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Satbayev University

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ИЗВЕСТИЯ

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ON THE ISSUE OF PREPARING THE WELLBORE FOR ITS FASTENING

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Abstract. The proposed article analyzes the issue related to the preparation of the wellbore for cementing the drilled interval of the well. It has been revealed that poor-quality cleaning of the well bore, including the existing cavities from drilling, brings great problems to the drilling process. For example, in conditions of insufficiently effective removal of cuttings to the surface due to the presence of a gradient layer in the flow of flushing fluid and stagnant zones in the caverns, accumulation of drill cuttings occurs. In the process of well placement, due to changing hydrodynamic conditions (pressure and flow fluctuations) when performing technological operations (flushing, development, drilling, tripping, etc.) and at certain volumes of the accumulated sludge volume in the cavity, it slips into the wellbore wells. As a result of the drilling tool sticking in many wells, sticking of the string with loss of a certain part of the wellbore takes place. The analysis carried out using buffer liquids known and widely used in the process of well fixing allowed us to reveal that these compositions, along with the fact that they have washing capacity in relation to the mudcake, must have viscoelastic properties in order to be able to clean the entire wellbore and cavities, including from the accumulated volume of particles of cuttings, and should also contribute to the removal of filter cake from the walls of the wellbore. However, the designated 3 (three) goals were not reflected in any of the works listed above. In this regard, the article presents the results on the effective cleaning of the wellbore including cavities from drilled cuttings of sludge. The influence of the compressibility of the buffer fluid on the cleaning process of the cavity from the accumulated volume of the accumulated volume of sludge particles was experimentally revealed. A new composition of a buffer fluid, characterized by high sedimentation stability and a high degree of washing capacity of the accumulated sludge particles from the cavern along the wellbore and erosion activity in relation to the mudcake, was developed.

Keywords: drilling oil and gas wells, preparation of the wellbore, the compressibility of the buffer liquid, sludge particles are washed away the ability of the buffer liquid, mud turbulent flow regime, sedimentation stability of the buffer fluid cavity, the volume of accumulated sl

Acknowledgments. The results of the studies showed the effectiveness of the developed composition of the buffer fluid, which is characterized by high sedimentation stability, leaching capacity of the volume of accumulated sludge particles from the cavity, as well as its erosive activity in relation to the clay cake.

The introduction of this buffer fluid in the process of preparing the wellbore for its fastening will significantly increase the life of the wells.

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ҰҢҒЫМА ОҚПАНЫН МОНТАЖДАУҒА ДАЙЫНДАУ МӘСЕЛЕСІ ТУРАЛЫ

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Аннотация. Ұсынылған мақалада ұңғыманың бұрғыланған аралығын цементтеуге ұңғыма оқпанын дайындауға байланысты мәселе талданады. Ұңғыманың оқпанын, оның ішінде бұрғылау кезіндегі бар қуыстарды сапасыз тазалау бұрғылау процесіне үлкен қиындықтар әкелетіні анықталды. Мысалы, үңгірлердегі шайылатын сұйықтықтың ағынында градиент қабатының және тоқырау аймақтарының болуына байланысты кесінділерді бетіне жеткіліксіз тиімді жою жағдайында бұрғылау кесінділерінің жиналуы орын алады. Ұңғымаларды орналастыру процесінде технологиялық операцияларды орындау кезінде (шаю, игеру, бұрғылау, өшіру және т.б.) гидродинамикалық жағдайлардың өзгеруіне байланысты (қысым мен дебиттің ауытқуы) және қуыста жинақталған шлам көлемінің белгілі бір көлемдерінде ол сырғып кетеді. ұңғыма ұңғылары. Бұрғылау құралының көптеген ұңғымаларға жабысып қалуы нәтижесінде ұңғыма оқпанының белгілі бір бөлігін жоғалтумен қатардың жабысуы орын алады. Ұңғымаларды бекіту процесінде белгілі және кеңінен қолданылатын буферлік сұйықтықтарды қолдану арқылы жүргізілген талдау, бұл композициялардың балшыққа қатысты жуу қабілетімен қатар, тұтқыр серпімді қасиеттерге ие болуы керек екенін анықтауға мүмкіндік берді. бүкіл ұңғы оқпанын және қуыстарды, соның ішінде шлам бөлшектерінің жинақталған көлемінен тазарту, сондай-ақ ұңғыманың қабырғаларынан сүзгі тортын кетіруге ықпал етуі керек. Алайда, белгіленген 3 (үш) мақсат жоғарыда аталған жұмыстардың ешқайсысында көрсетілмеген. Осыған байланысты мақалада ұңғыма оқпанын, оның ішінде шламның бұрғыланған шламынан қуыстарды тиімді тазарту бойынша нәтижелер берілген. Шлам бөлшектерінің жинақталған көлемінен қуысты тазалау процесіне буферлік сұйықтықтың сығылғыштығының әсері тәжірибе жүзінде анықталды. Шөгу тұрақтылығының жоғарылығымен және ұңғыма бойындағы үңгірден жиналған шлам бөлшектерін жуу қабілетінің жоғары дәрежесімен және балшыққа қатысты эрозия белсенділігімен сипатталатын буферлік сұйықтықтың жаңа құрамы әзірленді.

Түйінді сөздер: мұнай және газ ұңғымаларын бұрғылау, ұңғыма оқпанын дайындау, буферлік сұйықтықтың сығылғыштығы, шлам бөлшектері буферлік сұйықтықтың қабілеті, лайдың турбулентті ағынының режимі, буферлік сұйықтық қуысының шөгу тұрақтылығы, жинақталған шламның көлемі

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Аннотация. В предлагаемой статье проведен анализ вопроса, связанного с подготовкой ствола к цементированию пробуренного интервала скважины. Выявлено, что некачественная очистка ствола скважины, в том числе имеющихся каверн от выбуренной породы приносит большие проблемы в процесс бурения. Так, например, в условиях недостаточно эффективного выноса выбуренной породы на поверхность из-за наличия градиентного слоя в потоке промывочной жидкости и застойных зон в кавернах происходит накопление выбуренного шлама. В процессе проводки скважины в силу изменяющихся гидродинамических условий (колебания давления и расхода) при выполнении технологических операций (промывка, проработка, бурение, спуско-подъемные операции и т.д.) и при определенных объемах аккумулированного объема шлама в каверне происходит его оползание в ствол скважины. В результате указанного во многих скважинах имеет место заклинивание бурильного инструмента, что приводит к прихвату колонны с потерей определенной части ствола скважины. Проведенный анализ по известным и широко применяемым в процессе крепления скважин буферным жидкостям позволил выявить, что указанные составы наряду с тем, что они обладают смывающей способностью по отношению к глинистой корке они должны обладать вязкоупругими и эрозионными свойствами, чтобы могли очистить весь ствол скважины и каверны в том числе от аккумулированного объема частиц выбуренной породы, а также должны способствовать удалению фильтрационной корки со стенок ствола скважины. Однако обозначенные 3 (три) цели ни в одной из перечисленных выше работах не нашли свое отражение. В этой связи в статье приводятся результаты по эффективной очистке ствола скважины, в том числе и каверны от выбуренных частиц шлама. Экспериментально выявлено влияние сжимаемости буферной жидкости на процесс очистки каверны от аккумулированного объема скопившегося объема частиц шлама. Разработан новый состав буферной жидкости, отличающейся высокой седиментационной устойчивостью, высокой степенью вымывающей способностью объема аккумулированных частиц шлама из каверны по стволу скважины и эрозионной активностью по отношению к глинистой корке.

Ключевые слова: бурение нефтяных и газовых скважин, подготовка ствола скважины, сжимаемость буферной жидкости, смываемость частиц глинистой корки, турбулентный режим течения бурового раствора, седиментационная устойчивость состава буферной жидкости, объем накопленных частиц шлама в каверне

Introduction

The heterogeneity of rocks in their strength and rheological properties leads to the fact that the trunks of deep oil and gas wells in the process of drilling are complicated by caverns, the dimensions of which often reach significant sizes. At the same time, under conditions of insufficiently effective removal of drill cuttings to the surface due to the presence of a gradient layer in the flow of drilling fluid and stagnant zones in caverns, cuttings accumulate.

When drilling a well, due to changing hydrodynamic conditions (pressure and flow fluctuations) when performing technologically necessary operations (flushing, reaming, drilling, tripping operations, resuming circulation, etc.), at certain volumes of the accumulated volume of cuttings in the cavity, it slides into the wellbore. As a result of this, in many wells, the drilling tool jams, which leads to sticking of the string with the loss of a certain part of the wellbore (Budnikov et al., 2001). For example, Figures 1 and 2 show typical cavern logs obtained from well № 333, located in the Gunashli area in the intervals of 510–560m. and 2860–2990m. At the same time, the deepening of the wellbore associated with the performance of technologically necessary operations during the passage of these intervals was each time accompanied by the sliding of the volumes of accumulated cuttings into the annulus after accumulation and reaching the slope line in the caverns. This creates conditions for tool jamming, sticking of the drill string, etc. As a result, there were big problems associated with the loss of calendar time, the loss of penetration on the bit, as well as the loss of material resources and time spent to prevent complications and accidents associated with changes in hydrodynamic pressure (Ratov et al., 2022).

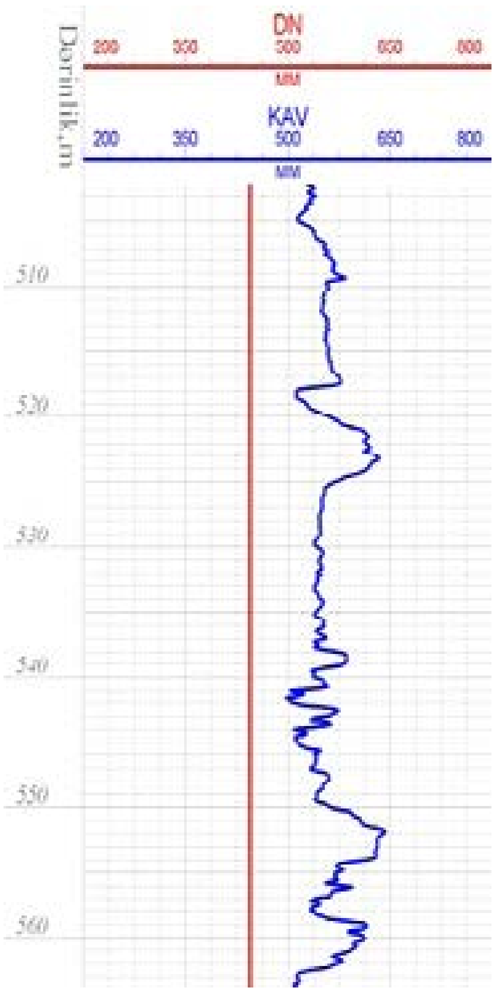

Fig.1 Cavernogram of well № 333 pl. Gunashli obtained in the interval of 510–560m.

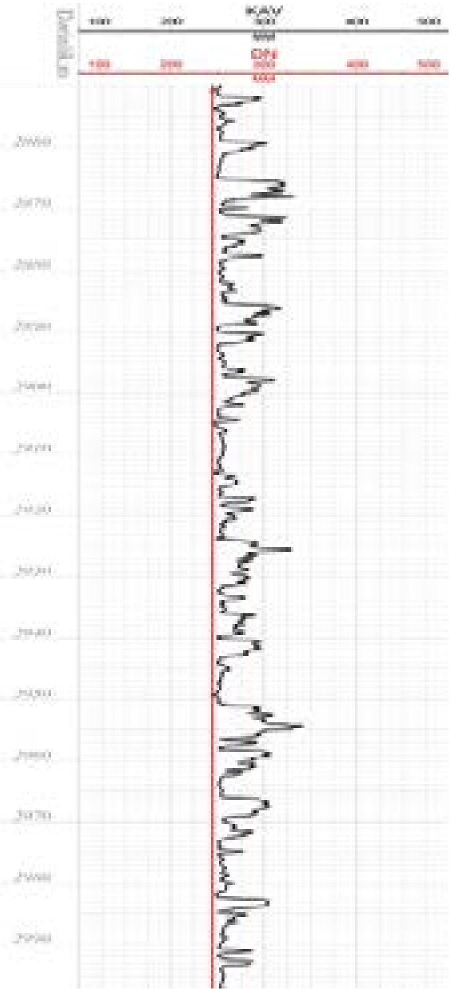

Fig.2 Cavernogram of well № 333 pl. Gunashli obtained in the interval 2860–2990m.

It is known that in the process of preparing the wellbore for running the casing, flushing is carried out with the study of the entire interval. However, due to insufficiently effective cleaning of the wellbore from cuttings and the wrong choice of the optimal flow rate of the drilling fluid, the entire wellbore is contaminated. shaft after which the rest of the drilled cuttings settles on the bottom and is again ground with a chisel (Leshchinsky et al., 2019). When the circulation stops, part of the accumulated volume of cuttings from the cavity settles on the bottom of the well.

Under these conditions, cleaning, and at the same time, preparing the wellbore for running the casing string and its fastening is complicated. I would also like to note that carrying out the above works is impossible due to some ordinary liquid, whether it be water or drilling fluid treated with some kind of chemical reagent.

Existing methods for cleaning caverns from the accumulated volume of cuttings particles, as well as the wellbore in general, provide for both the creation of a turbulent flow regime for the drilling fluid and the use of viscoelastic separators and buffer fluids.

In this regard, the foreign practice of preparing the borehole of a drilling well for its fastening involves the use of the following methods and compositions of buffer fluids for their implementation.

The conducted studies (Ba Geri et al., 2017) are aimed at developing a new formulation for removing barite filter cake. The stripping composition consists of chelating agents such as diethylenetriaminepenta acetic acid (DTPA), a converting agent or catalyst, and a polymer (enzyme) breaker.

The disadvantages of this fluid is its low compressibility, which only ensures that the walls of the wellbore are washed away from the oil crust.

Also in (Boyou et al., 2019), the effectiveness of the use of water-based drilling fluids with nanosilica for the process of cleaning a wellbore during directional drilling is considered. The article indicates the positive effect of nano-enriched drilling fluids on the process of transporting cuttings by only 30–44 %.

However, nothing was noted how this addition of nanosilica in the composition of the drilling fluid affects the process of cleaning the wellbore, caverns, as well as "troughs" from the volumes of drilled rock particles accumulated in them, since this fluid has low compressibility and leaching ability. Together with the above, the proposed nano-enriched fluid does not have the rigidity and elasticity, which is so necessary for cleaning the wellbore, caverns and "chutes" from cuttings.

Successful removal of the oil-based filter cake from the wellbore prior to cementing the well is essential for a strong bond between the cement and the formation. Known methods for removing the crust use both mechanical (water blasting, coiled tubing) and chemical means (acids, oxidizing agents, chelating agents and enzymes). However, these methods have limitations under certain conditions that can adversely affect well performance.

Further, in (Carpenter and Jonson, 2016), a composition is proposed that contains at least one alkyl ether citrate. In another embodiment, the invention provides combinations of at least one alkyl ether citrate and at least one alcohol ethoxylate.

In this work, reagents such as propylene glycol, ethylene glycol, hexylene glycol, dipropylene glycol, diethyglycol, tripropylene glycol and triethylene glycol, etc. are used. However, due to environmental problems, great problems arise in connection with their use. It is contemplated that these fluids will be injected into the wellbore, which can clean the wellbore walls of the filter cake.

At the same time, the disadvantages of this buffer liquid are its low efficiency due to both low compressibility and washout ability without the presence of an erosive material in the proposed composition.

In (Kremiewski, 2021), the proposed composition of the buffer liquid includes a mixture of C12–C14 ethoxylated alcohols (0.2) (ROKAnol L10/80); Surfactants, including a mixture of C12–C15 — ethoxylated alcohols and sodium salts (0.2), polyethyleneamine (0.2), nutshell (0.1), plastic shot, microspherical glass fractions-0.2;

defoamer (ethoxylation product of propoxylation of saturated fatty alcohols)-0.01. In the same work, it is indicated that this liquid has shown effectiveness in removing the filter cake. However, the disadvantages of this fluid is its low efficiency due to low compressibility, and at the same time, the low leaching capacity of the uncarried volume of sludge particles from the cavity and "gutter".

In the following work (Lichinga, et al, 2019), it was developed for the implementation in laboratory conditions of chemical washing, consisting of a mixture of NaOH and alkylpolyglycoside, which has a low density and viscosity. Said fluid acts as an emulsifier to remove the oil-based crust from the surface of the wellbore.

The main disadvantages of this work is its low efficiency due to the low compressibility, elasticity and rigidity of the proposed fluid, which is so necessary for cleaning the outer surface of the casing string and cavities along the wellbore from cuttings, which is actually a partially flushing fluid.

The study (Piriverdiev et al., 2019) shows that the role of optimizing the drilling process allows both saving time and money spent on the wiring process, as well as achieving high drilling speed, thereby increasing profits. However, this paper only considers the entire process of drilling a well. At the same time, if we take into account that this process consists of many sections of drilling, among which the section related to the preparation of the wellbore for its fastening occupies one of the important places and not taking into account this section in such a study does not allow successful completion of the well construction.

In addition to these works, studies were carried out in [Quintero, et al, 2019] on the development of buffer fluids and compositions that help clean filter cakes from the wellbore surface using nanoemulsion and microemulsion systems. At the same time, the negative qualities of these fluids include their low compressibility, erosive activity in relation to the clay cake present along the wellbore and leaching capacity from the cavern or "gutter" from the accumulated volume of cuttings particles.

The proposed work [Syed et al., 2013] includes the stages of a single-phase microphase microemulsion buffer fluid, pumping a buffer into the area between the casing string and the wellbore, feeding and pumping cement slurry into the area between the casing string and the wellbore. A microemulsion-based buffer fluid that is formed by combining a mixture of sulfonate-based surfactants, as well as an alcohol ethoxylate-based surfactant, solvent, co-solvent, surfactant, solubilizing oil, and water or saline solution. The solvent is selected from the group selected from the group of glycol ethers such as ethylene glycol monomethyl ether, etc. As a co-solvent, kerosene is used, which is present in an amount of from 5 to 45 % by weight of the microemulsion. The proposed microemulsion uses water or brine in an amount of 5 to 30 % (25 %) by weight of the microemulsion.

In (Xianzhi et al., 2021), a high-pressure rotating jet simulation technology is proposed for flushing insoluble particles, and the flushing system mainly consists of surface facilities and downhole flushing tools. Further, it is indicated in the same place that seven rotating high-pressure water jets can wash insoluble particles from the bottom of the cavity. At the same time, the water injection rate is 100m^3/hour, and the rotation speed is 300–400 rpm.

The disadvantages of this buffer fluid (Xianzhi et al., 2021) is its low efficiency due to both low values of compressibility and leaching capacity from the cavity, as well as the "gutter", and at the same time the wellbore from the unexploited volume of drilled rock particles without the presence in the composition of this fluid also erosion material. In addition to the disadvantages of this composition of the buffer liquid can be attributed to the use of the proposed compositions of many scarce and expensive chemicals and many other components.

In (Wanggi, 2008), a buffer liquid composition is proposed, which contains at least one alkyl ether citrate. In another embodiment of the invention, combinations of at least one alkyl ether citrate and at least one alcohol ethoxylate have been identified. In this work, reagents such as propylene glycol, ethylene glycol, hexylene glycol, dipropylene glycol, diethyglycol, tripropylene glycol and triethylene glycol, etc. are used. It is also assumed that these fluids will be pumped into the well, which will clean the walls of the wellbore from the filter cake. However, their use poses major environmental problems (Bissengaliev et al., 2022). In addition to the indicated disadvantages of this buffer fluid is its low efficiency due to both low compressibility and leaching capacity from the cavity and "gutter" of the volume of drill cuttings without the use of erosive material in this composition of the fluid.

In this regard, the practice of preparing the borehole of a drilling well for its fastening in the CIS countries involves the use of the following methods and compositions of buffer fluids for their implementation.

Existing methods for cleaning caverns from the accumulated volume of cuttings particles, as well as the wellbore in general, provide for both the creation of a turbulent flow regime for the drilling fluid and the use of viscoelastic separators and buffer fluids. The first way is not always feasible. The second one is preferred from the point of view of preparation of small volumes of liquid. However, the viscoelastic compositions and buffer fluids used in drilling practice (Mirzajanzade et al., 1979; Bulatov et al., 1981) are characterized by low values of compressibility, sedimentation stability, and erosion activity in relation to the clay cake formed on the borehole wall. At the same time, some components included in the compositions of these buffer liquids are toxic (formalin) and deficient (hexaresorcinol resin).

In (Bakirov et al., 2016), it is proposed to pump a buffer fluid into the well, consisting of 10–15 % butyl glycol, 3–4 % sodium tripolyphosphate, and the rest water. However, due to the fact that this solution does not have viscoelastic and erosive properties, the specified liquid will not allow to completely clean the wellbore, and at the same time the caverns and "chutes" from particles of cuttings from the unexploited cuttings.

In (Kuznetsova et al., 2010), the composition of the buffer fluid used in casing cementing is proposed, it contains, wt. %: water 91.7–99.37; plasticizer — Melflux polycarboxylate or a reagent based on melamine and naphthalene resins 0.01–1.0; cellulose ether — hydroxyethylcellulose, or carboxyethylcellulose, or polyanionic cellulose, or methylcellulose 0.01–1.0; POLICEMAN DF 0.1–0.3; caustic soda 0.5–5.0; synthetic detergent — CMC 0.01–1.0.

However, viscoelastic compositions and buffer fluids used in drilling practice

(Bulatov et al.,1981; Mirzajanzade et al., 1979) are characterized by low values of compressibility, sedimentation stability and erosion activity in relation to the clay cake formed on the borehole wall. At the same time, some components included in the compositions of these buffer liquids are toxic (formalin) and deficient (hexaresorcinol resin).

In the article (Moradi and Nicolayev 2020), the compositions of buffer liquids are considered, in which the following components are used: heat-resistant cement cement (PCT-1–100), quartz sand, quartz dust, hematite, magnesium oxide, hypan stabilizer, lignosulfonate plasticizer, kaolinite and water.

The disadvantages of this buffer fluid is its low degree of compressibility, as well as the rapid settling of quartz sand from the proposed compositions, which will not allow cleaning the walls of the wellbore from the mud cake.

In (Ryabokon et al., 2005), a buffer liquid was developed that improves the washing ability of the mud cake. It is prepared on a water basis and contains, wt.%: sodium tripolyphosphate 3–4, butyl glycol 10–15, the rest is water.

The paper (Sherbich et al., 2000) proposes a weighted buffer fluid composition that is designed for use in casing cementing. The disadvantages of this weighted buffer liquid is its low efficiency associated with sedimentation instability due to the impossibility of forming a structure capable of withstanding the weight of the weighting agent. In addition, the resulting composition is also not able to carry out a complete cleaning of both the wellbore and the existing caverns from the accumulated volume of drill cuttings, due to low compressibility and erosion activity.

The purpose of the research is to improve the quality of wellbore preparation for its casing by creating a buffer fluid with high compressibility, sedimentation stability and erosion activity in relation to the clay cake. The object of research are wells in the onshore and sea fields of Azerbaijan.

Results and discussion

In connection with the set goal, we carried out experimental studies to develop a new composition of the buffer liquid, which has a high degree of compressibility, sedimentation stability and erosion activity in relation to the clay cake. To do this, first, bentonite clay (powder) is mixed with water and aged for a certain time to dissolve the clay particles. Then, rubber dust is introduced into the resulting clay solution with stirring. In a separate container, a granular material with a microporous structure is impregnated with a light hydrocarbon liquid (Surakhan oil), which is faience after the first firing or zeolites, the porosity of which reaches 33–36 %. The latter is mixed with a clay solution containing rubber dust, which is used as waste from the shoe industry.

Thus obtained, the viscoelastic fluid composition is a rubbery elastic fluid with a density of 1180–1200 kg/m3. The compressibility of a sample of the proposed and known compositions of buffer liquids was determined on a press-type unit.

To study the influence of the viscoelastic properties of buffer liquids during the washing process, special studies were carried out on the installation (Akhundov et al., 1984). Moreover, the main parameter that ensures the pumpability of buffer liquids is the spreadability along the AzNII cone. In this regard, the specified parameter is chosen as the determining one, the permissible value of which is the value of 0.12m.

To conduct studies to determine the washout capacity of the investigated buffer fluids from the cavity, it was filled with a certain volume of cuttings particles with ferromagnetic properties, wetted with drilling mud. Further, a certain volume of the investigated buffer liquid was pumped into the system, exceeding the volume of the cavity by 5 times. Then the slurry pump is turned on and the studied viscoelastic fluid begins to move along the annular space and, having reached the cavern with the accumulated volume of sludge, its cross-sectional dimensions increase due to increased elasticity and, once in the cavern, it displaces clayed sludge from it. Specified is registered by multichannel tensometric and self-recording devices.

To identify the optimal composition of the buffer liquid, 8 liquids of different content were used, which include the following components: bentonite clay, rubber dust, granular material impregnated with a light hydrocarbon liquid (Surakhan oil), granular material with a microporous structure, which is used as faience after the first firing or zeolites, the porosity of which reaches 33–36 % and water. As a well-known buffer liquid, a composition was used containing (wt.%): 0.5–1.0 % aqueous solution of CMC, 16–17 % bentonite clay, 23–25 % quartz sand and the rest - water up to 100 % (Table 1).

I would also like to note that the buffer fluid in dynamics works not only for all-round, but also for one-sided compression under the action of a pressure drop in height, while it has the ability to compress in height due to expansion across the well, and thanks to this, when compressing, the buffer fluid is able to take the form of a cavity. Since the compressibility of rubber under one-sided compression with the possibility of transverse expansion can reach about 100 %, this implies the importance of the compressibility index, which is characterized by the final index — the degree of cleaning the cavity from cuttings.

The results of the studies carried out to study the washout capacity of samples of buffer fluids of the cavern with accumulated cuttings particles during wellbore flushing, as well as the cleaning of the cavern from the clayed volume of cuttings particles are shown in Table 1.

It should be noted that a simple increase in the content of the polymer (CMC) in known compositions cannot achieve the same positive effect, because. already at a content of 1–2 % CMC or PAA, the liquid becomes unpumpable. In addition to the above, these polymeric compounds are strongly sorbed by the borehole wall. These shortcomings are devoid of rubber dust, so it can be introduced into the liquid in higher quantities (10–12 %) with a positive effect.

An analysis of the sedimentation stability of these compositions showed the following.

The composition of the buffer liquid [Mirzajanzade et al., 1979], when quartz sand is added to it, practically does not keep it in suspension, which falls out of it immediately after.

In the proposed viscoelastic composition [Akhundov et al., 1987], throughout the entire observation time (24 hours), a granular microporous material (faience or zeolite), 0.0011–0021 m in size, impregnated with a light hydrocarbon liquid (Surakhan oil or diesel fuel) is stably retained.

In summary, I would like to note the following.

The review of the work related to the preparation of the wellbore for its casing showed that despite the development and use in wells of new compositions and compositions of buffer fluids prepared both on water and hydrocarbon bases, cleaning the wellbore, caverns, and also "troughs "from the volume of accumulated cuttings particles of the unexploited cuttings is not carried out efficiently enough.

The result of this is the sliding of cuttings particles into the annulus after reaching the critical volume, which leads to loss of drilling fluid, stuck casing, etc.

To prevent such cases of complications, it is necessary, in addition to those functions that the buffer fluid should perform, it is necessary to create additional properties in it, due to the presence of its elasticity and erosive activity within its composition, with the help of which it could help clean the wellbore, as well as the available caverns, including "chutes" from accumulated sludge particles in them.

The economic feasibility of this measure when carrying out work on the effective fixing of the wellbore is to prevent the occurrence of complications associated with poor-quality cementing of the wellbore, namely, ineffective preparation of the wellbore for its fixing.

Conclusions

By the work of many researchers, a large number of theoretical and experimental studies have been carried out to date, measures have been developed and recommendations have been given for the successful preparation of the wellbore, which does not lead to the occurrence of complications associated with the early loss of the wellbore of the drilling well. The authors of works performed at different times point out that the most effective methods for successful wellbore preparation are the development of new compositions of buffer fluids that contribute to the complete cleaning of the wellbore, cavern and "troughs" from accumulated cuttings particles of unexposed cuttings. The available capabilities of researchers today solve the problems of preparing buffer fluids on water and hydrocarbon bases for cleaning the wellbore from cuttings during drilling and before fixing the wellbore, due to the fact that today well drilling is carried out using drilling fluids on water, as well as hydrocarbon bases.

However, despite the material costs associated with the purchase of chemicals in very large quantities for the preparation of buffer fluids and the loss of time for repeated flushing of the wellbore and the outer surface of the casing, complications associated with preparing the wellbore for its fastening continue to occur. This is due to the fact that when carrying out these works, the wellbore, caverns, and also "chutes" are not completely cleaned from the accumulated particles of cuttings from the unexploited cuttings, which aggravates the further implementation of this technological operation.

In this regard, the composition of the buffer fluid proposed by us today is important in the issue of preventing complications associated with poor-quality preparation of the wellbore for its fastening.

It should be noted that the results of our studies showed the effectiveness of the developed composition of the buffer fluid, which is characterized by high sedimentation stability, leaching capacity of the volume of accumulated sludge particles from the cavity, as well as its erosive activity in relation to the clay cake. The introduction of this buffer fluid in the process of preparing the wellbore for its fastening will increase the life of wells for many decades.

Together with the above, the development of new most effective technologies based on the latest methods that contribute to the effective preparation of the wellbore for its casing is the main task that needs to be focused in the future.

Table 1

№ of experiment	The composition of the buffer liquid				Characteristics of the buffer liquid		Characteristics of the flushing liquid		Cavity volume, Vk, 10^{-4} m^3
	bentonite clay	Rubber dust	Material impregnated in non-petroleum	Water	Spreadability, m	Cavity cleaning, %	Drill Density solution, kg/m3	Upstream speed, m/s	
Suggested buffer liquid									
1	11	8	21	60	0,175	74	1350	0,65	2,84
2	13	10	23	54	0,16	91	1350	0,65	2,84
3	15	12	25	48	0,13	96	1350	0,65	2,84
4	13	12	25	50	0,13	95	1350	0,65	2,84
5	13	10	25	52	0,15	92	1350	0,65	2,84
6	15	10	23	52	0,145	91	1350	0,65	2,84
7	16	12	23	50	0,14	93	1350	0,65	2,84
8	17	14	27	42	0,09	non-pumpable	1350	—	2,84
Known buffer liquid (weight,%): 0.5–1.0 % aqueous solution of CMC, 16–17 % bentonite clay, 23–25 % quartz sand and the rest – water up to 100 %									
					0,18	11	1350	0,65	2,84

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