Section 3. Technical sciences

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MEASURES TO PREVENT AND COMBAT COMPLICATIONS DURING FOUNTAIN AND GAS LIFT OPERATION OF WELLS AT GAS CONDENSATE FIELDS

Abstract. the article presents measure to prevent and a combat complication during fountain and gas lift operation of wells at the Altyguyi field, and also provides recommendations on dewaxing the elevator for the normal operation of fountain and gas lift wells. In addition, optimization of operated gas lift wells according to existing methods is presented.

These measures can serve as instructions for the prevention and control of complications during fountain and gas lift operation of wells at gas condensate fields.

Keywords: puncher, paraffin, plug, gas injection line, fountain, contour water, fitting, pollution, catastrophe, filter shank.

At the Altyguyi field, when choosing the gushing mode (the diameter of the fitting), it is necessary that the well has an optimal flow rate with a small gas factor, gives less water and sand, gushes calmly, without large pulsations. Only when these conditions are met, it

is possible to ensure the most rational use of reservoir energy and long-term, uninterrupted gushing of the well.

When choosing the mode of operation of a fountain well, reservoir conditions are also taken into account – the proximity of contour water, the possibility of a plug in the well, the mode of the field itself, etc.

The main reasons for the disruption of the normal operation of fountain wells are the waxing of fountain pipes, the formation of a sand plug, corroding of the fitting, clogging of the fitting or ejection of paraffin complications, etc. [1].

Measures to restore the operation mode of wells are carried out depending on the reason that caused its violation.

When a sand plug is formed in the fountain pipes, which caused the buffer pressure to drop to zero and the supply is stopped, a liquid (oil) pump is flushed into the annular space to restore circulation and eliminate the plug.

A significant decrease in pressure in the annular space indicates the formation of a plug at the bottom and the appearance of water, the latter is detected by taking a sample from the jet. When water appears, it is necessary to increase the pressure on the face by reducing the diameter of the fitting. To eliminate the downhole plug, the well is allowed to work without a fitting or oil is pumped into the annular space.

The pressure drop on the buffer while increasing the flow rate of the well indicates that the nozzle is corroded by sand, in this case it is necessary to transfer the fountain jet to another outlet and immediately change the nozzle.

If the specified method fails to eliminate sand jams in the lifting pipes or at the bottom, then the well is stopped for repair work, after which it is put into normal operation.

Dewaxing of the elevator is the main way to ensure the normal operation of fountain wells. The largest amount of paraffin is deposited in the upper part of the lifting pipes, at a length of 400–1000 m from the wellhead and in the field oil collection system, in which paraffin deposition increases during the cold season. Several methods are used against waxing of lifting pipes. First of all, these are regime measures: reduction of pulsation and frequency of gushing, regulation of the gas factor in order to reduce it as much as possible.

If these measures do not give results, it is necessary to clean the lifting pipes from paraffin.

There are 3 types of cleaning from paraffin: mechanical, thermal, and chemical [2; 3].

Mechanical cleaning of pipes from paraffin is carried out during the operation of wells without stopping them with scrapers of various designs.

When exposed to heat, the lifting pipes are heated with steam, hot oil pumped into the annulus of the well without stopping it. The melted paraffin is carried out by a jet of oil to the surface, while the paraffin melts in the switch line. The thermal method does not prevent the deposition of paraffin in pipes, it is used sporadically, under favorable conditions and when for some reason it is not possible to use other more effective methods.

As a solvent of paraffin, it is envisaged to use condensate (gasoline), which is extracted at the Altyguyi deposit in sufficient quantities.

The most characteristic complications in gas lift mining are the appearance of sand and cork formation, the deposition of paraffin in lifting pipes and discharge lines.

Measures against sand entering the well are of a regime nature and are reduced to limiting depression, i.e. limiting oil extraction. The amount of liquid extraction from gas lift wells is regulated by changing the amount of injected working agent, the depth of im-

mersion of lifting pipes or their diameter. To prevent the settling of sand during the periods of its greatest inflow from the reservoir, without interrupting operation, oil is pumped into the annulus in small portions by a mobile pump.

Sometimes the pressure of the gas injected into the well increases sharply when the liquid supply is stopped at the same time. This may occur due to the formation of a so-called cartridge sand plug in the lifting pipes, which blocks the section of the lifting pipes, preventing the mixture of oil and injected gas from reaching the surface. To destroy such a plug, gas is pumped not into the annular space, but into lifting pipes. If in this way it is not possible to push the plug from the pipes to the bottom of the well, then it is necessary to remove the pipes [4].

When wells are equipped with a single-row lift, it is finished with a shank of a smaller diameter than the main tubing string. The descent of the lifting pipes with a shank to the filter facilitates the conditions for the removal of sand by the liquid to the surface and prevents the formation of sand jams.

Measures to prevent paraffin deposits in lifting pipes during gas lift operation of wells, and methods for cleaning pipes from paraffin are similar to those used in fountain operation.

With the drop in reservoir pressures and the flooding of reservoirs at some stages of development in the gas condensate fields of the western part of Turkmenistan, it is planned to improve the gas lift. It is proposed to install a column of lifting pipes equipped with borehole chambers with gas lift valves (starting and working) located in them in the production column on the packer. This eliminates the influence of the injected gas on the flow of liquid into the well. It is planned to conduct research on optimizing the operating modes of gas lift wells according to known methods to determine the optimal flow rate.

It is also necessary to equip the gas lift gas distribution system with regulating and measuring equipment.

All the measures mentioned above are aimed at increasing and stabilizing gas lift production and reducing the volume of injected gas.

At the Altyguyi gas condensate field under development, the number of gas lift wells will increase with the expiration of the operating time, since with the cessation of well gushing, it becomes necessary to transfer them to a mechanized method [5].

Under the existing modes of gas lift lifts, the depth of the input of the working agent (gas) is in the range of 1400–3000 m, the gas input into the lift is carried out through holes (punchers) temporarily replacing the working valves.

Gas supply to gas lift wells is carried out from the gas pipeline via separate gas injection lines at operating pressures of 6.2–11 MPa.

Operated gas lift wells need to be optimized according to existing methods. According to calculations, in gas lift wells with a gas inlet point of 2300–2500, we accept a working pressure of P_{work} = 6.4; 7.4; 8.4 MPa, and in wells with a gas inlet depth of 3000–3500 m – 10–12 MPa. At the Altyguyi gas condensate field, it is necessary to implement a closed-cycle compressor gas lift with high-quality gas preparation for the needs of the gas lift and further gas supply to the export gas pipeline.

The issues of ecology and nature protection include restrictions on the external impact on the environment, preventing the loss of hydrocarbon resources during the extraction, carrying out technical and control measures.

Oil and gas enterprises occupy one of the first places among other sectors of the national economy in terms of the degree of environmental impact. Exploration and development of oil fields includes such technologies as exploration drilling, oil production, collection and preparation of hydrocarbons, transportation and processing.

The enterprises of the oil and gas industry have a harmful effect on all objects of nature, the atmosphere, the hydrosphere and underground and surface waters, the geological environment, drilled wells at all depths, on the land where they are located.

The cycle of oil and gas works consists of two main groups:

1. New construction sites (search and exploration, drilling, installation of equipment)

2. Working processes of the enterprise (collection, processing, shipment and processing of oil and gas)

When carrying out construction work, a report is made on technogenic pollution of the earth and the environment for technical reasons.

A report on the measures taken to protect the environment should be prepared by oil and gas producing organizations.

It should be noted that the time spent on exploration, drilling and preparation of oil and gas fields, the production time of the enterprise, pollution is caused for technical reasons.

The performance of these works causes high harm to the environment. Ecological catastrophes that occur are physical and mechanical impacts on soil, land, flora, fauna, soil, lowering of hydrogeological conditions, strengthening of soil erosion conditions, deterioration of living conditions of fauna and flora and local residents, and others.

Currently, geological studies have been completed at the Altyguyi gas condensate field and a field test plan has been prepared based on the data obtained.

When drilling wells in the fields, the environment is polluted mainly by some chemical elements used in the preparation of drilling fluids.

Currently, normal limit values, chemical elements indicating aggressiveness used in the preparation of drilling fluids have not been established.

During drilling operations, the source of atmospheric air pollution is diesel-fueled equipment that emits 2 tons of hydrocarbons and soot, 30 tons of nitrogen oxides, 8 tons of carbon monoxide and 5 tons of sulfur anhydrite into the atmosphere during the year. When drilling wells, drilling mud is mixed with soil layers, surface and groundwater, forming 30 m^3/day of water used.

During the development of wells, hydrocarbon mainly causes pollution. In most cases, oil-based circulating solutions with serious environmental consequences produce used wastewater, suspension and colloidal solution.

When preparing environmental protection measures during installation work in wells, it is necessary to avoid work that negatively affects natural objects. Since the sources of pollution are closely related to the technology used by the enterprise, it is necessary to establish the technology that has the least impact on the environment. When geochemical breakdown of the soil, it is necessary to perform the following:

– When preparing plots, it is necessary to prevent contamination of the topsoil from the products obtained;
– To collect sedimentary rocks of drilled rocks on slurry barns;
– It is necessary to cover the slurry barn;
– Restore the soil area of the extracted products;
– Road construction.

As a result of drilling operations, there is a negative impact on the hydrogeological change in the soils of the earth, and as a result, drilling fluids penetrate into aquifers, which lead to the formation of a complex of waters.

The waters used in drilling fluids are divided into three groups:

1. Water formed during the production of works;
2. Water for household work;
3. Atmospheric, rainwater.

Circulating waters are used to carry drilled rocks to the surface. In world practice, 95% of clay elements are mixed into the composition of circulating waters for the preparation of drilling fluids.

The quality of the flushing solutions used helps the speed of drilling operations, the prevention of complications with colmatation and water occurrence.

During the operation of producing wells and oil and gas collection facilities, the integrated safety and environmental protection system includes:

– monitoring of the condition of borehole fittings;

– selection of equipment and pipelines that meet the specified operating conditions, taking into account current regulations;

– periodic testing of equipment for strength (crimping);

– corrosion protection;

– prevention of technological complications that create emergency situations (gas communications flooding, deposition of paraffin and salts in wells and collection systems), with the use of special inhibitor substances.

When collecting and storing oil, the requirement of safety and reduction of hydrocarbon emissions into the environment are ensured at the stage of arming assembly points in compliance with building codes and regulations, with the necessary equipment of tanks with floating roofs or breathing valves, with mandatory collapse of tank farms to localize emergency oil spills.

When implementing the gas lift method of oil production, with a high manifestation of gas injected into the well to ensure safety and environmental protection, it is envisaged (in addition to the design and construction of the main facilities in full compliance with the required technological parameters of operation according to the current building codes and regulations) the construction and proper operation of additional technological equipment that provides a hydrate-free opera-

tion of gas distribution systems (furnaces for heating gas and inhibition unit). In the case of the construction of furnaces for heating hydrocarbons, make a preliminary calculation of atmospheric pollution by combustion products and assess the need to determine the MPC.

Storage and use of chemicals is planned to be carried out in accordance with their individual characteristics and in accordance with Safety Regulations (SR) in the oil industry, including providing employees with personal protective equipment (PPE), carrying out instructions and monitoring the condition of equipment used for the use of chemicals (surfactants, methanol, etc.).

The operation of electrical installations and heating equipment is provided in accordance with the current rules of SR and fire safety rules.

According to estimates, in oil fields with a similar technology of oil extraction and collection, the maximum concentrations of the above harmful substances at the border of the sanitary zone (within a radius of 1000 m from the source of emission) do not exceed the maximum permissible (MPC), which are set for each harmful substance individually according to the methodology of the State Committee for Hydrometeorology (OND-86).

In this regard, emissions of harmful substances into the atmosphere, subject to regular (accident-free) technological modes of operation of oil and gas field equipment, can be considered approximately corresponding to the maximum permissible emissions (MPI).

A detailed assessment of emissions for all fishing facilities is taken into account when compiling an environmental passport.

The environmental passport is being developed in accordance with GOST 17.0.0.04–90 "System of standards in the field of nature protection and improvement of the use of natural resources", which already gives the full technological cycle of this production from the supply of raw products to the finished product. At the same time, the presence of emissions, discharges and solid waste is carefully

checked and calculated at each production facility and their impact on the environment is analyzed. All this material is described and calculated in the relevant chapters of the environmental passport. It also concludes that it is necessary to calculate the norms of MPD, the results of which are issued in the form of a second volume, but in the future, in the event of an increase in oil production due to Miocene-Paleogene and Mesozoic underlying red-colored sediments, it will be necessary to adjust all calculations on emissions.

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