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Research on Prediction Method of Drilling and Falling Recovery Law in Productivity Area

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Research on Prediction Method of Drilling and Falling Recovery Law in Productivity Area

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Abstract. With the expansion of production scale in recent years, the drilling drop in Sazhong Development Zone has a greater impact on output. From the statistics of recent years, the annual output of drilling drop affects an average of 106,000 tons, which is 2 to 3 times the output of new wells that year. Judging from the characteristics of the dynamic changes in the whole process of drilling and dropping, there are great differences in the dynamic changes in different blocks, different oil layers and different well spacing conditions. The dynamic response time of the Sapu oil reservoir is earlier than that of the Gaotaizi oil layer; the smaller the well spacing, the earlier the dynamic response time; However, there are few conclusive literatures on the effects of drill-down, and there is little discussion on the degree of drill-down effects. In order to further study the drill-down rule under different well patterns, different pressure levels, and different oil layer properties, and to further quantitatively study the degree of the drill-down effect, this paper takes the North East Block Duandong block as the research object, and analyzes different wells during the drilling recovery process. The in-depth study of the factors affecting the drill-down under different conditions of the network, pressure level, and different oil layers is carried out, and the law of drill-down recovery is summarized; combined with the theory of percolation, mathematical statistics is used to predict the influence of the drill-down to arrange the production operation for the next year As well as the preparation of the drill-down recovery plan to provide theoretical guidance.

Key words: Drill down recovery; Prediction; Influence level; Statistics.

1. Summarize the dynamic changes of oil wells with different oil layer properties, different pressure levels and different production capacities

1.1. The Recovery of Fluid Production in the Low-Pressure Well Area Is Slow, and the Water Cut in the Low-Pressure Well Area Rises Fast

It can be seen from Figures 1 and 2 that the degree of influence is different in the drilling process at different pressure levels: the fluid recovery in the low-pressure well area is slow to recover, the water cut in the low-pressure well area increases greatly, and the high-pressure well area is the opposite.

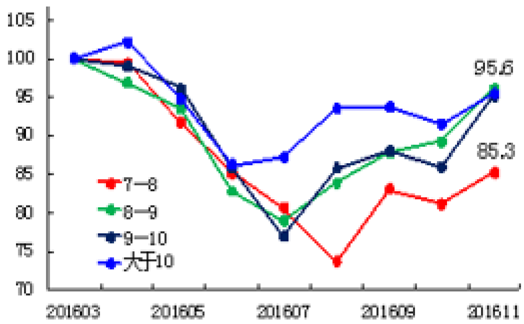

Figure 1. The curves of fluid recovery under different formation pressures

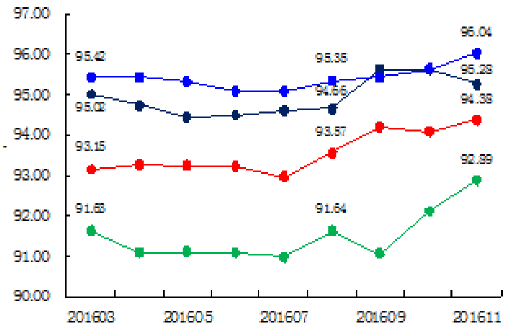

Figure 2. The curves of water recovery under formation pressures different

1.2. The Low-Permeability Layer Has A Long Impact Time and Slow Recovery, and the Medium-High Permeability Layer Oil Well Drilling Has A Short Impact Time and Fast Recovery

It can be seen from Figures 3 and 4 that oil production wells with different reservoir properties have different degrees of influence: the recovery of fluid production in the low-pressure well area is slow, the water cut in the low-pressure well area increases greatly, and the high-pressure well area is the opposite.

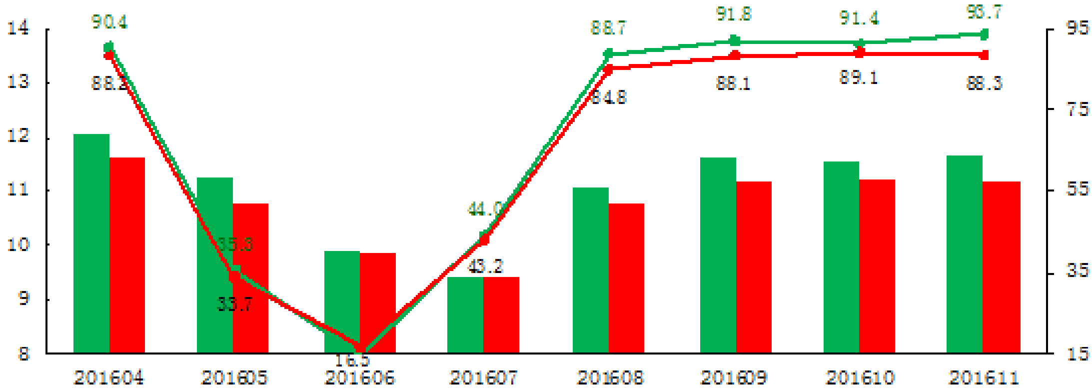

Figure 3. Drilling drop recovery curves of water injection wells with different oil layer properties

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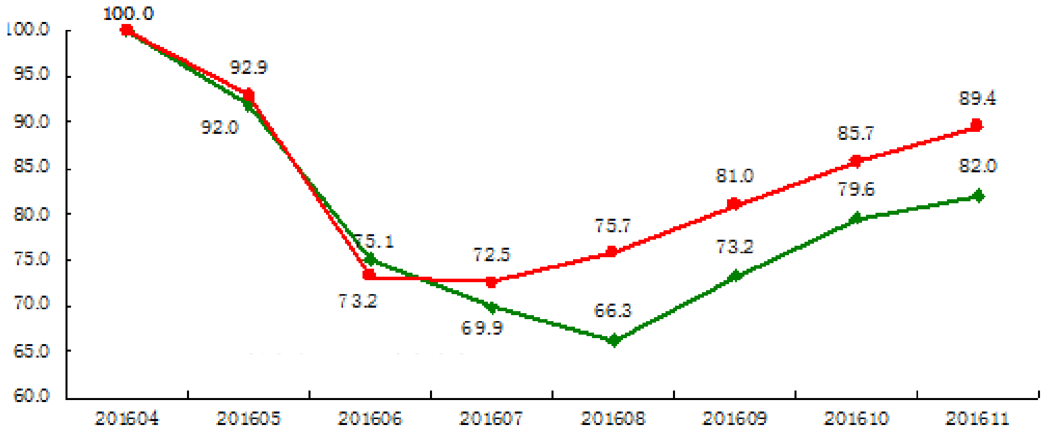


Figure 4. Drilling drop recovery curves of oil recovery wells with different oil layer properties

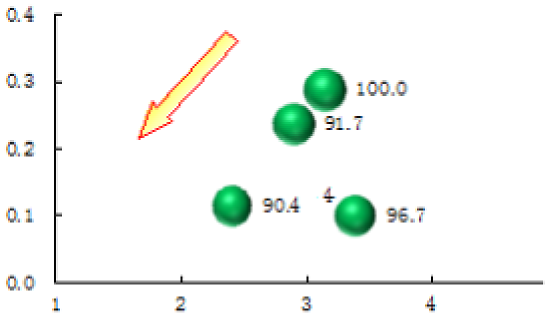


Figure 5. Permeability and connected wells-recovery of fluid production

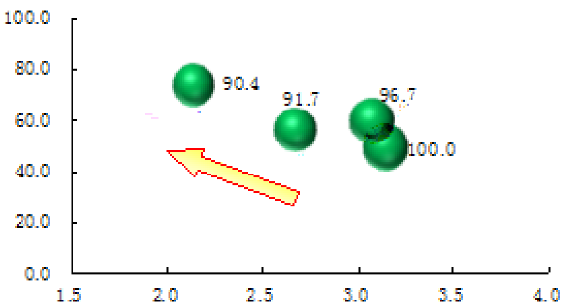


Figure 6. Days of shut-in wells and drilled wells-recovery of fluid production

It can be seen from Figures 4 and 5 that the degree of recovery from drilling is related to the number of connected water wells and the number of closed wells and closed days.

1.3. The Basic Recovery Pattern Is the Fastest, Followed By the Adjustment Pattern, and Finally the Gaotaizi Pattern

As shown in Figure 7, the recovery of fluid production in different layers is different, and the recovery of the basic well pattern and polymer flooding pattern is the fastest. The second is to adjust the well pattern, the slowest recovery is the Gaotaizi well pattern, which is mainly related to the reservoir conditions; as can be seen from Figures 8 and 9, the water cut rise is positively correlated with permeability and effective thickness.

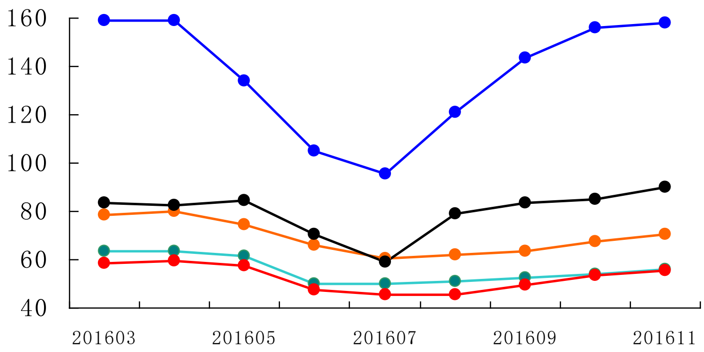
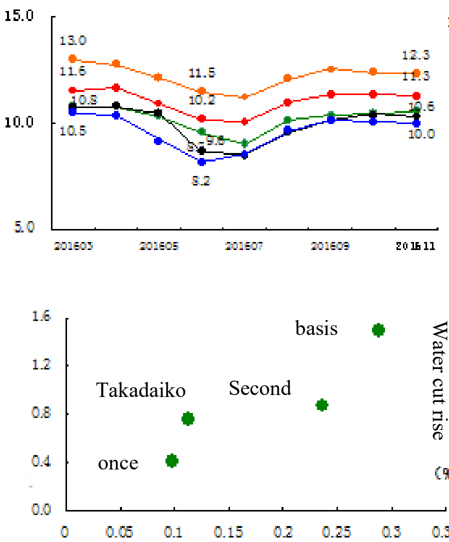


Figure 7. Drilling drop recovery curves of different layers



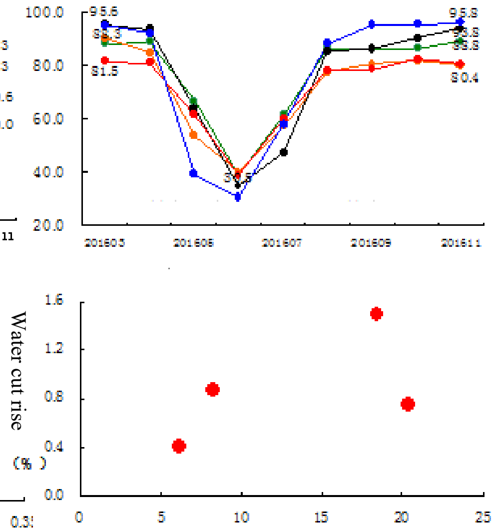


Figure 8. Relationship between rise in water content and effective thickness

Figure 9. Relationship between rise in water content and permeability

1.4. Different Production Levels Have Different Laws

The higher the level of fluid production, the slower the recovery of fluid production. The reason is that after the well is drilled, the formation pressure at the production end drops significantly; the lower the water cut, the greater the rise in water cut. Therefore, the water wells in the area of the electric pump wells are restored in one step (Table 1), and the invalid circulation of high aquifers is controlled in conjunction with the interval adjustment (see Figures 10 and 11).

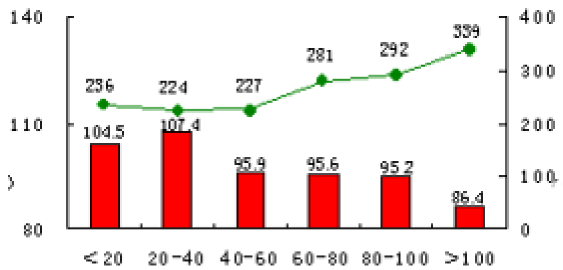


Figure 10. Histograms of different fluid and rising values

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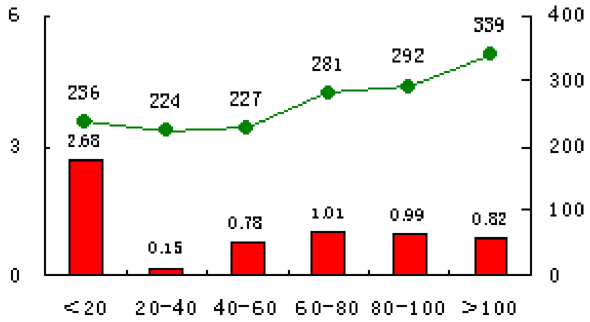

Figure 11. Histograms of different water cut levels production levels and recovery levels

2. Establish the relationship between dynamic response time, permeability and well spacing

The dynamic response time is directly proportional to the well spacing and inversely proportional to the permeability (Figure 12, 13).

The expressions of dynamic response time, permeability and well spacing are established, so some wells can be closed and opened early (see Figure 12).

The drill-down response time can be understood as the reaction time after the water well is shut down and the pressure drop is transmitted to the oil well. The pilot pressure coefficient can be applied to study the dynamic response time. The pressure guiding coefficient is the parameter of the speed of pressure transmission. In the same block, the fluid viscosity and the overall elastic compression coefficient are constant, therefore,

Permeability is the reflection of the pressure guiding coefficient. Permeability can be used to study response time.

$$\eta = \frac{K}{\mu \times C_t}$$

k —— Permeability;

μ —— Fluid viscosity;

C_t —— Comprehensive elastic compression coefficient;

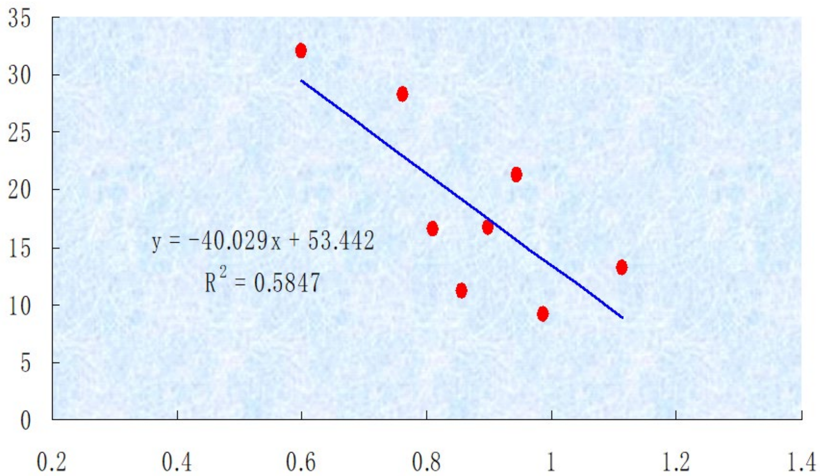

Figure 12. The graph of mathematical relationship between response time and permeability well spacing

3. Quantitative evaluation of the impact of drill-down

3.1. Forecast the Impact of Drilling Down in the Production Area in 2017

According to the statistical results of the impact of drilling down over the years, the production fluid appears low after drilling down for 5 months, with a decrease of about 30%. The formula calculates that the water cut rise is 0.35 percentage points, and the drill down can be restored to 92% (Figure 14).

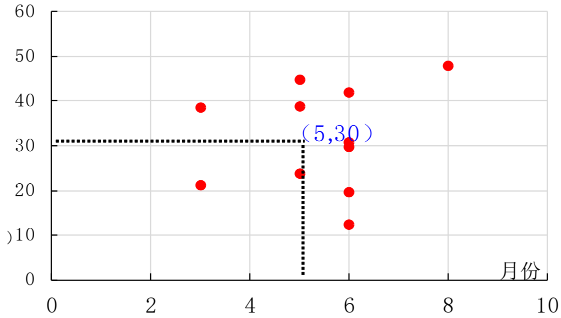

Figure 13. Over the years, the rate of decline in drilling fluid production and the intersection of time

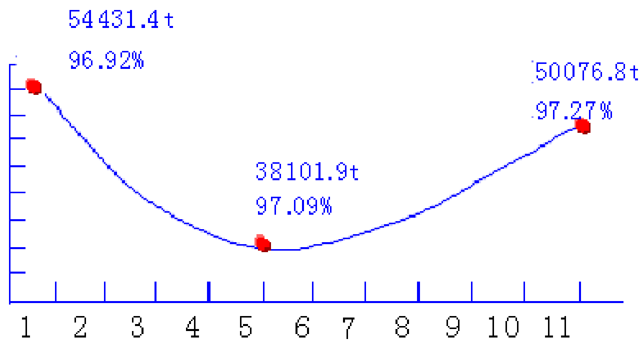

Figure 14. Schematic diagram of formula calculation steps

Based on the statistical results of the drill down over the years and the research results of this paper, the predicted impact of drill down is 113,000 tons. If targeted adjustment measures are taken, the predicted impact is 105,400 tons (see Figure 15).

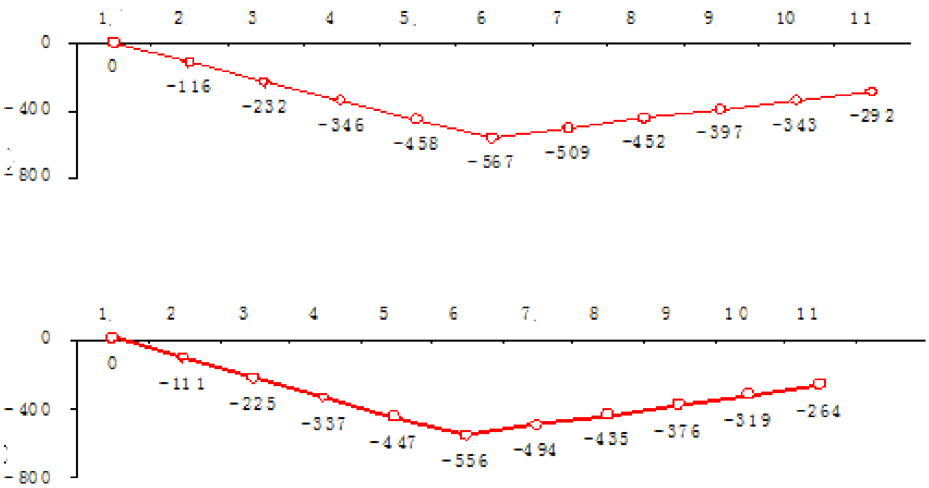

Figure 15. The forecast curve of the impact of drilling down in 2017

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4. Conclusion

1. Statistical results show that the nature of the oil layer and the number of days the well is closed have a greater impact on drilling recovery.

2. The expressions of dynamic response time, well spacing and permeability are established to guide the optimization of the drill-down switch well.

3. Established mathematical relationship between drilling fluid recovery and fluid production, water content, quantitatively describing the degree of drilling impact, and providing a theoretical basis for future drilling recovery.

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