that the water flow in the injection well is as consistent as possible.

3.3 The water absorption of each layer changes

By means of differential well temperature logging or isotope logging, the absorption profile data of the output well are analyzed, so as to understand the absorption between different layers and observe its change trend in history. In this way, the absorption differences between different layers can be better understood and more effective application techniques can be developed more effectively. To maximize the area covered by injected water, ensure that each layer absorbs water evenly as much as possible.

In order to ensure the balance of injection and production in an oilfield, the amount of water injected into the ground should be equal to the amount of fluid produced. This requirement must be met whether it is an entire well, a stratification or a single sand body. However, due to the heterogeneity of the reservoir, the uneven water absorption in plane, between and within the reservoir results in the unbalanced reservoir pressure. In the interlayer, the distribution of reservoir pressure is unbalanced, resulting in interlayer interference. Within the reservoir, the difference of water drive state and reservoir pressure makes the distribution of remaining oil more fragmented, especially in the late period of high water cut, and these situations become more complicated [5]. Therefore, according to the analysis of injection-production ratio and reservoir pressure, the injection allocation between zones and planes should be adjusted as much as possible. In addition to the usual adjustment of the nozzle in the wellbore to change the interzonal water absorption, a series of measures to transform the reservoir should be carried out if necessary.

3.4 Wellbore performance analysis

Based on the dynamic analysis, we should assess whether downhole tools such as water distributors, packers, and taps are performing to relevant standards and observe how they perform during the injection process. If the cause of failure or state change occurs in the above parts, we should respond by observing the wellhead oil pressure and system measurement indicators curve. If part of the fault occurs, the water flow will be unstable. Therefore, it is necessary to check and analyze the failure factors regularly and take preventive measures to solve them. Significant changes in oil pressure and water flow can occur when a tubing perforation is lost, a first-stage packer is damaged, or cement is routed outside the sleeve. If the reservoir above the stage 1 packer absorbs more, a strong casing pressure increase, oil pressure decrease, and water injection increase can occur. When stage 2 and 3 packers are damaged, oil pressure decreases and water injection increases. If the water nozzle is blocked or out, the oil pressure and water volume will change greatly, the oil pressure will increase, and the water injection will decrease, which indicates that the water nozzle has been blocked. When the oil pressure decreases and the amount of water injected increases, it indicates that the water nozzle has come out.

4. Conclusion

To sum up, in order to adjust the differences between different oil formations, low-pressure and low-aquifer injection can be carried out, water injection profile can be adjusted, and the vertical production profile can be more consistent. In addition, combining with the exploitation condition of oil sands and water flooding condition, some layered water injection Wells can be repored, injection and production system can be improved, or water injection well points can be added, so as to achieve better results and improve the fluid production of oil Wells. Improve the exploitation condition of oil sand body, improve the exploitation efficiency of oil sand body and realize the effective utilization of oil and gas resources. As a result of increased pressure, more productive potential can be developed.

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