Analysis of hedge loss factors and protective measures in the western part of Area-A

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Abstract: With the continuous development of oilfield, the number of oil and water wells is increasing, and the number of casing loss wells is on the rise. This paper analyzes and researches to further understand the causes of casing loss, and proposes measures to protect casing loss wells in the western part of area A. It summarizes the experience and methods of "six checks, six preventions and six controls" for casing loss protection, which provides direction for preventing casing loss and provides a basis for reasonable development.

Key words: Prevention of nesting; causes of nesting; protective measures.

1. Introduction

The western part of area A belongs to medium and low permeability oil reservoir, with oil-bearing area of 24.83×km², geological reserves of 8094.25×10⁴t and a total of 2318 oil and water wells. With the extension of oil recovery and water injection time and the continuous adjustment of oil field development program, the working condition of casing becomes worse and damaged, which destroys the normal injection and extraction well network system and causes the well network imperfection. In 1996, the first set loss peak appeared in a mining area, and the set loss wells concentrated in A north block in 2013, and the second set loss peak appeared in 2014, and the number of annual set loss wells reached 57.

2. Analysis of the causes of casing damage

2.1 Geological factors

2.1.1 Water Swelling and Creep Effects of Mudstone

When the injected water enters Nen II member, the stress state will change due to the unstable nature of the mudstone, and these changes will cause displacement, expansion and deformation of the mudstone, increasing the amount of load on the outside of the casing. When the external load degree of the casing is greater than the compressive strength, the casing will be extruded and deformed or even wrongly broken. After the oil field is developed with water injection, the injected water in the sandstone permeates through the pores, there is no softening of the rock skeleton, and there is no change in ground stress. While the mudstone absorbs the softening of injection water, its cementing force gradually disappears and creep rate increases. For the un-shooting section, the casing is subject to elliptical stress that cannot be released, forcing the non-uniform horizontal stress to squeeze the outer wall of the casing, and when the equivalent damage load is greater than the casing yield strength, the casing produces elliptical deformation, which eventually causes casing damage.

2.1.2 Rock sliding

In the west of area-A, there are Sa0–SaI interlayer and SaI–SaII interlayer. If the interlayer does not absorb water, the action of the original ground stress keeps the rock formation stable, but the weak interlayer usually has a strong ability to absorb water. In the process of oil field development, when the injection pressure reaches a certain value, the injection water will flee to the interlayer through the fracture and make it absorb water, resulting in the destabilization and sliding of the rock formation, thus causing oil and water well set loss.
2.2 Engineering Factors

2.2.1 Poor quality of cementing injection water runoff

The poor quality of cementing (cementing quality rate less than 80%) provides a channel for the water to escape from the injected wells into Nen II member, causing the mudstone to absorb water and slide, which leads to the loss of cementing.

2.2.2 Scrapping is not a complete tampering

Census 189 scrapped well situation, found 68 wells scrapped when the well has fallen, of which 50 wells have been drilled to update / side-slant wells, scrapped well condition is unclear scurry into the tender second section, there is a set of potential damage.

3. Countermeasures to protect the casing loss well area

The work of casing protection adheres to the work idea of mainly hidden danger investigation and combining prevention and control, and through the work of investigation, prevention and treatment, the casing loss protection countermeasures of "6 investigation, 6 prevention and 6 control" have been summarized to achieve a clear situation of hidden danger and reasonable preventive measures, which effectively control the speed of casing loss and gradually stabilize the situation of casing loss.

3.1 Carry out casing hidden danger survey

3.1.1 Checking the quality of well cementing in the layer section

Using the acoustic variable density curve, the cementing data of 988 layers sections of 247 poly-drive injection wells in the key monitoring area of the casing loss can be viewed. It can be seen from the cementing quality contour map that the cementing quality of the poly-drive wells in the planar B North block casing loss area is the worst, with 21.4% of the whole wells having a quality rate of 80% or more; the cementing quality rate of the longitudinal cement return high ~ Sa I1 and Sa II1 ~ Sa II4 layer sections is low.

3.1.2 Census layer section abnormal water absorption condition

Using isotope information, the current situation combined with history, a census of 1,176 isotope data in the past ten years, focusing on the proportion of water absorption at the top boundary of the injection hole, focusing on the analysis of a single layer of water absorption of more than 30%, stopping the injection layer of water absorption of the potential problems of the well, to take a total of 80 wells treated by means of measurement and adjustment of the amount of lowering, operation adjustment, etc., to reduce the risk of set loss.

3.1.3 Census casing protection packer down into and sealing condition

Census of 985 injection wells found 42 wells were shut down without protective packers due to unplugging, set loss and other reasons. For 16 wells with abnormal pressure to implement the seal of the packer, 2 wells are not sealed, all sealed after the second release.

3.1.4 Census well group injection and extraction relationship

In recent years, the proportion of oil layer parts set loss has increased, the injection and extraction relationship of the water-driven well group was analyzed, and 19 layers sections with injection, no extraction and injection greater than extraction were stopped and controlled after reservoir reawakening, and the water injection intensity was adjusted downward by 1.57 m3/d.m.

3.1.5 Census of previously hedged injection well rupture pressure

After the rupture loss occurred in the standard layer, the top boundary depth of the injection hole in the rupture pressure calculation formula was shifted up to the depth of the standard layer, and the rupture pressure of the ruptured wells in the standard layer was adjusted downward by reducing the calculation depth to reduce the risk of rupture loss. A survey was conducted on 37 injection wells that had been damaged in the Tender II section and had been overhauled and opened, and the rupture pressure of 10 wells was adjusted downward by 0.5MPa.

3.1.6 Census of water injection strength of wells in the hidden area

A survey was conducted on 206 water wells with water injection intensity inside and at the edge of the hidden area. Aiming at 80 wells with water injection intensity greater than 6m3/d.m, the relationship between injection and extraction of well groups and the degree of hidden damage of the set was analyzed and 16 well reductions were implemented, with water injection intensity decreasing by 1.32m3/d.m.

3.2 Carry out casing damage prevention work

3.2.1 Comprehensive enhancement of hedge protection awareness

Adopt the way of "lecture, examination and investigation", carry out training on knowledge of set loss at different levels and with different focus; implement the management of set loss wells, pay attention to the dynamic changes of oil pressure, set
3.2.2 Timely circling of hidden hazards

Combined with the four data items of "the distribution of the set loss wells in NenⅡ member, the degree of set loss, the distribution of the submerged water in NenⅡ member, and the implementation of the pipe column", seven key areas for monitoring set loss were divided. Combined with the "proportion of lossy wells and the submerged water", we drew up a map of the level of potential loss, and defined three levels of "danger zone, buffer zone and relative safety zone" in each key lossy monitoring area.

3.2.3 Resolutely implement shutdown and control to prevent the spread

After the discovery of the set of damaged wells, resolutely implement the surrounding 300m injection wells all shutdown, and the development of shutdown control program immediately after implementation, until the implementation of the well condition without hidden problems before resuming water injection.

3.2.4 Accelerated investigation to prevent unclear well conditions

Based on the principle of "two timely, a comprehensive" implementation, that is, the timely development of the survey program, timely and effective survey methods, comprehensive coverage of the survey, the implementation of a total of 164 wells well condition survey, electromagnetic flaw detection, timely detection to determine the set loss of 56 wells, reducing the risk of hidden defects.

3.2.5 Balanced set control area boundary pressure difference

Monitor the difference in formation pressure inside and outside the boundary of the hidden area. In order to prevent large changes in the pressure difference between the boundary inside and outside the block, 16 well adjustments to the injection and extraction parameters were implemented to control the pressure difference between the boundary inside and outside the block to within 0.2MPa.

3.2.6 Prevention of water injection on the hidden danger

In recent years, for the history of 156 SaⅡ 1 ~ 4 injection wells have been stopped to take tests, isotopes and other ways to verify. At the same time, increase the monitoring of injection pressure, water injection, 156 SaⅡ 1 ~ 4 stop injection layer section to view and analyze 271 isotopes, test results and other information, no water absorption was found to show.

3.3 Casing protection monitoring work

Establishing six attention standards to reduce the risk of hedging losses by laying out a full range of monitoring well points in a flat and vertical manner. Through the above comprehensive protection measures, the number of casing loss wells decreased from 57 to 37 in 2017 compared with 2014, and the casing loss situation turned better.

4. Conclusion and Awareness

(1) The situation of casing damage in Area A is serious, and the prevention and management capabilities of casing damage wells should be continuously strengthened.

(2) To strengthen the management of casing damage wells, new processes should be introduced and multiple measures should be taken to reduce the frequency of casing damage.

(3) Through continuous monitoring of the well group injection and extraction profile and pressure measurement data, detailed analysis of the injection and extraction relationship can provide a basis for the prevention of damage.

(4) The prevention and control work should be done in time after the occurrence of casing damage to avoid the expansion and spread of the casing damage area.
References

