

Analysis of low production and low efficiency oil recovery and enhanced oil recovery methods

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Abstract. Since the 21st century, under the background of steady social and economic development, China's petroleum enterprises have developed rapidly, but in the process of oil well engineering, there are also low production, low efficiency, in order to improve oil well recovery, it is necessary to understand the low production, low efficiency, the implementation of effective solutions. This paper analyzes the causes of low production and low efficiency in combination with specific examples of oil well engineering, and further puts forward methods to improve oil well recovery, hoping to provide some valuable suggestions for the development of oil well engineering.

Key words: low yield; Inefficient; Oil well recovery; To improve.

1. Introduction

In recent years, China's oilfield engineering has developed rapidly, but in the process of oilfield exploitation, the water cut of oil Wells has gradually increased. In the process of high water cut development, it will obviously increase the difficulty of oil well development, resulting in low production and low efficiency. Low production and low efficiency Wells are those with less than 1.0 tons of oil per day [1]. Obviously, low production and low efficiency are not conducive to the improvement of oil well production efficiency and benefit. In view of this, this topic for "improve low production, low efficiency oil well recovery" analysis has a certain value.

2. Identification of low production and low efficiency Wells

This paper focuses on the old Wells in our factory. At present, the judgment of low production and low efficiency Wells in our factory is that the daily oil production is less than 1.0t.

In addition, if the production of oil well is below the limit, but the production is in the stage of steady increase, it is not a low benefit well. Due to production measures or other reasons, the production of the oil well is abnormal in the month, resulting in production below the shut-in limit, and other times when the production is high, it is not a low benefit well.

Objectively speaking, the existence of low production and low efficiency Wells has seriously restricted the economic development speed of the whole oilfield, so it is necessary

to carry out reasonable analysis and comprehensive treatment of low production and low efficiency Wells in a planned way.

3. Definition and cause analysis of low production and low efficiency oil Wells

3.1 Definition of low production and low efficiency oil well

According to the relevant documents issued by the development Department of oilfield company at the end of 1999, low production and low efficiency Wells are clearly defined, that is, the Wells with daily oil production of less than 1.0 tons are called low production and low efficiency Wells. In view of the present situation, some oil well engineering enterprises regard the unprofitable well as the profitable well, which presents the situation of low production and low efficiency without effective treatment.

Based on the actual oil well engineering, it can be seen that the causes of low production and low efficiency Wells are mainly reflected in two aspects: 1. Second, water factor. Under the current situation, Wells with fluid production less than 1.0 tons per well are classified as low production and low efficiency Wells. If the industrial volume of the well is between 1.0 tons and 2.0 tons, the Wells with water cut $\geq 50.0\%$ per well will be considered low production and low efficiency Wells. If the fluid production of the well is 2.0 to 4.0 tons, then the single well water cut $\geq 70.0\%$ Wells are called low production and low efficiency Wells; If the fluid production of the

well is more than 4.0 tons, the well with water cut $\geq 80.0\%$ is called low production and low efficiency well [2].

In a word, low production and low efficiency Wells are closely related to the fluid production and water cut of Wells. In order to improve the recovery of oil Wells, it is necessary to strengthen analysis, evaluation and monitoring, and further implement effective solutions.

3.2 Causes of low production and low efficiency Wells

Taking an oil well project as an example, according to the actual situation of the oil well project, the main reasons leading to the low output of the oil well are summarized as follows: (1) the management system of oil recovery is not perfect enough, which makes the organization and operation of oil recovery seem not reasonable and scientific; (2) The system of oil extraction is not standard, the average daily oil extraction is low, and the number of Wells opened is less; (3) The potential of long well shutdown and oil recovery in the operation area needs to be further improved; (4) The basic data of oil extraction design are not sound enough, and the accuracy of design requirements is insufficient; (5) Due to the influence of ground and underground factors, the construction of fishing oil well cannot be carried out smoothly.

4. Analysis of methods to improve recovery efficiency of low production and low efficiency oil Wells

In the process of the above analysis, the cause of low production and low efficiency of oil Wells has a certain understanding. In order to improve the recovery efficiency of low and inefficient Wells, it is necessary to implement effective methods. To sum up, the specific methods are as follows:

4.1 Identify the overall objective of enhancing oil recovery from the well

According to the actual situation of low production and low efficiency oil recovery mentioned above, in order to effectively improve the oil recovery of low production and low efficiency oil Wells, it is necessary to define the overall objective of improving oil recovery, including: (1) to define the optimal recovery period. Combined with the dynamic data and static data of the well, the standard production and operation table is further formulated. (2) The number of fishing Wells should be appropriately increased [3]. Investigate the long well stoppage in the operation area and increase the number of dredging Wells reasonably; For salvageable oil Wells that cannot be constructed, measures can be taken to resume production; (3) Optimize the design of fishing oil well. Check the basic data of each oil well in detail to ensure the accuracy and accuracy of the oil design.

In summary, the overall goal of enhancing well recovery needs to be identified. It is believed that on the basis of identifying the above overall objectives, the recovery efficiency of the well will be improved comprehensively.

4.2 Take effective measures to promote the improvement of oil well production

In order to increase oil well production effectively, it is necessary to pay attention to the application of corresponding methods. On the one hand, the production cycle of single well recovery is established. Take field tracking measures to single well output, obtain the optimized oil recovery period, and further formulate a reasonable and scientific recovery period; At the same time, the management of the vehicle crew was strengthened, and the daily number of oil extraction Wells was increased; It is worth noting that according to the actual situation of engineering work, the oil recovery operation schedule excluding single well optimization cycle should be formulated. On the other hand, the utilization rate of fault-block oil well can be effectively improved by recovering the long shutdown and checking the long shutdown at a fixed time in the operation area. In order to effectively improve the production of oil Wells, it is necessary to take the long shutdown and production resumption as the basic planning work, and then implement the measures of long shutdown and recovery of oil Wells, water plugging, layer adjustment and supplementing.

4.3 Other Methods

In addition to the above methods, other methods are necessary to improve the recovery of the well. For example, the well pattern can be optimized to improve the recovery of the well. In the process of carrying out the actual work of oil well engineering, it is necessary to carefully analyze the causes such as low productivity and the occurrence of reservoir fractures, and further conduct the well pattern optimization tests such as rectangle and square and reverse nine spots, so as to further lay an effective foundation for the implementation of corresponding methods to improve the oil well production rate [5]. To improve the oil well production rate effectively, also can adopt advanced water injection method, need to realize is to extend a low permeable oil field is usually low saturation reservoir, usually only 0.8 on reservoir pressure coefficient, so advanced water injection measures can the special low permeability reservoirs, which based on the reservoir internal build effective displacement pressure system, This results in increased production per well and ultimate reservoir recovery. In addition, you can take a plane control method for a low permeable reservoir production on the part of the characteristic of surface pressure distribution is not enough to "balance, strengthen and control" as the basic principles of water injection, to reasonable adjustment of injection-production ratio, of good reservoir physical properties, water flooding uniformity and high oil well effective wellblock balance water injection measures, for invalid or did not see a well of water, Water injection should be strengthened appropriately, and the measurement of water injection should be controlled according to the Wells already seen. In a word, the above methods can effectively improve the recovery efficiency of oil Wells, which is worthy of reference and application.

5. Measures to improve the recovery of low and inefficient oil Wells

5.1 Casing damaged well overhaul and update, improve injection-production relationship

Improving injection-production relationship is a fundamental measure to control low efficiency Wells and improve ultimate oil recovery. Affected by the casing damage of injection well, the oil well is in an imperfect injection-production state with production without injection, and becomes a liquid supply insufficient well. Timely overhaul and renewal of casing damaged Wells can effectively control the rate of production decline and water cut increase around low production and low efficiency Wells.

In the past two years, in the east of pure oil area, 10 injection Wells including well A have been overhauled and one well including well B has been updated. The average daily recovery water injection is 2336m³, and the average recovery flow pressure per well is 0.11mpa. The average daily increase of fluid and oil is 1.7t and 0.3t, respectively.

Table 1. Statistical table of measures effect of water flooding and water injection Wells in pure oil area

year	Measures type	Compare the number of Wells (bite)	Measures the effect
			Daily recovery water injection (m ³)
2011	overhaul	7	833
	update	1	125
2012	overhaul	3	1378
total	overhaul	10	2211
	update	1	125

5.2 Strengthen the comprehensive adjustment of water flooding to lay a solid foundation for the treatment of low-efficiency Wells

Under the guidance of "four refinements", the adjustment of water flooding scheme in the east of pure oil area is classified and adjusted to improve the production degree of oil layer, improve ineffective and inefficient circulation and balance formation pressure.

In order to alleviate the interlayer contradiction caused by the long well section and the combined production of multiple oil layers in the block, 123 Wells were subdivided, restructured and adjusted in the past two years, 142 zones were added, and the average daily injection was increased by 5m³ and daily actual injection was increased by 11m³. The average daily fluid gain and oil gain per well are 1.2t and 0.12t respectively. On the other hand, reasonable selection of injection measures for low efficiency Wells to increase the foundation of oil flooding. Up to now, a total of 39 water injection Wells have been acidified. After acidification, the initial average water injection pressure of single well has decreased by

0.92MPa, and the daily actual injection has increased by 25m³. 20 injection Wells were fractured, and the average water injection pressure per well decreased by 0.82MPa at the initial stage after fracturing, while daily actual injection increased by 32m³. The average daily fluid gain and oil gain per well are 2.1t and 0.24t respectively.

5.3 Fracturing thin and poor layers to improve the oil supply capacity

In view of whether low production and low efficiency Wells can be fractured, the following aspects should be considered:

- (1) The remaining oil saturation is high and the recovery degree is less than 20%.
- (2) There should be more than two connected directions with surrounding Wells.
- (3) The extreme difference of interlayer permeability is above 2.0.
- (4) The thickness of the poorly exploited zone and the high aquifer should not be less than 3.0m throughout the well.

After carefully analyzing the geological conditions of the reservoir in the east of pure oil area, on the premise of water injection, combining with various dynamic monitoring data, the potential layer is determined and the fracturing is carried out, and the appropriate technology is selected according to the geological conditions of single well, which alleviates the contradiction between layers and improves the ability of oil layer to supply liquid.

From January 2011 to September 2012, 12 low-efficiency Wells in the east of the pure oil field were fractured in 34 stages, including 20 conventional fracturing stages, 12 multi-fracture stages and 2 selective fracturing stages. After pressure, the average daily increase of oil in a single well is 5.1t, and the water cut decreases by 3.9 percentage points, which alleviates the contradiction between layers and improves the liquid supply capacity of reservoirs, and has achieved good results.

5.4 The combination of water plugging and pressure plugging can change the direction of liquid flow and alleviate the contradiction between layers

After water plugging or pressure plugging measures are carried out, the fixed flow direction of injected water is changed to drive out the crude oil in the high oil saturation area, or the permeability of water phase is changed by changing the seepage direction in micro level to improve the movable oil saturation, and finally the effect of water flooding is improved.

In the past two years, a total of 5 Wells were blocked and 5 layers were blocked. The average thickness of sandstone per well in the water plugging measure section was 22.4m, the average effective thickness of sandstone per well was 15.5m, the average daily increase of oil per well was 2.03t, and the average water cut per well decreased by 1.2 percentage points. Seven Wells were combined with plugging and pressure, with an average daily oil increase of 3.3t per well and water cut reduction of 5.5 percentage points.

5.5 The corresponding relationship of sand body can be improved by combining filling hole and changing pump

According to the results of fine geological research -- sedimentary facies zone map, after careful analysis of reservoir and single well, the Wells with low injection and production corresponding rate should be supplemented or combined with pump replacement to improve the corresponding relationship of sand body and improve productivity.

6. Conclusion

Through the study of this topic, to realize low yield, inefficient Wells will be influenced by a number of reasons, in order to improve the low productivity, low oil recovery factor, it is necessary to pay attention to the implementation of effective methods, including: a clear recovery efficiency of oil Wells is improved overall goal, efforts to improve the comprehensive quality of management and construction personnel and take effective method to promote the improvement of oil well production, etc. It is believed that by adopting the above methods, the recovery efficiency of low production and low efficiency oil Wells will be effectively improved, and further lay a solid foundation for the improvement of the overall economic efficiency and social benefits of oil well engineering.

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