Study On Fast Optimization Method Of High Efficiency Adjustment Well Near Fault

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Abstract. The edge of the fault is a concentrated area of remaining oil in the stage of extra high water cut, but with the deepening of the potential tapping work in recent years, it is difficult to select potential wells in the fault area, and the benefit of the effect is decreasing year by year. In this paper, by comparing the relationship between the effect of high efficiency wells that have been put into production in fault area and the development factors, the technical process of high efficiency well potential optimization is established, and a set of high efficiency well potential optimization software system is developed, which is more than 5 times higher than the efficiency of manual well selection, which proves the effectiveness of this method.

1. Introduction
In view of the development of fault-block oilfield, domestic and Foreign Scholars[1-10] have analyzed the relationship between the occurrence of faults and stress by combining drilling, logging, geological, seismic and development data, and summarized the structural style of fault-block, at the same time, we try to deploy development wells on the edge of the fault, and get a good effect. Since 2008, the research of well-seismic combined structure has been carried out in the old planticline area of Daqing Oil Field, explaining that the number of faults increases, the development of faults becomes more fractured and the contact relationship between faults becomes more complex, the area near the fault is changed from risk area to potential area. By drilling high-efficiency wells, the local potential of the area is dug, and the effect is remarkable. However, with the continuous progress of the work, the difficulty of finding high-efficiency wells is increasing, the workload is also increasing, it is urgent to establish a set of optimization methods of high-efficiency wells to realize high-efficiency development in fault zone.

2. Analysis of well pattern control degree
The selection of horizontal well pattern in the development zone is generally based on the principle of improving sand body control and economy and efficiency. Taking the North Sabei Development Zone as an example, there are altogether 6 well patterns in the study area, which are divided into 8 sets of strata for development, different well patterns are adopted for different drilling thickness and sand body distribution. After long-term development, assuming that the underground is a mean oil layer, residual oil will be formed at the distributary line of injection and production wells (Figure. 1), there is residual oil in some well patterns with or without injection, without injection or without production, and without main or non-production.
According to the calculation (Table 1), the area of the non-control area of the well pattern in the distributary line area is smaller than the area of the non-control area of the well pattern near any fault.

For the fault zone, the original area well pattern is cut by the fault, resulting in the existence of residual oil in different locations. This kind of residual oil is a whole series of residual oil which is brought by area well pattern uncontrollability, and is different from single layer and in-layer residual oil type. According to the analysis of fault and actual well pattern, there are four potential areas in the study area: Blank well area, injection-production line, injection-non-production area and fault block area. When the well spacing reaches the original well spacing or above, it can be regarded as the favorable area of remaining oil that has not been exploited.

Table 1. Area statistics of uncontrolled area of well pattern.

| Serial number | Acreage (m²) | Area of one-way injection-production control area (m²) | Number of directions | Well control area (m²) | Well uncontrol area (m²) |
|---------------|-------------|-----------------------------------------------|---------------------|-----------------------|------------------------|
| 1             | 62500       | 18132                                         | 2                   | 36264                 | 26236                  |
| 2             | 62427       | 18132                                         | 1                   | 18132                 | 44295                  |
| 3             | 65096       | 18132                                         | 1                   | 18132                 | 46964                  |
| 4             | 150597      | 18132                                         | 1                   | 18132                 | 132465                 |
| 5             | 48462       | 18132                                         | 1                   | 18132                 | 30330                  |
| 6             | 69995       | 18132                                         | 0                   | 0                     | 69995                  |
3. Automatic Identification of incomplete potential of injection-production
Considering the heavy workload caused by well pattern investigation, the flow chart of automatic identification of potential area is designed and the potential area is demarcated automatically. The steps are as follows (Figure 2):

![Figure 2. Technical flow of high efficiency well potential screening](image)

3.1. Determination of well location relationship
All wells in the study area, including abandoned wells, are classified one by one according to different intervals to form the well location bottom map of each casing series. For the division of Upper and lower strata, each well is divided into three segments: Saertu, Putaohua I group and Putaohua II - Gaotaizi according to the development strata. For the classification of thick and thin layers, the percentage of sand bodies with thickness less than 1 m is counted by using the perforation data table, which is classified as thin layer and thick layer well, in this way, it is divided into five sets of well patterns: Saertu Thick Layer, Saertu thin layer, Puaohua I thick layer, Putaohua II - Gaotaizi thick layer and Putaohua II - Gaotaizi thin layer.

3.2. Analysis of residual potential
The author makes statistics of uncontrolled area of well pattern, and forms the distribution chart and ranking table of uncontrolled potential of well pattern of each set of strata. The specific methods are as follows: firstly, the oil-water well connection of well pattern and the near-fault well-to-fault fault connection (45° to the Azimuth of well pattern) are drawn, the artificial supplementary part is connected with the cutting area near the fault to form a closed area (Fig. 1). Do not switch wells, in the well marked “turn” word, the final well is not based on the current well, for the renewal well, drawing scrap-update two wells connection. Then area calculation is carried out, the area of well pattern control area is drawn between injection and production wells, and the area of uncontrolled area in well pattern is calculated. Finally, according to the size of the uncontrolled area in the well pattern, the index relation is established and the well pattern is calculated one by one.
3.3. Potential well location determination

Single well statistical optimization is carried out to form single well potential diagram and ranking table. The method is as follows: firstly, the best target position of a single closed area is determined, and a large area of the block is taken, and the distance line from the fault is set by reference distance. Then, a series of well patterns are connected from bottom to top, and the initial trajectory is formed by manually connecting the targets in the near-distance interval series. At last, the index relation is established according to the sum of control area of different single well, and the index is made from big to small. The map of potential distribution and the comprehensive evaluation table of potential are formed, and the well locations are selected by manual interaction.

4. Conclusion

Through the analysis and demonstration of well by well injection production relationship, the development potential area is defined, including the blank well area at the edge of the fault, the location of injection production diversion line, the area with or without injection and the area covered by the fault. A potential recognition system for injection and production imperfections in fault areas is developed, which can automatically identify the potential of local infill development.

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