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METHODS OF IMPROVING COMPLEX CLEANING OF SAND PLUGS IN KHODJAOBAD UNDERGROUND GAS WELLS

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***Abstract**.The purpose of the study is to develop recommendations for improving the methods of cleaning complex sand plugs in wells of underground gas storage. To organize the correct and efficient use of underground gas storage, the bottom of wells must be kept clean. The article develops recommendations on the use of optimal methods for cleaning wells from complex sand jams on the example of Khujabad UGS. In addition, recommendations were developed for the operation of production wells in the horizons of the XX-XXI-XXII underground gas storage of Khujabad.*

***Keywords**: underground gas storage, gas-dynamic studies, injection-production wells, bottomhole, anti-blowout equipment, sand plugs, thief, coiled tubing technology, pump compressor pipe, bottomhole flushing, pressure indicators, technological processes, downhole motor, rotor, picadolot.*

Introduction.World fossil energy demand is increasing and it requires underground storages to collect and supply in time. Oil and gas are still cheapest source of energy for the growth of the country's economy and the improvement of the population life.Recently established new plant JV "UzKorGas" which is producing various polymer products from processing of natural gas, significantly reduces the import of plastic and polymer products from abroad and makes a major contribution to the economy of the country [1].After introducing the GTL technology, Uzbekistan enables the production of high-quality gasoline and diesel fuels from Natural Gas.Based on this GTL technology LLC "Oltinyo'l GTL" started operations since 2016 and employed more than 2000 specialists [2].

Extensive work was carried out to increase the production amount of gas by "Uzbekneftegas" JSC to supply large-scale projects. The fact that the weather in Uzbekistan differs by region and some cold places requires more gas, especially in Winter season. This causes difficulties in the system transportation (by JSC "Uztransgaz") and supple system (by JSC "Hududgaz".There is an issue with public gas supply due to coincident accidents in gas transporting pipelines, technical failures in gas compressor stations and decreases in gas production rate in mines. Therefore, underground gas storage facilities should be implemented to avoid above issue. Figure 1, shows the types of construction methods for underground gas facilities in use [3 1]. The most projecting and common form of gas storage is the reservoir formations of natural gas fields that have produced all of their recoverable gas [4 2].

There are three large underground gas storage facilities in Uzbekistan, one is north soh UGS which was established in 1978, second UGS is Gazly, established in 1988, and the third is Hodzhaabad UGS which located in Khodjaabad district of Andijan region and they have 64 storages in total [6-7 4-5].

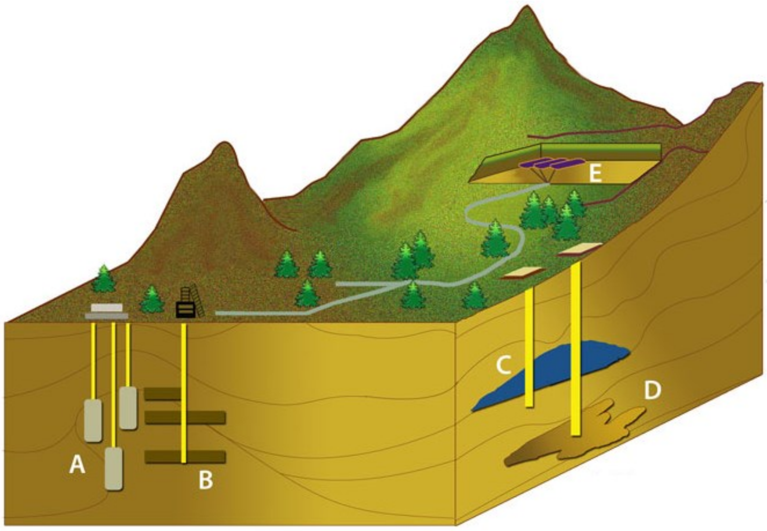


Figure 1. Methods of implementing gas storage facilities; (A) Salt formation, (B) Mines, (C) Aquifer reservoirs, (D) Depleted reservoirs and (E) Hard-rock caverns [5 3].

In 2019 there was a project aimed to increase the volume of gas storage up to 1,0 billion m3, and 10 more storage facilities. According to this project in Khodjaavad UGS, one storage was drilled and implemented successfully. After the installation of the equipment on the top of the well, it is planned to start work for drilling of two more wells in this area, this year [8].

There are a number of problems in the use of Khodjaabad UGS [9]. First of all, the protective layer consists of Sandy Mountain Ash, the layer is also located at an average depth of 1900-2100 meters. This leads to excessive force on the compressorsworkduring driving gas from wells, and also there is a sand plug at the bottom of the wellduring extraction.

The upper pressure of the Wells reaches the average of 180-190 kgf/cm2 at the beginning of the gas extraction season. By the end of the season, the pressure above the well drops to 18-25 kg/cm2. Due to a high pressure drop, a large amount of sand accumulation at the bottom of the well is observed. With high pressure the sand plugs (which occurred from previous season) become denser and the upper site of the sand plug solidifies. The holes of the storage wells will be filled with sand plugs over time, and this leads to blocking the way of withdrawal gas. Accordingly, it requires to clean the bottom of the storage.

There are several ways to clean the bottom of the well and the most prominent way to clean is washing the storage. There are direct, reverse and combination methods of washing. Direct washing is used to clean hard-to-reach places of the storage bottom. The reverse wash is used in cleaning the well that does not require large pressure, where the plugs are easy to wash. Combination type of washing is used to clean the drilling pipes from inside. These methods help to prevent sand plugging in the pipes and in storages [10].

There are many other ways to clean the bottom of the storage facilities in the world. As an example: Bailer method, hydraulic drill, with the use of surfactants, foam and washing with carbonated liquid solutions [11 6]. The bailer method is used because of the absence of the possibility of obtaining a circulation in the absorbent layer Wells. There are advantages of using bailers for storage cleaning. Bailers can be lowered to any depth while pumps have sharp limitations on the depth of the well. The main drawback of using bailers is the well can not be cleaned by 100%, it depends on the samples created by plugs. It is desirable to clean porous (loose) plugs on the bottom of the well with low liquid bailers, gaseous liquid, foam and compressed air. The advantage of this method is that the washing liquid does not become hardened; it is added to use after cleaning from sand plugs and accelerates the process of obtaining products; possibility of cleaning the bottom of the column filter holes. Storage washing with surfactants are used to reduce the surface tension between oil and water contact.

Methods and discussions. Recently, when analyzing the results of the latest geophysical and hydrodynamic studies in the Khodjaabad UGS, a change in the depth of the well was revealed in 20 out of 15 wells from which the survey was carried out. That is, due to the flow of sand from the layer rises to the surface while forming plug (blockage). The perforation intervals of one well are completely closed, in the rest they are partially closed, and it urges to repair the wells in which the intervals are closed as quickly as possible. The next part of the perforation intervals in the wells is of the dibhole type, in some wells it is more than 100 meters, in others - 10-20 meters. Dibholedoes not clean the bottom of a large well every year. It is advisable to include in the plan when the intervals after 1-2 seasons begins to cover. Butthere are such seasons when the gas that is driven into the well rises to a higher pressure, the sand will bring the surface of the tap to a much harder level. This surface cannot be washed and cleaned with a regular pen. In such cases, the actual bottom of the well will not be cleaned up in the coming years, which will prevent sufficient gas inflows in the coming seasons. We analyzed the data of some wells and presented them below (Table 1).

Table 1.

The analysis of the well depth based on the results of hydrodynamic studies.

Well №	833	842	850	873
Downhole artificial tubing, m	2150,66	2209,50	2184,37	2169,50
Head and end perforation intervals, m	2132,50-1966,15	2188,05-2001,41	2163-1993	2130-1948
Borehole Measurement, 2017 y	2065	2112	2080	2113
Filling degree of Borehole, %	46	47	54	25
Borehole Measurement, m 2021 y	2054	2083	2053	2108
Filling degree of Borehole, %	52	61	68	27
Well perforation intervals, degree of filling,%	42	50	57	12

Apparently, during the 4 years of study, there was an increase in the level of sand ingress into the wells. During 4 seasons, the sand plugs of the well were not cleared. Cleaning with sandpaper cleaning with simple methods, as mentioned above, becomes more difficult.

To avoid problems arising in such cases, we would like to include our suggestions. Sand здгпк in the well will be as hard as cement. During drilling, cement pouring molds with a screw downholemud motor (MM) are used. (Figure 2).

When using a screw-in pump and compressor engine (MM), the pump is lowered with the compressor pipes; during flushing, the drive pump unit and technological capacities are used. When flushing with Pero, depending on the depth of the well, the pressure in the drive pump is 0.2-0.3 MPa, when using a screw downhole mud motor (MM), a pressure of 0.35-0.4 MPa is created.

Requirements for drilling mud when using a screw downhole tubular mud motor (MM) are presented in Table 2.

Table 2.

Requirements for drilling mud motor

Parameters	Indicators
1. Fluid type	Water, drilling mud
2. Densityg/sm3	≤ 1,5
3. Mass fraction of sand, %	≤ 1
4. Chloride ion fraction, kg/m3	≤ 50
5. Petroleum fraction, %	≤ 10
6. Hydrogen indicator, pH	≤ 7...10
7. Washing fluid temperature, 0C	≤ 100 (120, 160)

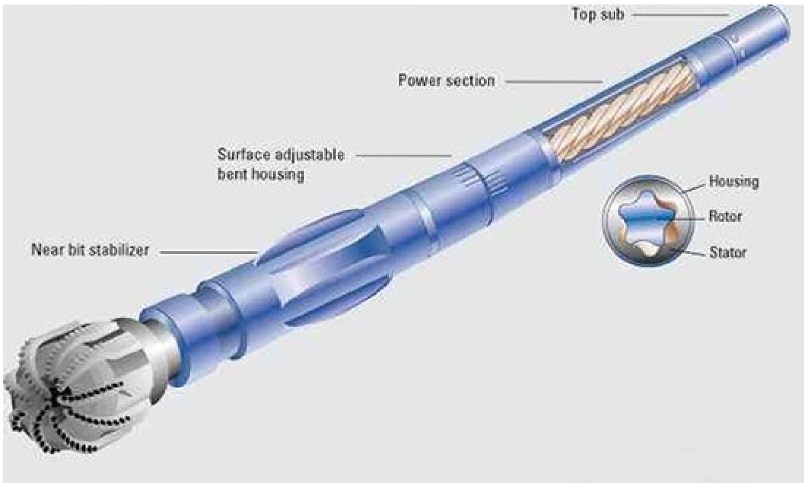


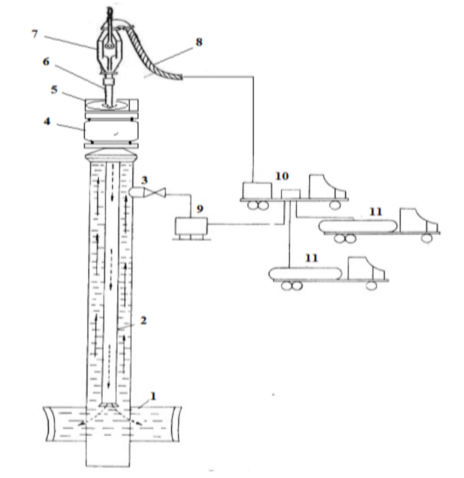
Figure 2. Working parts and diagram of the scroll pump and compressor engine (MM). [3]

When preparing the well for flushing, it is necessary to install a filter on the power line of the drive pump, which, of course, will retain dispersed particles. This ensures long and reliable operation of the (MM) motors. Otherwise, the same well itself may clog up without giving the expected result. It will be necessary to divert the well from the drilling fluid to avoid "ignition" due to pressure. [5] for example, in practice, when the pressure in the bed is 18.0 MPa, the density of the washing and quenching liquid is around 1.14 g/cm3, the gas content in the circulating liquid was determined and the density was increased to 1.2 g cm3. The use of a downhole drilling mud motor (MM) should preferably be carried out prior to the driving season when mining is finished. Because during this period the bed pressure is relatively low. The fluid prepared to reduce the pressure in the well will also have a lower fluid density and viscosity. This forms the basis for the reliable operation of mud motor that we offer.

The main disadvantage of this method is that the parameters of the drilling mud are able to meet the demand, in the case of high pressure, of course, it will be necessary to use a high density and viscosity mud, which is not suitable for the full operation of the device.

We can recommend picadolota as another treatment for difficult sand plugs. (Figure 3). This device is lowered in heavy drill pipe (HDP), as opposed to a screw pump motor (MM). Because this device rotates completely with the combination of pipes. Drilling with a picadolite will help you easily drive through even difficult to drive traffic jams. When using it, the density of the solution of the washing liquid is 1.6 g, while the viscosity - up to 55-60 (HDP) does not interfere with its use

Figure 3. Picadolot for use in sand plug treatment complexes



1- Well pipe and layer,
2-Combination of heavy duty drill pipes,
3- Part of the pipe above the well
4- Anti-squirting equipment,
5- Rotor,
6- Primary drill pipe (square)
7-Swivel,
8- Washing hose,
9-Technological vessel,
10-CA-320 unit,
11-Water tank.

Figure 4. The process of organizing the correct flushing of the bottom of the well using a picadolt

This ensures trouble-free operation even in the event of an abnormal high pressure layer. If the bottom of the well consists of a production string, bits are selected or prepared depending on the dimensions of the inner diameter of the string. If the filter is placed at the bottom of the well, then after reaching the depth filled with a sand plug, a relatively small bit is selected, a technological process is formed, as in the following diagram. (Figure 4)

To drill the bottom of the well, the rotor (4) is installed on the BOP (5) in the well, the original drill pipe (square) (6) is sealed with an insert, the flushing fluid is supplied through the drive pump (10) to the inner part of the pipe, an outlet from the excess part (3) the circulation pipe into the process tank (9). The driver receives a source from the water tank (10) until the pump (11) creates circulation. While the technological capacities are full, he pumps himself. Then we will be able to control both the density and the viscosity of the outgoing fluid. This will serve as the basis for a safe passage of the process.

Conclusion. Maintaining the cleanliness of the bottom of the well and sand plugs in the perforated areas is achieved through movement and detection of stuttering in the wells during the production seasons. The methods discussed above are of great benefit when cleaning the bottom of a well in Khujaabad UGS. Because these methods have proven effective in cleaning up difficult sand accumulations in other gas fields. The motor of the spiral borehole tubing is convenient in that it is connected to the pressure at which the number of its revolutions is formed. When working with picadolota, the number of revolutions will depend on the rotor located at the top of the well. In cases where the helical well tubing motor does not work, the target can be achieved, towards which the rotation of the picadolot with the rotor is directed. The following advances can be achieved by using a downhole motor or pico hammer when clearing difficult sand plugs in wells. The bottomhole cleanliness is 90-95%, the openness of the formation perforations is 100%, the full workover interval is up to 30-36 months. Cost reduction for complete well workover is 30-50%, the amount of gas injection into wells increases by 2-5%.

In addition, due to the inability to reach the bottom of the well, it is also possible to return wells transferred from the second stage to the first stage for use in the second stage by jointly cleaning the cement barriers and increasing the amount of gas that can be released up to 5%. the amount of gas that can be released

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