The Discussion About Rational Pressure Limit of Four Strip in The North Intermediate Zone of SaBei

Chao Liu
The Third Oil Recovery Factory of Daqing Oilfield Limited Liability Company
Heilongjiang Daqing 163113
Email: 56181854@qq.com

Abstract: Based on material equilibrium and mechanics of fluid through porous media principle, this paper analyzes formation pressure and the degree that all kinds of influencing factors to it by using basic physics knowledge, it also discusses how to establish rational pressure limit, which presents references to harness effect and controls validly to the formation pressure of intermediate zone in Sabei.

1. Introduction
The Fourth Strip in the north intermediate zone of Sabei oilfield (it is called four strip in the following) lies in margin of Sabei development area, which plunged into development in 1989. Due to serious heterogeneity of oil reservoir is very severe in it, the property of the reservoir material of the oil is weak and viscosity is rather high. During the development of water injection, this area exposes many problems, such as formation pressure is higher, water injection is difficult, the effectiveness of increasing injection is not good. Furthermore, it exists oil flow-out, which is disadvantageous for the casing. So it is necessary to discuss the rational formation pressure limit of four strip.

It is well known, formation pressure is one of indexes to express the ability of supplying liquid of oil reservoir. Keeping formation pressure at a high level can make oil reservoir to achieve significant productive capacity. On the contrary, too high formation pressure will be unfavorable. It can bring out flow-out of oil, reducing active oil calculations and increasing energy consumption, in the same time it can eventuate the casing pipe damage. So formation pressure must keep at a rational level. Based on material equilibrium principle, we can come to that formation pressure will run up when injection-production ratio of year is greater than 1 and it will be higher than primordial pressure when the injection-production ratio of summation is greater than 1. But from relation between injection-production ratio and pressure we can see that it is not simple about their relation, so this paper sets about practice knowledge, based on petroleum reservoir engineering, to discuss the rational pressure limit in four strip.
2. Analysis of formation pressure and its fluencing factors

It is indicated after analyzing mechanics of fluid through porous media that formation pressure of various point is controlled by all kinds of factors such as working system of oil and water well, the type of hole pattern, interwell distance, heterogeneity of oil reservoir exploitation mode, and so on. To the water injection development oil field, oil and water well within the same water dynamic system, the pressure of all the petroleum reservoir should be the average formation pressure of them, but at present it is only the average of oil well, it can’t express the average pressure of water well, so it also can't stand for actual condition all of the petroleum reservoir pressure.

According to the change of reservoir pressure, we find that the reservoir pressure of oil and well is mainly affected by the amount of oil produced, the viscosity of oil, the permeability of oil layer and the thickness of oil layer.

Therefrom we can get the following conclusions.

2.1. The lower perviousness of oil reservoir and bigger viscosity of oil, the greater formation differential pressure between the oil and water well; the lower level of formation pressure of oil well, the greater energy consumption of injection and inject difficultly.

2.2. There is the falling tendency of formation differential pressure of oil reservoir with the rising of hydrous.
2.3. After taking measures of rising liquor, differential pressure between oil and water well become higher, and the level of oil pressure become lower.

3. Establishment of rational pressure
It is indicated through theoretical analysis and productive practice that under given hydrous stage and specific condition of oil reservoir, the flowing pressure and formation pressure is intimate dependent, formation pressure will be establish after defining the flowing pressure of oil well and injection pressure of water well. Therefore, establish formation pressure limit is the same as researching rational flowing pressure and injection pressure limit.

3.1. Establish rational flowing pressure and injection pressure
Indicate by the practice production, the damage of casing will exacerbate and at the same time will bring out oil’s flow-out in intermediate zone when the injection pressure is higher than fracture pressure. So the injection pressure should be lower than fracture pressure. And the fracture have direct relation with the reservoir’s buried depth.

Generally, the highest flowing pressure of injection well shouldn’t be lower Horizontal fracture pressure. The average mid depth of oil reservoir in four strip is 1150.2 meters, calculated the fracture pressure is 27.3MPa. At present, it is considered that the injection pressure lower fracture pressure 90 percent is rational. Therefore the rational injection pressure should be lower 24.6MPa in four strip. The hole injection pressure shouldn't overrun 14.9MPa in four strip.

3.2. Establishment of flowing pressure limit
Flowing pressure exist a lower limit too, when flowing pressure is lower than it, not only bring out degasification of formation oil, but also decline duty of pump, and emerge the degradation of oleiferous quantity. How to establish rational flowing pressure limit should be consider from the following aspects.

3.2.1. Oil well should have higher productivity
It is well known, under the condition of bottom flowing pressure is greater than the saturation pressure, with the degradation of the bottom hole flowing pressure the output will increase. But after it is lower than saturation pressure the growth of produce will become slowly. When flowing pressure decline to a certain limit, when go on declining it the output increase no more but show decreasing trend. This value can be the rational flowing pressure lower limit.

To ensure don’t exist degasification that rational flowing pressure lower limit in four strip area is 4.2MPa.

3.2.2. Oil well should keep a high duty of pump
Duty of pump will decline considerably when flowing pressure is lower, we generally consider that keep the gas-oil ration at 20-30 percent will have higher duty of pump. From the relation between gas-oil ratio and flowing pressure we can see that for keeping higher duty of pump the flowing pressure of oil well should keep at 4.0-4.5MPa in the four strip.

Synthesize above analysis, we can conclude that the flowing pressure’s lower limit is 4.0-4.5MPa in this area.

3.3. Establish formation pressure of oil and water well
Under the condition that have obtained the lowermost flowing pressure of oil well and the maximum flowing pressure of water well, basing on the present oil production index, absorptive index, ratio of oil and water well number and injection-production ration, exert the following expression we can obtain differential pressure of injection and liquid recovery, whereby calculate formation pressure.

So we can calculate that the formation pressure of oil well is not lower 11.53MPa in the four strip area. And the formation of injection well should be lower 19.36MPa, in order to protect casing.
3.4. Present condition of oil and water well in four strip area
From the following curve we can discover that oil and water well pressure in the four strip area is tending fitness after several years adjustment and modification.

4. Several conclusions

4.1. In the injection development of oilfield, we must insure the lowermost flowing pressure limit of bottom hole so that we assure the duty of pump and eventual percent recovery. To the four strip the lowermost pressure limit is 4.0-4.5MPa.

4.2. Establishment of lowermost pressure limit provide an important reference for the planning and designing of oilfield.

4.3. Reasonable pressure limit provides reference to harness effective and control validly to the formation pressure of Sabei inertia mediate.

4.4. With the hydrous rising, rational flowing pressure lower limit should be supposed falling.

4.5. In the four strip injection pressure should be lower 14.9MPa, which not only insure injection quality but also prevent damage of casing.

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