• Ore deposit acidification - supply of working solutions to the ore-bearing horizon in order to change its state and ensure the conditions for the transition of uranium into solution.

• Active leaching - formation and extraction of productive solutions from the block.

• Modification of operating units (additional leaching, “washing” of uranium) is the final stage of uranium mining, which is characterized, as a rule, by a decrease in the uranium content in productive solutions [2].

When mining blocks at the stage of active leaching, the hydrodynamic equilibrium (balance) of the injected and pumped-out solutions must be strictly observed, both for individual production cells, as well as for blocks and areas [3]. In this case, as a rule, provided optimal solutions hydrodynamic filtering mode in block circuit. In the development of deposits in the conditions of high-pressure nature of groundwater, ensuring optimum hydrodynamic filtering mode solutions unit circuit is very difficult. With an imbalance towards pumping (negative balance, pumping exceeds pumping), productive solutions dilute due to the pulling up of formation water due to the block contour. The imbalance in the direction of pumping (the positive balance exceeds injection pumping) leads to the exit of process solutions beyond ore deposits. Thus, there is a uranium loss due to the spreading and re-sedimentation, increased consumption of leaching reagents. It should also be noted that the unbalance solutions in operational blocks may occur overflow of process solutions between adjacent blocks. This significantly complicates, and often makes it impossible to account for uranium production by block (calculation of the movement of reserves) [4].

Hydrodynamic equilibrium (balance) for individual production cells, blocks and sections is established because of data from measurements of production rates of pumping wells and injectivity of injection wells. As a result of mudding, the flow rates and injectivity of wells can vary significantly [5]. Therefore, timely measurements and repair and restoration work is very important to ensure the balance of injected and pumped out solutions. In connection with the above, the studies carried out in this work are quite relevant.

As is known, the main factors when using the method of in-situ leaching are projection of the ore deposit to the surface that determines the location of the wells and infrastructure, the specified productivity of the processing complex and the number of pumping and injection wells. Thus, binding process begins with arrangement of wells in the upper portion of the exhaust well submersible pump, which is the cause of the borehole drilling large diameter "plant around" the larger diameter pipes to equip the upper end of the well head part correspondingly more expensive. In addition, electric cables are laid to the location of the technological unit and each well from the transformer substation and from the distribution units of solutions. All of these additional costs is inevitable because of pumped well location identified the morphology of the ore body and the need to define solutions underground vector of their movement with the use of a submersible pump [6,7].

Experimental part and discussion of results

The experimental unit is located in the section №2. The area of the block is 40,500 square meters, the ore is represented by hard rocks, the thickness of the aquifer is 8-12 m, the depth is 670 m. The experimental block has 30 injection wells, 14 extraction wells, the distance between the injection and extraction wells is 30 meters. An in-line autopsy scheme was adopted. Drilling is carried out with the drilling machine BFU-1200m (mobile drilling unit). Extraction wells are constructed in the injection format, as shown in Figure 1, cased with 89 mm PVC (poly vinyl chloride) pipe, filter - KDF 118. To carry out experimental work, an improved scheme for connecting technological wells was proposed (Figure 1), the essence of which is the extraction of pumping wells in the injection format; near the transformer substations with a depth of 50-100 meters, "pumping wells" are being built, equipped with a blind filterless column, in which submersible pumps are located. The total power of the pumps is equal to - optimal with a traditional piping scheme [8].

Pumping wells connected to the extract hose and constitute a system of communicating vessels. Apparently, a necessary condition in this case should be - a positive head of groundwater above the surface and the location of the pump below the dynamic level. The minimum number of such “pumping wells” is one per processing unit [9].

In this case, the flow rate in the extraction wells is regulated by means of shut-off equipment. The use of "pumping wells", along with a direct economic effect, makes it possible to use any combination of injection wells in the functions of pumping wells at different stages of block development.

Модернизация схемы узла приема и распределения раствора в условиях высоконапорного характера подземных вод

[1] Алиев С.Б., [2*] Омарбеков Е.У.

[1] *Институт проблем комплексного освоения недр им. академика Н.В.Мельникова Российской академии наук ИПКОН РАН, Москва, Россия*

[2]*Satpayev University, Алматы, Казахстан*

** Электронная почта автора: 13s_yernur88@mail.ru; y.omarbekov@stud.satbayev.university*

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АННОТАЦИЯ

В данной работе проанализирован опыт разработки уранового месторождения в условиях высоконапорного характера подземных вод, предложены технология «насосных скважин» и схема модернизации узла приема и распределения раствора. Приведены результаты экспериментальных исследовании применения «насосных скважин» при отработке месторождений урана методом подземного скважинного выщелачивания на руднике «Каратау». Доказана, что при использовании предлагаемой технологии и схемы в условиях высоконапорного характера подземных вод уменьшаются затраты на закупку кабельной продукции, существенно уменьшаются затраты на приобретение погружных насосов, экономятся средства на оголовниках. На практике на один технологический блок установлен один узел приема и распределения раствора, поэтому на все закачные скважины подается выщелачивающий раствор с одной и той же кислотностью. Во избежание таких случаев, требуется выборочная подача с разными концентрациями кислоты с учетом разных показателей pH. Модернизация схемы узел приема и распределения раствора была осуществлена за счет соединения двух байпасных линий, где одна байпасная линия предназначена для перевода закачных скважин в откачную, а вторая-для перевода откачных скважин в закачную. Соединяя две байпасные линии, можно будет подавать выщелачивающий раствор с более высокой концентрацией кислоты, выборочна на любую закачную скважину. В результате снизится расход кислоты за счет выборочной ее подачи и сбалансируются pH показатели в скважинах.

Ключевые слова: Подземно-скважинное выщелачивание, высоконапорный характер, «насосные скважины», показатель pH.

Информация об авторах:

Алиев Самат Бикитаевич *- Доктор технических наук, Институт проблем комплексного освоения недр им. академика Н.В.Мельникова, Российской академии наук, Москва, Россия; https://orcid.org/0000-0002-3699-8322, Email: alsamat@gmail.com*

Омарбеков Ернур Уразгалиевич *- PhD докторант Satbayev University, Алматы, Казахстан; https://orcid.org/0000-0003-1317-1303, Email: 13s_yernur88@mail.ru; y.omarbekov@stud.satbayev.university*

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