ADVANCES IN PETROLEUM EXPLORATION AND DEVELOPMENT
Vol. 18, No. 1, 2019 pp.45-48
DOI: 10.3968/11304

CSCanada
www.cscanada.net
www.cscanada.org
ISSN 1925-542X [Print]
ISSN 1925-5438 [Online]

# Modular Frame Method Plugging in Fuyu Problem Well for Treatment Application

**LIU Yongsheng[a],*; YANG Erlong[b]; HE Zengjun[c]; GE Zhenyu[d]; CUI Yunzhe[e]**

[a] Fuyu Oil production plant of Jilin Oilfield Company, Songyuan, Jilin, China;
[b] Key Lab of Ministry of Education for Enhancing the Oil and Gas Recovery Ratio, Northeast Petroleum University, Daqing, China;
[c] Fuyu Oil production plant of Jilin Oilfield Company, Songyuan, Jilin, China;
[d] Jilin Petroleum Group, Jisong quality and technology testing limited liability company, Songyuan, Jilin, China;
[e] Fuyu Oil production plant of Jilin Oilfield Company, Songyuan Jilin, China.
* Corresponding author.

**Supported by** the first level of the provincial leading talent echelon 535 Project (719900043).

## Abstract

In Fuyu oil field wells spit mudstone serious, sloughing, lost the problems on the top of the fish, take relief well construction method, using new drilling trajectory, through reservoir perforated interval as China Unicom media, from and old wells trajectory formed a U-shaped connecting device, eventually set up a China Unicom, so as to implement to new wells trajectory cement injection to sealed wells eyes return channel to. The technology to solve casing fault at the lower part of the fish top completely lost without channel, shallow mudstone strata serious collapse and leakage, et in sleeve and a lot of spit mudstone and operation cannot on the lower part of wellbore and reservoir were blocked. In the communication of the trajectory of the new and old wells by chemical plugging agent and augmented injection provided measures of pressure, relative effective reduces the invalid diversion effect, improve good communication relationship between new and old wells eyes and Unicom performance, finally realizes the effective sealing effect. In the field application, it has achieved good results, effectively blocking the difficult wells, and provides a new method for the safety management of Fuyu oilfield.

**Key words:** Fuyu oilfield; Severe mud rock; Formation collapse; Fish head loss; Model frame method

## INTRODUCTION

At present, there are more than 118 problem wells with formation collapse in Fuyu Oilfield, 9 wells have occurred reversed flow, which cannot be completely rectified by conventional overhaul techniques. With the continuous development of oil fields, the number of such wells is increasing. The difficult casing reversed flow not only plagued the water injection development of Fuyu Oilfield, but also polluted the ground environment and caused certain harm to groundwater resources. The key to solving the problem of formation collapse and difficult wells is to effectively suppress the formation collapse and the phenomenon of spit mudstone. In order to better solve this part of the problem well, the relief well construction method is adopted, the communication between the new and old wellbore trajectories is established, and the upwards going flow channel on the wellbore trajectory is sealed. Three problem wells have been tested in the field and achieved very good results.

† Received 21 October 2019 Accepted 3 December 2019 Published online 26 December 2019

Liu, Y. S., Yang, E. L., He, Z. J., Ge, Z. Y., & Cui, Y. Z. (2019). Modular Frame Method Plugging in Fuyu Problem Well for Treatment Application. *Advances in Petroleum Exploration and Development*, *18*(1), 45-48. Available from:http://www.cscanada.net/index.php/aped/article/view/11304 DOI: http://dx.doi.org/10.3968/11304

Copyright © Canadian Research & Development Center of Sciences and Cultures

# 1. CAUSE ANALYSIS AND PRESENT SITUATION OF DIFFICULT WELLS IN FUYU OILFIELD

## 1.1 Serious Fault Damage of Casing Caused by Water Absorption and Expansion of Mudstone in Shallow Layer Because of Groundwater Breakthrough

Massive water absorption of mudstone at casing leakage, casing deformation and casing return well outside casing, leads to mudstone accumulation and expansion around casing, resulting in casing leap, mudstone broken and collapse, a large number of mudstone fragments into wellbore and buried reservoir, at this time, a large number of injected water into mudstone layer, because of mudstone water absorption and leakage, mudstone expands into radiative outward extension, formation expansion stress further expands and strengthens. Under the combined action of mudstone expansion force and injected water corrosion, casing deformation or leap occurs one after another in the same well site or near well.

## 1.2 Current Situation of Problem Well

(1) The casing is broken and completely staggered, and the lower fish top is completely lost.

(2) The formation collapses seriously, at the same time, it is accompanied by serious leakage.

(3) There is serious split mudstone in and out of the casing, and the single pipe cannot be added in the casing washing and milling operations of the casing.

(4) Severe groundwater breakthrough to ground and returning, seriously disturbing the geological development of the oilfield.

Because oil, water, mud and other return materials rise to the ground, it pollutes the ground environment and have a greater impact on groundwater, and the third and fourth water layers will face serious pollution. The casing return well not only affects the normal production of the well, but also affects the normal production of the surrounding oil and water wells, destroys the balance of injection and production in the block. The individual wells are forced to seal the wells, resulting in imperfect well pattern for water injection development in the oilfield.

The casing return well wells with good well conditions can be treated by overhaul techniques such as borrow casing and well plugging. However, there are some sets of the casing return well with casing leap and a lot of spit mudstone, it is impossible to achieve effective governance purposes by overhaul borrow casing and sweeping plug.

# 2. TECHNOLOGY OF SOLVING PROBLEM WELLS BY MODULAR FRAME METHOD

The relief well construction mode is adopted, the new drilling hole trajectory is used, and the oil layer perforation well section is used as the connection medium, so that the new and old hole trajectory forms a U-type connector, and finally a connection relationship is established. The overall design concept and idea is to abandon the traditional unrealistic method of finding fish top to carry out the inner well sealing operation, and to make use of the special relationship of the U-type connector formed by the new and old wells, so as to carry out the injection of cement slurry into the new hole trajectory to achieve the purpose of sealing the old hole return channel.

## 2.1 Design for Relief Well Technology by Modular Frame Method

### 2.1.1 Modular Frame Method of Relief Well Near Well Zone in the Same Well Site

Within 5m of the old wellbore, a new wellbore is drilled within 2m, and the U type connection relationship is established by using the new and old hole trajectory and the perforation well section of the reservoir as the medium. The main principle is to implement a new wellbore trajectory cement to seal the return channel of the old wellbore trajectory.

### 2.1.2 Well Plugging of Directional Inclined-Relief Well by Modular Frame Method

Far from the old well site, a directional well is drilled in the stable part of the overlying formation to seal the well by relief well. Two construction methods are generally designed: Firstly, if the operation technology is excellent and has considerable operation technical ability, it can directly adopt the construction method of drilling the old wellbore trajectory. At this time, the non-penetrating hard mudstone layer is used as the medium, and open hole packer is used for well plugging using cement; Secondly, if the operation technology generally does not have the above capabilities, then the well bottom Modular Frame Method is used for well plugging. In the same way as the well plugging method of relief well near the well site, The bottom hole spacing can be appropriately relaxed, but the maximum distance should not exceed 10 m, preferably controlled at about 5 m.

Advantages: avoiding the collapse section of the formation near the old hole, it can realize the completion of the well and avoid the damage of the upwards going channel of casing return, and convenient to observe the upwards going situation of old borehole.

Copyright © Canadian Research & Development Center of Sciences and Cultures

Technical difficulties: during directional drilling, magnetic interference caused by casing return well will affects MWD, which makes the control of the new well trajectory more difficult.

#### 2.1.3 Observation Well

The observation well is located near the wellhead of the old wellbore, and well depth is designed as the part of the casing leap of the old well. The observation wellbore size is ϕ102 mm casing or ϕ62mm tubing, no cement cementing is carried out outside the pipe, and 10~20m screen pipe is connected to the lower part of the pipe string. The purpose is to timely grasp and observe the upwards going situation of the old wellbore and judge the quality of the cementing well.

The main purpose: facilitate communication between new and old well layers; timely grasp and observe the upwards going situation of the old wellbore; judge the quality of cement as an indicator mark; Seal the collapsed formation and upwards going channels to the ground to prevent the surface fluid from flowing into the formation and pollute the third and fourth water systems. A problem well that without set return must drill an observation well, otherwise it is impossible to judge the sealing quality of the reservoir in the old well.

### 2.2 Key Technology of Modular Frame Method for well sealing

#### 2.2.1 Treatment Technology of Collapse and Leakage of Upper Mudstone

(1) Using uninterrupted drilling technology with continuous square auger; (2) Adopting high-quality anti-collapse, anti-leakage mud and plugging and forced drilling and other technical measures; (3) Adopting reasonable matching techniques and measures of drilling parameters

#### 2.2.2 Technology for the Establishment of the Well Plugging Channel

(1) Using conventional drilling technology to drill 5 to 10 above the old wellbore perforation section of the oil layer, and cement the casing; (2) A group of perforated oil layers were drilled by using conventional open-hole drilling technology to establish a U-type connection relationship between new and old well trajectories.

#### 2.2.3 The Technical Practice of Injecting Cement to Realize Well Plugging

(1) Construction methods include the well sealing string put down to the perforating top boundary of a sand formation about 30 m or the whole well casing extrusion test; (2) Extrusion test with clear water or inject indicator to observe the reversed relationship between new and old wells and formation pressure changes; (3) The old hole reversed flow rate is not less than 30% of the injection rate, and the injection pressure is not less than 6.0 MPa; (4) When the reversed weight is insufficient or the injection pressure is low, the chemical injection agent is used to implement the temporary technology. Purpose: to block the passage near the old borehole and prevent the peripheral diffusion of injected cement; increase formation pressure to ensure that cement injection can effectively enter the old wellbore trajectory; (5) Chemical gel cement and conventional cement are used for closing well, injection volume is controlled around 50~100t; (6) After the completion of the construction, the new well trajectory is sealed by the circulating method; (7) Observation hole trajectory circulation or extrusion test with water to seal the observation hole trajectory, finally the observation hole string is set up to ensure the cementing quality is foolproof.

## 3. APPLICATION EFFECT

X16-8 was completely treated on May 6, 2014, the surrounding 4 injection wells restore water injection, total daily water injection is 210 $m^3$, among them, X16-8.21 water injection is 50$m^3$, X16-10. 2 water injection is 40 $m^3$, X18-8.21 water injection is 60$m^3$, X16-9.2 water injection is 60$m^3$; the total daily incremental oil of the surrounding oil wells is 1.61 t.

This process makes use of the working principle of the A-type connector, adopts the relief well construction mode, utilizes the new drilling trajectory, and finally establishes a connected relationship between the new and old well trajectories through the oil hole perforating well section, and implements the cementing of the old wellbore. In 2014, 3 wells were implemented, 11 wells were recovered and 34 wells benefited, with cumulative incremental oil of 1,300 t and a cumulative effect of 5.88 million yuan. At the same time, the economic loss can be reduced by 3 wells caused by the returning ground pollution environment by 5 million yuan per year (outward transport and handling charges, material and labor costs for on-site control measures, temporary land requisition fees, etc.), total effect is 11.24 million yuan. It is necessary to reduce the pressure of environmental protection, so the social benefits are greater.

## CONCLUSION

Well-filling techniques of by Modular Frame Method is suitable for casing leap, formation collapse and a lot of split mudstone, and there is no return at present. This method effectively solves and realizes the communication problem between the new and old hole trajectories. Modular Frame Method. In the communication of new and old wellbore trajectories, chemical plugging and increasing injection and pressure lifting measures are adopted, which

Copyright © Canadian Research & Development Center of Sciences and Cultures

effectively reduces the effect of ineffective shunting, improves the good communication relationship and connectivity between old and new wells, and finally achieves effective sealing.

In the process of remediation, the set return point plays a key role in cementing. The ground set return point has played a key role in many times of test extrusion and temporary plugging, which is used as a special indicator and symbolic significance of cement quality. The most direct reflection of the success of the well cementing is that the set return amount of the ground changes with the symbolic change of the cementing period, that is, the change of the set return amount from large to small, from small to no, and the liquid flow backflow occurs on the ground, and finally all set return amount stops. The new drilling can be used as a utilization well for the treatment of well plugging, both for the purpose of governance and for improving the well pattern.

## REFERENCES

He, Z. J. (2011). Analysis of viscosity-reducing measures for the heavy oil in Block Dong17 of Fuyu Oilfield. *Special Oil & Gas Reservoirs*, *18*(6), 100-102.

He, Z. J., Lin, Y. P., & Li, G. J. (2012). Produce reserves from shallow reservoirs under surface pressure — summing zones by large drill platform in Fuyu oilfield—A case in Chengping 12 block. *Special Oil & Gas Reservoirs*, *19*(3), 144-142.

Zhuang, S. L., Zhang, Y. H., & He, Z. J. (2006). Exploiting potential of fuyu oilfield by horizontal well technology. *Techniques for improving development effect in high water cut oilfield* (pp.341-346). Beijing: petroleum industry press.

Zhang, Z., Yuan, M. Z., & Wang, H. (2014). Large Concrete Structures During Solidification Temperature Field Research. *Applied Energy Technology*, *9*(201), 11-15.

Copyright © Canadian Research & Development Center of Sciences and Cultures 