A Development Area of surplus reserve production ratio influence factors

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Abstract. The remaining oil reserve production ratio of A Development Area is low,there is a serious contradiction between the remaining recoverable reserves and stable production.Aiming at the analysis of the low remaining oil reserve production ratio of the A Development Area,quantifying parts of the influence factors which influence the recoverable reserves value and re-accounting the remaining recoverable reserves.It is very necessary to guide the compiling of the "13th Five-Year" plan of the A Development Area .The results show that: the number of drilling wells in water flooding production block,the strength of comprehensive adjustment can influence the annual recoverable reserves value added; The scale of geological reserves of tertiary oil recovery block has certain effect on the year recoverable reserves value added;the value of EOR of tertiary oil recovery block which had been put into operation has great influence on the calibrated recoverable reserves;The recognition and calibration of sporadically distributed wells and test blocks which have not calibrated recoverable reserves ,which will provide contribution to the increase value of recoverable reserves. The research results also provide new ideas for the development blocks of low remaining oil reserve production ratio in Daqing Oilfield.

Introduction

At present, most domestic oilfields have entered the development stage of super high water cut and high recovery degree, the water flooding development of old oilfield is still the main research subject of oilfield development and further enhanced oil recovery[1-3]. Water flooding and polymer flooding coexist with multi production well patterns in the current A development area after 40-year large-scale development adjustment, in which underground injection-production relationship is very complex.By the end of 2014, the geological reserves of A Development Area were 61290 * 104t, recoverable reserves were 28097 * 104t, the remaining recoverable reserves were 1797 * 104t, the remaining oil recovery rate of recoverable reserves was 19.63%, according to the "13th Five-Year" planning research results of A Development Area , by 2020, the only remaining recoverable reserves of A Development Area will be 35 * 104t,the high degree of reserve recovery of recovery reserves will reach up to 99.88%.From the viewpoint of the remaining oil reserve production ratio and the remaining oil recovery rate of recoverable reserves, stable situation of oil field is grim. Need to re-calibrate the recoverable reserves of A Development Area ,verify the remaining recoverable reserves,implement resource potential that can be used for exploitation,which can better guide the development planning.For the above reasons, the author started from the influence factors of recoverable reserves,such as water flooding,polymer flooding,test blocks ,based on thorough analysis of various influence factors ,quantified part of influence factors of the recoverable reserves,verified the reliability of quantitative results ,confirmed the remaining recoverable reserves potential that can be used for exploitation of A Development Area,offered a significant guide for the later development modification of oilfield[4-6].

Reasons for low recoverable reserves

The Number of New Water Flooding Wells Decreased Year by Year, and There is No New Comprehensive Adjustment Reserves. From the development process of the A Development Zone, It has experienced a encryption, second encryption, expansion of the edge, polymer flooding the four stages, the current water flooding, polymer flooding, the coexistence of the two mining methods[7-8]. From the number of years of drilling, the development object became worse gradually drilling potential gradually decreases, resulting in the number of new drilling decreased year by year, "11th Five-Year", only the injection production system adjustment, SA 0 group test, layer recombination a small amount of new drilling wells, The drilling number during "fifteen" is 205 every year , during"11th Five-Year"declined to 60 every year , the water flooding is the new recoverable reserves declined from an average of 160* 104t to an average of 40 * 104t , with an average annual increase of recoverable reserves dropped sharply; from the comprehensive adjustment, 1990-2004 water flooding comprehensive adjustment efforts in the year 500, an average annual increase of recoverable reserves of 130 * 104t with water content increasing, comprehensive adjustment potential has become smaller, since 2005, every year has no water flooding comprehensive adjustment increase recoverable reserves. The above two reasons have led to significant reduction in water flooding new recoverable reserves than the "fifteen" period.

The Polymer Flooding Block Has Been Improved to Enhance The Recovery Value and Increase The Recoverable Reserves. Calibrated polymer flooding blocks refers to the blocks which has entered the stage of water cut increasing and subsequent water flooding blocks. by the end of 2014, there were total 12 blocks in Saertu development zone. the blocks calibrating recoverable reserves , in accordance with the new block, applied to methods that geological reserves multiplied the value of improving recovery factor[9-11] . Recoverable reserves of new blocks were calibrated enough once. According to this method of calibrating recoverable reserves, in the reservoir blocks which were developped early , calibration value of improving recovery factor was only 12%. While from a practical perspective, for class I oil reservoir blocks which had been transferred to subsequent water flooding development ,the value of improving recovery factor should be 17% - 18%. So further calculation was needed .recoverable reserves of the 12 tertiary oil recovery blocks can be added 328.3*104t on the basis of the original calibration of recoverable reserves.

TABLE 1 Calibration table of recoverable reserves in polymer flooding block

Block	Reserves /10^4t	Polymer Injection Time	Stop Polymer Injection Time	Improve Oil Recovery of Polymer Flooding %		Calibration Value of Improve Recovery Factor /%	Difference From Calibration Value of Improve Recovery Factor /10^4t
				scheme	actual prediction		
1	1575	199512	200306	12.0	17.5	12.04	86.0
2	1237	199608	200305	12.1	12.1	12.10	0.0
3	752	199911	200606	11.5	12.1	11.48	4.7
4	1367	199808	200508	11.2	17.8	11.24	89.7
5	762	200105	201107	10.6	19.6	11.71	60.1
6	837	200212	201107	14.1	14.7	14.05	5.4
7	1452	200308		9.8	9.8	9.8	0.0
8	1062	200707		9.5	9.5	9.5	0.0
9	1296	200610		8.3	13.0	10.33	34.6
10	1314	200811		8.1	14.5	12.92	20.8
11	549	200910		8.4	12.0	10.33	9.2
12	584	201109		8.1	13.0	9.93	17.9
Total	12787						328.3

Other Newly Added Recoverable Reserves. According to the calibration of recoverable reserves, In the past five years, the test blocks and scattered wells that have been put into development have not been verified by the recoverable reserves. Polymer flooding test block including A block, which belongs to the first grade oil and weak base ASP flooding, block B, it belongs to the second grade oil and weak base ASP flooding, and block C, it belongs to weak base ASP flooding. The geological reserves of these three blocks are 878.3*104t, The recoverable reserves can be calculated according to the predicted recovery values after the end text of each block , the three test blocks are expected to increase recoverable reserves of 170.9*104t, In addition, the water flooding block D layer recombination zone and the Western pure oil fill it after drilling, combined with seismic injection production system adjustment, developped in 2009-2013. Total drilling 178, is expected to increase recoverable reserves of 98.1*104t. Test wells and scattered production wells can increase the total recoverable reserves of 269.1*104t.

TABLE2 Table of enhanced oil recovery

project	BLOCK	Geological Reserves/10^4t	Polymer Flooding Enhanced Oil Recovery/%	Increase Recoverable Reserves/10^4t	Remarks
test block	B	116.3	28.0	32.6	
	A	549.0	18.2	100.0	
	C	213.0	18.0	38.3	No Calibration
	D			18.6	
Injection production system adjustment	E			79.5	
Total		878.3		269.1	

The untabulated reservoirs of the water flooding has a certain thickness of the thickness of each layer in the A Development Zone, From the point of view of the use of water, from the use of water absorption data, the untabulated reservoirs water absorption ratio was 41%, the proportion of the use was 45.4%.According to the geological reserves of Institute report in 2006 of the A Development Area, the first class of independent geological reserves was 5223.05*104t, the first kind of gradual change of geological reserves was 315.85*104t, the first class of out balance sheet geological reserves was 5538.9*104t. According to the calculation of the final recovery rate of 30% of the outer geological reserves of this part, the outer layer can increase the recoverable reserves by 1661.67*104t.

Recoverable reserves verification results

Through the analysis, we found out the reasons for low remaining reserve-production ratio of A development area and recalculated the recoverable reserves. An additional 2259 * 104t were added in A Development Area of recoverable reserves after recalculation. By the end of 2014 ,the recoverable reserves of A Development Area was 30356*104t ,the recovery ratio was 45.42%. Using Tong's chart method to calibrate the A Development Area ,the recovery rate is 45.8% at the end of 2014 .The project "recoverable reserves evaluation" resulted the recovery rate is 46.45%. Through comparison of different results, we further verify the reliability of the results.

According to the current plan, at the end of the "12th Five-Year"in A Development Area, the remaining recoverable reserves was 3507 * 104t, the remaining reserve production ratio was 9.49, the remaining oil recovery rate of recoverable reserves was 10.54%. According to preliminary production plan in "13th Five-Year ",to 2020 the remaining recoverable reserves of A development area would be 2294 * 104t, the recovery degree of recoverable reserves would be 92.77% . The

recoverable reserves verification results will effectively guide the "13th Five-Year" development planning of A Development Area .

Conclusions

(1)To study the cause of low reserve-product ratio, we need analyze the following aspects: the amount of wells in water-flooding productive blocks,measures of comprehensive adjustments, the geological reserves of tertiary oil recovery areas which are already starting production, EOR in tertiary oil recovery areas which are already starting injecting chemicals.

(2)Recalculated the recoverable reserves in A Development Area, studied the potential of recoverable reserves, guiding the compiling of development plan in A Development Area during the "13th Five Years", base on studying the influencing factors of the recoverable reserves in A Development Area.

(3) Analyzing the mechanism of lower recoverable reserves in A Development Area, which can be a reference to other similar areas in Daqing Oil Field.

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