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ANALYSIS OF WELL COMPLETION COMPLICATIONS AND THEIR ELIMINATION IN THE KARACHAGANAK FIELD

By examining well completion issues, the paper will demonstrate the importance and beneficial effects of using multi-stage selective acid treatment technology to regulate reservoir development. The original goals for the Karachaganak field were a review of the field's operating conditions, the building of the first plant for producing gas and gas condensate, and the design of the production circuit. After the separation of products contract was signed, new goals were added, such as accelerating oil well commissioning, increasing gas condensate production over the long term, and pumping at least 40 % of the gas back into the layer. Numerous well completion techniques have been improved thanks to technical developments, including applying tubing while sealing metal-to-metal threaded connections, omitting the use of a circulation valve above the packer, and utilizing a downhole shut-off valve. The field development project's Phase 2M got under way in 2003. An innovative well completion technique was used in the Karachaganak field, which used acid fracturing in an open hole with packers and circulation valves to separate the intervals. In 8 horizontal wells, the multistage stimulation approach has proved effective, saving both time and money. In one of the wells, selective stimulation was made achievable by an acid treatment plan that met zonal injectivity standards. Increased well productivity, flow distribution, gas, water, and drawdown control have all been benefited by multistage selective acid stimulation.

Keywords: well completion, Karachaganak field, openhole, packer, oil, tubing, drilling.

Introduction

The Karachaganak field's original objectives included a study of the field's operational circumstances. The research was conducted based on the outcomes of different geological exploration, assessment, and additional exploratory operations in a field with low output, along with the construction of the first plant for the selected completion of gas and gas condensate production. The majority of the production strings were fed by combined 7-inch and 5-1/2-inch production casing strings.

Among the options for the layout of the production circuit during the initial execution, it is worth noting the valve seat for inhibiting corrosion inhibitors and chemicals to prevent wax build-up, the circulation valve for killing the well, and the process fluid pump for stimulation, a bypass valve for acidizing long drilled sections, drilling and installation of a variety of landing blue packers or at least 2 bypass valves for long liners in open pits 200 – 600 m long; hole tool, etc.

Wells were dug for gas and gas condensate in the early stages of development. However, the following objectives were added after the contract for the separation of products to the original goals was signed:

– A faster pace of oil well commissioning.

– Long-term growth in the production of gas condensate.

To maximize output, pump at least 40 % of the gas back into the layer.

In order to accomplish new objectives for the field's continued development, certain wells that were first drilled were afterwards moved to the second or third operational development target.

The idea of utilizing multiple well completion strategies in the Karachaganak field has been continuously refined while accounting for various technical advancements:

In the area above the packer, apply tubing while sealing metal-to-metal threaded connections.

The decision to forgo using a circulation valve above the packer, which would have lowered the number of potential leak pathways.

The use of a downhole shut-off valve that is dropped onto the tubing to reduce locations where the inner diameter of the tubing is narrowing.

Phase 2M of the field development project, which targeted to produce a low GOR oil rim in the third production facility, started to be executed in 2003. These ideas led to the building of new wells with several horizontal wells, sidetracking in vertical wells, and horizontal wells with a single wellbore of great length more than 800 m (Figure 1).

The choice was taken to optimize the current well completion approach as the field progressed and completion expertise was gathered. As a consequence, a novel well completion method that comprised acid fracturing in an open hole outfitted with circulation valves and packers to segregate the intervals was implemented in the Karachaganak field [1].

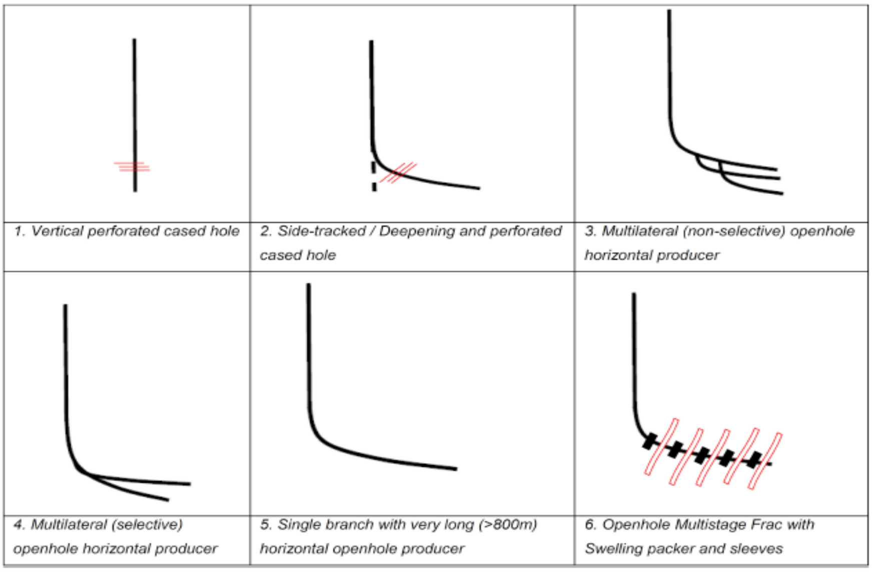

Figure 1 – Development of Well Completion Techniques in the Karachaganak Field

Materials and methods

The current patterns of increased production drilling, late-stage field development, and new fields with challenging geological and technical conditions point to the need for existing issues in the area of oil and gas well casing quality to be resolved, and this issue is becoming more and more important. Lack of effective and long-lasting reservoir separation, annular and interstratal oil, gas, and water shows and crossflows, loss and underlift of cement slurry to a specific height – all these issues result in reduced productivity of built-in wells and, generally, reduced field development efficiency. They also raise the cost of repair work during the development and operation of a well. In order to complete high-quality well casing, it is essential to make sure that the technology, tools, and materials utilized for these activities are chosen skillfully at each stage, from drilling the wellbore to running the casing string and further cementing it.

Oil and gas well cementing quality is primarily affected by the following factors:

a) the geometry of the wellbore and the properties of the drilling fluid;

b) the location of the casing string with respect to the wellbore’s axis;

c) the pace of the rock cutting tool.

Cross-flows and watering of well products might result from poor well cementing quality. By performing insulation and repair work on the current well stock and enhancing the quality of new well repairs, this issue may be resolved. Geological conditions at the well-drilling site, in addition to the proximity of water and oil-bearing horizons, complicate the issue of different formation pressure intervals, which calls for the use of new technologies and modifying additives for cementing oil and gas wells. The efforts to reduce water inflows offer several categories of repair and insulation projects based on how difficult they are, as well as the finest technologies for eradicating the root reasons of watering wells. As a consequence, the authors classified repair insulation job difficulty into four groups. Liquidating wellbore leaks, reducing and completely preventing interlayer fluid migrations, and building a dense impermeable bridge to separate the water horizon from the productive formation are some of the easiest repair insulating tasks. When a well has to be overhauled, isolation and restoration work is done to strengthen the wellbore, stop gas migration, and stop foreign water from entering the production plant. The lifetime of wells as capital facilities can be affected by the high quality of isolation of pressure horizons during the building stage, thus special attention should be paid to the quality of their support. Reduced well performance, wellbore integrity loss, decreased tightness, and violations of safety and environmental regulations can all result from insufficient cement strength. It is vital to improve cement's performance qualities, especially its bending and compressive strengths. Traditionally, the problem has been resolved by adding various chemical additives, both natural and synthetic, to cement. Additionally, it is advisable to momentarily isolate formations with saturating fluids of various properties during the drilling stage, particularly for the potential water inflow intervals [2].

Result and discussion

In the Karachaganak field, the multistage stimulation technique has been successfully applied to 8 horizontal wells, and excellent experience has been gained since the first trial in 2011. The operating efficiency of subsequent tasks has increased, saving time and money. By compartmentalizing the open hole and permitting tailored acid treatment for each zone based on geology and petrophysical hole condition concerns, the multistage stimulation approach has shown to be extremely successful. Most often, swell packers and ball triggered fracture sleeves are used to isolate and stimulate horizontal wells in order to increase productivity.

Selective stimulation was made possible in one of the wells that was delayed because of poor reservoir quality or connection into better reservoirs and finished with swell packers and frac sleeves by an acid treatment design that complied with the demands of the various zonal injectivity criteria. The open hole completion would have been severely hampered by fluid diversion. This design produced a well that is currently regarded as one of the best in the industry and is very productive. A 10-stage multistage is now finished in less time because to improvements in pumping operating efficiency, and the method has shown to be cost-effective for stimulating numerous zones.

Improved well productivity, flow distribution, gas, water, and drawdown control are just a few of the important, beneficial effects of multistage selective acid stimulation on Karachaganack reservoir management. This has been made possible by the capacity to selectively stimulate the whole wellbore in accordance with the geology and petrophysics, and more critically, by the ability to manipulate the sleeves in the future to open or shut in order to permit or block flow from a specific zone.

Additionally, it has been demonstrated that a zone can be isolated using the Composite Bridge Plug (CBP). The capability of the sleeves or CBP is still being investigated and data is being acquired in the case of controlling water infiltration. The impact of applying the multistage selective acid stimulation has been accurately assessed and quantified thanks to the use of cutting-edge technology in Production Logging Tool (PLT) acquisition and analysis. This involves the effective use of the PLT tools Flow Scanner Imager (FSI), Multiple Array Production Suite (MAPS), and their techniques for conveying coil tubing and an e-line downhole tractor. The findings clearly identify flow contribution zones and pinpoint areas of tight formation where reserves have been released [3].

Conclusion

Multiple well completion techniques have been used to develop the Karachaganak field, including tubing while sealing metal-to-metal threaded connections, skipping circulation valves, and utilizing a downhole shut-off valve. Beginning in 2003, Phase 2M of the field development project resulted in the construction of additional wells with several horizontal wells, sidetracking in vertical wells, and a single, lengthy wellbore. To address issues currently facing the well completion industry. Productivity has been successfully increased while saving time and money using a multistage stimulation approach.

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ҚАРАШЫҒАНАҚ КЕН ОРЫНДА ҰҢҒЫМАЛАРДЫ АЯҚТАУ КЕЗІНДЕГІ АСҚЫНУЛАРДЫ ТАЛДАУ ЖӘНЕ ОЛАРДЫ ЖОЮ

Ұңғымаларды аяқтау мәселелерін қарастыра отырып, мақалада қабаттардың дамуын бақылау үшін көп сатылы селективті қышқылдандыру технологиясын қолданудың маңыздылығы мен оң әсерлері көрсетіледі. Қарашығанақ кен орны үшін бастапқы міндеттер кен орнының жұмыс жағдайын сынау, бірінші газ және газ конденсатын өндіру цехын салу және өндіру схемасын жобалау болды. Өнімді бөлу туралы келісім-шартқа қол қойылғаннан кейін мұнай ұңғымаларын іске қосуды жеделдету, ұзақ мерзімді перспективада газ конденсатын өндіруді арттыру, газдың кемінде 40 пайызын қабатқа қайта айдау сияқты жаңа мақсаттар қосылды. Ұңғымаларды аяқтаудың көптеген әдістері техникалық әзірлемелер арқылы жетілдірілді, оның ішінде металдан металға тығыздағыштары бар құбырларды пайдалану, пакердің үстіндегі циркуляциялық клапанды пайдалануды жою және ұңғыманы жабу клапанын пайдалану. 2003 жылы кен орнын игеру жобасының 2М кезеңі басталды. Қарашығанақ кен орнында ұңғымаларды аяқтаудың инновациялық технологиясы қолданылды, оның ішінде аралықтарды бөлу үшін пакерлер мен циркуляциялық клапандардың көмегімен ашық ұңғымада қышқылды жару. 8 көлденең ұңғымада көп сатылы стимуляция уақыт пен қаржыны үнемдей отырып, тиімді болып шықты. Ұңғымалардың бірінде селективті ынталандыру аймақтық инъекциялық стандарттарға сәйкес келетін қышқылмен өңдеу жоспарының арқасында мүмкін болды. Ұңғыманың өнімділігін арттыру, ағынды, газды, суды бөлу және ағынды бақылау барлығына көп сатылы селективті қышқылды ынталандыру арқылы қол жеткізілді.

Кілтті сөздер: ұңғыманы аяқтау, Қарашығанақ кен орны, ашық ұңғыма, пакер, мұнай, құбыр, бұрғылау.

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АНАЛИЗ ОСЛОЖНЕНИЙ ПРИ ЗАКАНЧИВАНИИ СКВАЖИН И ИХ УСТРАНЕНИЕ НА МЕСТОРОЖДЕНИИ КАРАЧАГАНАК

Путем изучения вопросов заканчивания скважин в статье будет продемонстрирована важность и положительный эффект использования технологии многостадийной селективной кислотной обработки для регулирования разработки коллектора. Первоначальными задачами по

Карачаганакскому месторождению были проверка условий эксплуатации месторождения, строительство первого завода по добыче газа и газового конденсата и проектирование схемы добычи. После подписания контракта о разделении продукции были добавлены новые цели, такие как ускорение ввода нефтяных скважин, увеличение добычи газового конденсата в долгосрочной перспективе и закачка не менее 40% газа обратно в пласт. Многие методы заканчивания скважин были усовершенствованы благодаря техническим разработкам, включая применение насосно-компрессорных труб с герметизацией резьбовых соединений металл-металл, отказ от использования циркуляционного клапана над пакером и использование внутрискважинного запорного клапана. В 2003 г. началась реализация Этапа 2М проекта разработки месторождения. На Карачаганакском месторождении была применена инновационная технология заканчивания скважин, включающая кислотный гидроразрыв пласта в открытом стволе с использованием пакеров и циркуляционных клапанов для разделения интервалов. В 8 горизонтальных скважинах многоступенчатая стимуляция доказала свою эффективность, сэкономив время и деньги. В одной из скважин селективная стимуляция стала возможной благодаря плану кислотной обработки, соответствующему зональным стандартам приемистости. Повышение продуктивности скважины, распределение потока, газа, воды и контроль депрессии – все это было достигнуто за счет многоступенчатой селективной кислотной интенсификации.

Ключевые слова: заканчивание скважин, Карачаганакское месторождение, открытый ствол, пакер, нефть, НКТ, бурение.

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