Management Methods of Drilling Shut in

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Abstract. The Daqing oilfield was put into development in 1960. At present, it is in the late stage of ultra-high water cut period. Various displacement modes coexist, and the reservoir development and management is complex and difficult. In order to control the decline of production, the number of new drilling wells increases year by year, the surface and underground conditions are complex, and the management is difficult. The drilling shut in affects the production year by year. The formation pressure decreases greatly during the drilling shut in process, which affects the development situation. In order to reduce the impact of drilling shut in on production, control the decline of formation pressure, and explore the management methods and methods of drilling shut in. In order to reduce the impact of drilling shut in on production and control the decline of formation pressure, we explore the management methods of drilling shut in.

Keywords: Development situation; Drilling shut in; Management methods.

1. Introduction

A target management project team with the chief geologist as the project manager and the participation of relevant personnel from the geological research institute, the process research institute, relevant departments of plant authorities and operation area has been established, and an "integrated" management guarantee system of reservoir engineering, oil production engineering and surface engineering has been established, forming a long-term management mechanism. At the same time, optimize the division of labor, decompose the goals vertically and horizontally, achieve the vertical decomposition in place, expand horizontally to the end, and decompose and implement various goals to all units and individuals, forming a situation in which everyone has a heavy burden and indicators on everyone. At the same time, we optimize the division of labor and decompose the objectives vertically and horizontally, so as to achieve the vertical decomposition in place and horizontal expansion to the end. We have broken down and implemented various goals to all units and individuals, forming a situation in which everyone has a heavy burden and everyone has indicators.

2. Preparation Before Drilling in Advance

2.1 Before drilling, the engineering organization is meticulous, and the well location survey is carried out in advance

The geological research institute actively organized, conducted well site survey half a year in advance, implemented the cushion work of 315 low-lying wells, and prepared the drilling operation plan in advance. According to the field survey results, we completed the overall planning of drilling rig operation in advance, optimized the preparation of drilling operation scheme, and defined the drilling time of each well. The drilling disclosure meeting shall be organized half a year in advance, with the participation of the drilling company, the production and operation department of the plant, the planning institute and other departments, to preliminarily discuss and plan the drilling rig operation line and power erection line and formulate the next work plan. [1]

2.2 The ground is paved in place

The planning department shall actively coordinate and issue the temporary plan for paving earthwork in advance. The production and operation department shall organize the earthwork paving team to complete the earthwork paving and pipe laying in advance according to the preliminary well location survey results.

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2.3 The lines are erected in place

The production and operation department shall comprehensively organize the disclosure and implement the material plan. The supervision and management center systematically organizes the construction team, completes the stringing work in advance, and constructs the temporary transformer outlet and high-voltage line to meet the drilling needs. [2]

3. Innovation of Drilling Operation

There are many influencing factors involved in drilling off optimization. Combined with the actual drilling operation of our plant, drilling off optimization is mainly carried out from four aspects: drilling off distance, drilling off time, drilling operation and drilling off recovery.

3.1 Drilling shut in distance is standardized

In order to ensure the normal operation of drilling, shut in and depressurization shall be implemented for water injection wells within a certain range around the well shut in. Combined with the previous shut in practice experience, the wellhead residual pressure of water injection well before drilling is adjusted from 2MPa to 3Mpa. The standard of well control and injection shut in is adjusted from 450m to 300m. For the layer system well pattern with injection production well spacing less than 300m, the drilling shut in well spacing can be adjusted to not less than the injection production well spacing. If there is pressure relief at the production well point between the water injection well and the new drilling point, the water injection well may not be closed. For water injection wells where the residual pressure at the wellhead still fails to meet the standard requirements for a long time, the existing injection control methods shall be used. At the same time, the reasons for the failure shall be analyzed to determine the corresponding injection control standard. [3]

3.2 Drilling shut in time is personalized

The number of shut in days is adjusted from 15 days to optimize the number of shut in days according to reservoir conditions. Based on the actual monitoring pressure data of more than 300 wells, the pressure drop trend is analyzed, and the shut in days before drilling shut in of each well pattern are counted and analyzed. From the analysis results, if the pressure drops below 3MPa after shut in, the drilling requirements can be met. The average shut in days are 6.9 days for the basic strata with well-developed reservoir conditions and high permeability and tertiary oil recovery class I and II reservoirs with well spacing of 125m. Primary infill wells with medium and low permeability, relatively good reservoir conditions and low formation pressure and class I oil reservoir of tertiary oil recovery have a well spacing of 250m, and the average shut in days are 9.4 days. For secondary and tertiary infill wells with poor reservoir conditions, high formation pressure and slow pressure drop after shut in, the average shut in days is 14.6 days.

According to the numerical simulation results, if the pressure drops below 3Mpa after shut in, it can meet the drilling requirements. The average shut in days are 6.0 days for the basic strata with well-developed reservoir conditions and high permeability and class I and II reservoirs of tertiary oil recovery with well spacing of 125m. Primary infill wells with medium and low permeability, relatively good reservoir conditions and low formation pressure and class I oil reservoir of tertiary oil recovery have a well spacing of 250m, and the average shut in days are 9.0 days. For secondary and tertiary infill wells with poor reservoir conditions, high formation pressure and slow pressure drop after shut in, the average shut in days is 16.0 days.

According to the above two methods, a "personalized" drilling shut in scheme is designed to shorten the drilling shut in time. The specific principles are as follows:

(1)The injection wells are shut in 7 days in advance for the basic strata of water flooding.

(2)The injection wells are shut in 10 days in advance for the primary infill strata of water flooding.

(3)The injection wells are shut in 15 days in advance for the secondary and tertiary infill strata of water flooding.

(4)The injection wells are shut in 7 days in advance for class I and II reservoirs of tertiary oil recovery with well spacing of 125m.

(5)The injection wells are shut in 10 days in advance for class I reservoirs of tertiary oil recovery with well spacing of 250m.

3.3 Drilling rig operation is integrated

According to the well location distribution, centralized drilling, overall promotion, local optimization and piece improvement are carried out to reduce the impact of drilling and shorten the drilling construction cycle on the premise of ensuring the drilling quality. According to the load of the drilling line and the control analysis of the impact of drilling, we arrange a reasonable number of drilling rigs for drilling construction. The construction period of a single well is calculated as 7 days, which can calculate the pure drilling period required to complete all drilling tasks in the block. In addition, according to the impact of shut in time on production and pressure (Fig.1), the impact of formation pressure and production after 38 days of shut in of water injection well is increased. Therefore, if the drilling shut in time is controlled within 38 days through reasonable rig operation, It can greatly reduce the impact of drilling shut in on formation pressure and production. [4]

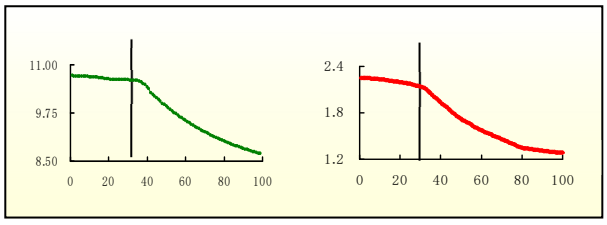

Fig.1 Effect of shut in time on pressure and production

3.4 Drilling shut in recovery scheme is refined

Drilling shut in is not only a factor affecting production, but also a potential that can be optimized. The step-by-step recovery scheme shall be determined according to the water flooding interpretation data of new wells and the comprehensive water cut changes of surrounding oil production wells during drilling shut in. For the oil wells with high liquid production, the water cut drop value is larger after drilling shut in, while the water cut drop value of the oil wells with low liquid production is smaller, which is mainly caused by the large drop range of high-yield liquid and high aquifer in the wells with high liquid production, and the small drop range of low-yield liquid and low aquifer. This reflects the great influence of interlayer differences. At the initial stage of drilling, the water injection pressure decreases and the water injection volume increases for the well-developed reservoir with good connection with the oil well, while after drilling, the water injection pressure decreases but the water injection volume does not increase for the reservoir with poor water absorption and poor connection with the oil well, which indicates that the pressure of the well-developed reservoir with good connection decreases more than that of the poor reservoir. This proves that the water cut of the oil well with high-yield liquid decreases greatly after the drilling shut in of the water injection well. Therefore, we follow the following principles when recovering from drilling. For the water cut descending well area, and the water flooding interpretation data of the new wells is interpreted as a high water flooded layer, we mainly control the injection of high aquifer, which is restored to 80% in the second step of water injection wells and 100% in the second step of polymer injection wells. For the water cut rising well area, and the water flooding interpretation data of the new wells is interpreted as medium and low water flooded layer, we mainly improve the injection of low aquifer, which is restored to 120% in the second step of water injection wells and 120% in the second step of polymer injection wells. For the water cut stable well area, the water injection volume should be kept stable, which is restored to 80% in the second step of water injection wells and 100% in the first step of polymer injection wells. For the low-pressure and under load well areas, the main task is to speed up the recovery of production, and the water injection volume is restored by 100% in the first step. [5]

4. Institutionalization of Process Management

Process management highlights institutionalization. We have established the management regulations on drilling shut in of injection well, check the process nodes every week, include them in the assessment, report them at the production and operation meeting, and require timely rectification. We have formulated management regulations for well opening and well shut in and established procedures. The drilling team of the Geological Research Institute shall provide the drilling well number, drilling time and completion time to the relevant business departments of the Geological Research Institute. The relevant business departments and offices shall prepare the drilling shut in plan and drilling open plan, which shall be dispatched to the relevant operation areas, so that the special work can be managed by a specially assigned person, so as to realize no more shut in of one well and no more shut in for one day. We have formulated the management regulations of electric pump well, established the operation table of electric pump well in drilling shut in area. First of all, we should verify the well conditions and data to ensure that they are accurate, and the parameter adjustment equipments such as electric pump nozzle and frequency conversion are fully prepared. The second is process management. When the water well is shut in, we shall reduce the oil nozzle in time, strengthen the liquid level monitoring, increase the oil quantity times, track and adjust the oil nozzle in time. When the oil nozzle is adjusted to the minimum, the electric pump well is still under load. We shut in the well after wax scraping and well washing according to the electric pump management measures. The third is to resume production. Before well opening, we shall clean and scrape the well according to the electric pump management method, use the daily current card within one week after well opening. We formulate the oil measurement scheme and liquid level test scheme according to the production situation, and switch to the conventional management after the operation is stable. [6]

5. Targeted Site Supervision

The supervision and inspection on drilling site highlight pertinence. As the drilling operation is 24-hour construction, it is difficult to supervise. In order to strengthen supervision and management, we adopt targeted on-site supervision methods. In the drilling stage, we implement three monitoring measures. The first is to monitor the performance of drilling fluid in strict accordance with the design. The second is to monitor the wellbore quality and observe whether there are special conditions. The third is to monitor the wiper trip and reaming to ensure the borehole quality. The first is to check the pressure test report of incoming casing to ensure the compressive strength of casing. The second is to check the position and quantity of centralizers to ensure the centering of casing. The third is to check the casing appearance and casing running torque to ensure the casing quality. In the cementing stage, we should control the speed, density and cleanliness. The first is to control the displacement speed to 1.5m/s to ensure the displacement efficiency. The second is to ensure that the density of cement slurry is strictly in accordance with the design value. The third is to keep the drilling fluid circulating before cementing to improve the cleanliness of the wellbore. In addition, we should control the amount of pad fluid, injected mud and displacement fluid. 4m3 clear water is generally used as the pad fluid to fully isolate the drilling fluid and cement slurry. According to the well depth and casing structure, the injection mud volume shall be implemented in strict accordance with the design volume. The displacement fluid volume is generally 3m3-5m3 clear water. Through the above methods, clear objectives and key control are achieved to ensure that the

drilling team is implemented in place according to the design, so as to improve the drilling quality.

6. Conclusion

Based on the results and discussions presented above, the conclusions are obtained as below:
(1) The preparation before drilling is the basis for realizing the overall promotion of the drilling rig and reducing the impact of production.
(2) The drilling shut in limit is applicable to large-scale regional drilling. Since there are relatively few wells drilled and shut in for scattered wells, and the pressure drop is relatively slow, the shut in distance and shut in days should be appropriately increased.
(3) Drilling shut in stage is an effective opportunity to understand the difference of formation physical properties and residual potential.

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