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**Results of the International Scientific and Practical Conference
"European Union decarbonization decision and a new paradigm for
the development of fuel and energy complex of Russia
(a year later)"**

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Abstract. The past year after the international conference on the decarbonization of the fuel and energy complex in Kazan, it was saturated with significant events in the sectors of the fuel and energy complex, which seemed to be the failure of the "climatic agenda" adopted with the actively aggressive West. Hopes for a advertised energy transition to the so-called green solar-wind energy were no longer justified due to low efficiency, discomfort and complexity of use and economically more harm. Understanding has come about a limited set of greenhouse gases, a microscopic fraction of this carbon dioxide, which is the basis of life on Earth and our entire planet. Therefore, decarbonization has no scientific justification, but only harms life on Earth. Carbon neutrality should not be a goal and as a concept needs to be clarified. The same applies to the concepts of carbon footprint, low-carbon energy, carbon trading unit. With a cold snap, and especially with a warming climate on Earth, the role of traditional fuel and energy sources (oil, gas, coal) increases and such energy will have to be developed further (instead of decarbonization, further carbonization comes). This requires a new paradigm for the development of the oil and gas complex with the simultaneous withdrawal of the Russian Federation from the Paris climate agreements.

Key words: *climate agenda, greenhouse gases, carbon dioxide, steam, hydrocarbons, carbon, coal, oil, gas, renewable energy sources, CHPP, NPP, HPP, solar power plants, wind farms, hydrogen, renewable energy sources, global warming, thermal pollution of the planet, energy transition, natural resources, climate change*

For citation: R.Kh. Muslimov Itogi mezhdunarodnoy nauchno-prakticheskoy konferentsii «Resheniye Yevropeyskogo soyuza o dekarbonizatsii i novaya paradigma razvitiya toplivno-energeticheskogo kompleksa Rossii (god spustya)» [Results of the International Scientific and Practical Conference "European Union decarbonization decision and a new paradigm for the development of fuel and energy complex of Russia (a year later)"]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 1-35. DOI <https://doi.org/10.25689/NP.2022.4.1-35>. EDN UVAFHT (in Russian)

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EDN UYUIVA

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Biostratigraphical disclosure of the Jurassic deposits of the Aral-Usturt region according to plant impressions and spore-pollen complexes

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Abstract. This article substantiates the relevance of research, the combined use of various paleontological methods, in particular, floristic and palynological, along with lithofacies and field geophysical data, to determine the oil and gas potential of the Jurassic deposits of Ustyurt, where it is necessary to create a reliable stratigraphic scheme, which is impossible without a detailed study of paleontological remains. For this purpose, complexes of spore-pollen and plant remains were studied by area Saamskaya-1p, Arka-Kungrad-1p, Muynak-1p, Northern Aral-1, Aral-3, Akchalak-4, East Berdakh-7, Akchalak-13, Shakhpakhty-1p, Northern Koskala-1, Kyzyl-Shaly-1p and others. The main types of sections were attributed by many lithologies and fishermen to the Lower Jurassic deposits. On the basis of spore-pollen analyzes and the study of plant remains, the age of the exposed rocks is dated as Middle Jurassic. Biostratigraphic subdivision of Jurassic deposits according to plant imprints and spore-pollen complexes in the Ustyurt region is developed on the basis of small stratigraphic units, such as a layer, a reference horizon, a suite, which meets the requirements of the international stratigraphic code (ISC).

Key words: *stratigraphy, Jurassic deposits, Ustyurt oil and gas region, hydrocarbon raw materials, paleontological materials, geophysical data, well, interval, formation*

For citation: M.Kh. Iskandarov, T.M. Tursunova, I.N. Khakimzyanov, A.U. Mirzaev, Sh.A. Umarov, B.I. Khudayberganov Biostratigraficheskoye raschleneniye yurskikh otlozheniy Aralo-Ustyurtskogo regiona po rastitel'nyim otpechatkam i sporovo-pyl'tsevym kompleksam [Biostratigraphical disclosure of the Jurassic deposits of the Aral-Usturt region according to plant impressions and spore-pollen complexes]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 36-64. DOI <https://doi.org/10.25689/NP.2022.4.36-64>. EDN UYUIVA (in Russian)

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EDN WGVCTU

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Tracer analysis of hydrodynamic connections in the silurian deposits of the Timan-Pechora oil and gas province

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Abstract. The purpose of the article is to consider the features of the geological structure of a tectonically fragmented deposit and its influence on the development. In the process of studying the block structure of the field, the results of tracer analysis for the period 2003-2019 were used. During the analysis, the hydrodynamic connectivity of blocks IA, IB, IC, II was revealed due to "feathering" fractures near tectonic faults. The results obtained from tracer analysis indicate the need for the formation of unified RPM system.

Key words: *tectonic faults, blocks, faults, tracer analysis, hydrodynamic connectivity*

For citation: A.V. Raspopov, S.A. Prokusheva Izuchenie gidrodinamicheskikh svjazej silurijskih zalezhej Timano-Pechorskoj neftegazonosnoj provincii metodom trassernyh issledovanij [Tracer analysis of hydrodynamic connections in the silurian deposits of the Timan-Pechora oil and gas province]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 65-78. DOI <https://doi.org/10.25689/NP.2022.4.65-78>. EDN WGVCTU (in Russian)

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EDN YEBGNH

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On the issue of monitoring of in-circuit flooding of oil and gas fields by ground measurements of natural electric fields

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Abstract. In this paper presents the results of the study of natural electric fields registered at the Ivanovsky site oil field, located on the territory Sarmanovsky district in Tatarstan Republic. Measurements of electrical potentials on the daytime surface were carried out in various modes of operation of injection wells.

Key words: *electrokinetic processes, natural polarization (NP), filtration potential, development monitoring, oil recovery coefficient (ORC), in-circuit flooding, injection wells*

For citation: E.E. Andreeva, S.E. Valeeva, A.V. Valeeva, R.S. Mukhamadiev, E.M. Nurieva K voprosu monitoringa vnutrikonturnogo zavodneniya neftegazovykh zalezhey putem nazemnykh izmereniy yestestvennykh elektricheskikh poley [On the issue of monitoring of in-circuit flooding of oil and gas fields by ground measurements of natural electric fields]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 79-96. DOI <https://doi.org/10.25689/NP.2022.4.79-96>. EDN YEBGNH (in Russian)

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EDN ZYHKUJ

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Evaluation of infill drilling impact on closely spaced wells in AV1(1-2) reservoir of the Samotlorskoe field

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Abstract. The base oil production maintaining is the relevant task for brown fields. This is especially important in case of the infill drilling process, due to the fact that infill wells and recompleted wells not only increase conformance factor, but also change distribution of drainage areas. Oil production losses in closely spaced wells might be sufficient, which in turn impact on oil recovery index and the planning of technological development indicators. This article presents the results of interference calculations at the AV1(1-2) object of the Samotlorskoe field, obtained using several methods: regression model, CRM model and reservoir simulation model. In general, all used methods show a fairly high convergence of results. Average percent of base oil production losses are equal to 18,4%. The average share of base oil losses from the production of infill wells is 30%.

Key words: *Infill drilling, well interference, infill well pattern, oil production losses, simulation model, regression model, CRM*

For citation: I.S. Kanaev, I.V. Savchenko, A.A. Shkitin Ocenka vliyaniya uplotyayushchego bureniya na skvazhiny bazovogo fonda obekta AV1(1-2) Samotlorskogo mestorozhdeniya [Evaluation of infill drilling impact on closely spaced wells in AV1(1-2) reservoir of the Samotlorskoe field]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 97-111. DOI <https://doi.org/10.25689/NP.2022.4.97-111>. EDN ZYHKUJ (in Russian)

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EDN CTCHOT

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Influence of geomechanical effects during the reservoirs development on the risks of drilling, development and field production enhanced

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Abstract. The paper presents a coupled geomechanical model creation containing the reservoirs of the Berezovskaya, Kuznetsovskaya and Pokurskaya suits. Based on the data of 4D hydrodynamic and geomechanical modeling, taking into account the simultaneous development of several reservoirs, the risks of drilling wells in transit wells and their stability, the impact of reservoir development on the processes of production enhanced (fracturing designs), the risks of destruction of shale barriers, the processes of the surface subsidence and the reservoir top, the risks of faults reactivation. The arrangement of the obtained geomechanical effects made it possible to implement a detailed program of monitoring, studying, minimizing risks for production and increasing economic efficiency, including by removing negative scenarios and obtaining benefits on real production examples.

Key words: *core laboratory studies, elastic-strength properties, coupled 4D hydrodynamic and geomechanical modeling, evaluation of geomechanical effects, production and transit wells*

For citation: V.A. Pavlov, N.A. Pavlyukov, M.D. Subbotin, M.I. Samoiloov, R.A. Yagudin, A.A. Aleksandrov, A.Yu. Goloviznin Vliyaniye geomekhanicheskikh effektiv pri razrabotke gruppy plastov na riski bureniya, razrabotki i in-tensifikatsii mestorozhdeniya [Influence of geomechanical effects during the reservoirs development on the risks of drilling, development and field production enhanced]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 112-127. DOI <https://doi.org/10.25689/NP.2022.4.112-127>. EDN CTCHOT (in Russian)

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EDN CTDJPM

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Development of an inhibiting drilling fluid composition for drilling wells in unstable clay rocks

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Abstract. The article presents the results of laboratory research of inhibiting biopolymer drilling mud with the addition of the complex reagent Devon-2l on the swelling of the clay phase when passing through the argillites of the Sharkansky field. Positive result of pilot tests of the reagent confirms the efficiency of the developed reagent Devon-2l, which is able to provide stability of the borehole walls, to reduce sealing and increase lubricating ability of the drilling mud, which contributes to creation of load on the drill bit.

Key words: *Devon-2L reagent, inhibiting drilling mud, sticking coefficient, clay swelling*

For citation: G.L. Gaymaletdinova, R.A. Mulyukov, R.A. Ismakov, S.A. Sitnov Razrabotka sostava ingibiruyushchego rastvora dlya bureniya skvazhin v neustoychivyykh glinistykh poro-dakh [Development of an inhibiting drilling fluid composition for drilling wells in unstable clay rocks]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 128-139. DOI <https://doi.org/10.25689/NP.2022.4.128-139>. EDN CTDJPM (in Russian)

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EDN EHBGWJ

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Analytic dependencies used to determine temperature profile resulting from injection of hot water and steam into reservoirs with underlying contact water zone

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Abstract. The paper considers analytical dependencies to determine the radius of the steam chamber that is formed in the oil zone following injection of heat carrier into a high-viscosity reservoir with underlying contact water zone. Analysis of the analytical dependencies showed that the radius of the steam chamber in the oil zone resulting from injection of hot water into the underlying contact water zone below the WOC is 1.24 times the radius of the steam chamber resulting from hot water injection directly into the oil zone. It was found that when steam is used as a heat carrier, the steam chambers' sizes are comparable regardless of whether the steam is injected directly into the oil zone, or into the underlying contact water zone. It was further found that the ratio of the steam chamber radius resulting from the steam injection to that resulting from the hot water injection varies from 9.9 to 13.4 depending on the injection zone. In case the heat carrier is injected into the oil zone, the steam chamber growth is only determined by the duration of injection, i.e. the steam chamber radius is increased with time. In case hot water is injected both in the oil zone and into the underlying contact water zone, the steam chamber is 1.1 times the steam chamber developed from injection of hot water in the oil zone alone. In case hot water is injected both in the oil zone and into the underlying contact water zone, the steam chamber is 3.5 times the steam chamber developed from injection of hot water in the underlying contact water zone alone.

Key words: *high-viscosity reservoir, oil zone, underlying water zone, heat carrier, hot water, steam, steam chamber, radius of steam chamber*

For citation: Yu.L. Egorova, G.V. Aleksandrov, R.Kh. Nizaev Analiticheskie zavisimosti dlja opredelenija raspredelenija temperaturnogo polja, obrazujushhegosja pri zakachke gorjachej vody i para v plast s nizhelezhashhej kontaktnoj vodonosnoj zonoj [Analytic dependencies used to determine temperature profile resulting from injection of hot water and steam into reservoirs with underlying contact water zone]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 140-155. DOI <https://doi.org/10.25689/NP.2022.4.140-155>. EDN EHBGWJ (in Russian)

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EDN EJQEYB

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Analysis of the application of injection of polymer compositions using «Kem-Tron» installations at the experimental site of the Bureikinsky field

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Abstract. The article presents the results obtained by analyzing the dynamics of technological indicators of the operation of the Bureikinsky field site, where polymer compositions were injected using Kem-Tron installations, and the control area not covered by polymer flooding. Injection of polymer compositions using the "Kem-Tron" installations at the Bureikinskoye field has been carried out since 1995. When analyzing the dynamics of the technological indicators of the polymer flooding site and the control site of the Bureikinsky field, the following indicators were considered: oil and liquid production, water content of products, oil and liquid flow rate, the number of producing and injection wells, the volume of injection, compensation for injection selection and the pick-up rate of injection wells. The efficiency of injection of polymer compositions using Kem-Tron installations at the Bureikinsky field site was evaluated by comparing the dynamics of the main technological indicators with the basic version.

Key words: *analysis, control area, injection of polymer compositions, dynamics of technological indicators, oil and liquid production, water content, water and oil factor*

For citation: *Yu.L. Egorova, A.V. Nasybullin, S.V. Nasybullina, R.Kh. Nizaev Analiz primenenija zakachki polimernyh kompozicij s ispol'zovaniem ustanovok «Kem-Tron» na opytном uchastke Burejkinskogo mestorozhdenija [Analysis of the application of injection of polymer compositions using «Kem-Tron» installations at the experimental site of the Bureikinsky field]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 156-164. DOI <https://doi.org/10.25689/NP.2022.4.156-164>. EDN EJQEYB (in Russian)*

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EDN ESEHPR

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Some questions of laboratory assessment of changes in the properties of bituminous oil after solvent injection into steam cycle wells

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Abstract. The development of hard-to-recover oil reserves is an urgent problem that requires attention. One of the methods for solving this problem is the use of a complex method of influencing the bottomhole zone of the well. For the analyzed object, a technology is proposed based on thermal and chemical effects, namely, the injection of steam together with the solvent. The article presents the results of laboratory studies of bituminous oil samples before and after solvent injection into procyclic wells.

Key words: *extra-heavy oil; chromatography; thermogravimetry; optical research methods; reduction of oil viscosity; thermal methods of stimulation*

For citation: E.F. Zakharova, V.A. Sayakhov, L.R. Shaikhrazieva, R.H. Sadreeva, L.K. Shaidullin K voprosu laboratornoj ocenki svojstv nefi posle zakachki rastvoritelja [Some questions of laboratory assessment of changes in the properties of bituminous oil after solvent injection into steam cycle wells]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 165-182. DOI <https://doi.org/10.25689/NP.2022.4.165-182>. EDN ESEHPR (in Russian)

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EDN ETBGSN

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Mechanical method of protection against colmatation and hydrophilization of the boreholehouse formation zone

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Abstract. In the late stage of field development, there are significant changes in the productivity of wells, there is a differentiation of energy potential and hydraulic conductivity between interlayers. The main changes are in deepening the differentiation of the perforated zone of the reservoir in terms of the productivity of interlayers in terms of energy and reservoir characteristics. Those intervals of the reservoir that were not initially involved in development due to low permeability and were not brought in as a result of production stimulation measures further deteriorate the reservoir properties, but retain their energy potential. This leads to a gradual breakthrough of formation water through the most highly permeable intervals of the formation with an increase in fluid flow rate. The ratio of the liquid flow rate after water breakthrough to the initial flow rate of wells will be an order of magnitude higher in the production of high-viscosity oil. Often, circulation is lost during technological flushing of such wells, and the shortage of oil during flushing increases. There are conditions for oil and gas water showings due to the difference in the state of development of layers.

A mechanical device is proposed that allows to prevent the well fluid from getting back into the formation during technological flushing and killing of the well, to ensure the operation of the oil formation in a hydrophobic environment, as well as to improve safety during well workovers.

Key words: *reservoir, well, bottomhole zone, reservoir properties, flushing, killing, absorption, hydrophilization, colmatation*

For citation: A.M. Nasyrov, S.A. Krasnoperova, Yu. G. Epifanov, A.N. Vanchurin Mekhanicheskiy metod zashchity ot kol'matatsii i gidrofilizatsii prizaboynoy zony plasta [Mechanical method of protection against colmatation and hydrophilization of the boreholehouse formation zone]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 183-195. DOI <https://doi.org/10.25689/NP.2022.4.183-195>. EDN ETBGSN (in Russian)

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EDN EXLNHF

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Improving the efficiency of the development of high-viscosity oil deposits by flooding with hot water on the example of the Novo-Elkhovsky oil field

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Abstract. The article discusses the features of the development of high-viscosity oil deposits using thermal methods based on hydrodynamic modeling. The object is considered - the site of the 22nd deposit of the Novo-Elkhovsky oil field, represented by the Bobrikov horizon. Hot water with a temperature varying in the range from 20⁰C to 90⁰C was chosen as the main coolant. A series of calculations has been carried out, which makes it possible to determine the range of the effective temperature of hot water according to the schedule of the derivative of the increment of additional oil production. A minimal decrease in the ratio of dynamic viscosities of water and oil has been established, at which the temperature of the injected hot water is effective.

Key words: *high-viscosity oil, methods of increasing oil recovery, hydrodynamic modeling, thermal methods, coolant, temperature of injected water, hot water, additional mining*

For citation: Orekhova L.G. Povysheniye effektivnosti razrabotki zalezhey vysokovyazkoy nefi zavodneniyem goryachey vodoy na primere Novo-Yelkhovskogo neftyanogo mestorozhdeniya [Improving the efficiency of the development of high-viscosity oil deposits by flooding with hot water on the example of the Novo-Elkhovsky oil field]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 196-207. DOI <https://doi.org/10.25689/NP.2022.4.196-207>. EDN EXLNHF (in Russian)

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EDN FFSXHY

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Geomechanical modeling to assess the development impact of poorly consolidated reservoirs

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Abstract. The paper presents approaches and methods that allow minimizing the risks of developing gas poorly consolidated reservoirs under conditions of intensive production and a high probability of well watering. On the basis of numerical calculations in the creation of a 4D coupled hydrodynamic-geomechanical model, taking into account specialized studies of core samples with different sample saturations, the effect of weakening of poorly consolidated rocks during a change in saturation from gas to water and subsequent destruction, which causes an increase in reservoir permeability, was taken into account. Based on the obtained updated permeability cubes, an assessment was made of changes in the intensity of watering of gas wells and the impact on the destruction of the reservoir. The results obtained make it possible to analyze and predict production, as well as, if necessary, perform optimization for wells operation.

Key words: *core laboratory studies at different saturation, elastic-strength properties, coupled 4D hydrodynamic and geomechanical modeling, evaluation of geomechanical effects, production wells*

For citation: V.A. Pavlov, N.A. Pavlyukov, M.D. Subbotin, A.A. Hakimov, R.A. Yagudin, A.A. Aleksandrov, A.Yu. Goloviznin Geomekhanicheskoye modelirovaniye dlya otsenki vliyaniya razrabotki slabostsementirovannykh kollektorov [Geomechanical modeling to assess the development impact of poorly consolidated reservoirs]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 208-222. DOI <https://doi.org/10.25689/NP.2022.4.208-222>. EDN FFSXHY (in Russian)

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УДК 622.276.6

Improving the efficiency of hydraulic fracturing in a deviated well by the multi-stage injection of proppant in conditions of proximity of the injection water front

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Abstract. Most of the fields in Western Siberia are at the latest stage of development, which is characterized by high water-oil ratio (WOR) and water cut of the produced products. In this connection, the current exploitation conditions of the well stock make it necessary to adjust the criteria for applying workovers program aimed at maintaining the level of oil production. Therefore, about 40 % of hydraulic fracturing operations are performed in the zone of the injected water front at a base level of water cut in candidate-wells of more than 90 %, which contradicts generally accepted selection standards. However, it should be noted that the existing fracturing technologies and the accompanying preliminary workover operations allow performing cost-effective work package in these conditions. The aim of the work is to increase the efficiency of classical single-stage fracturing in deviated oil wells in conditions of proximity to the front of the injected water by the method of multi-stage injection of proppant into one target perforation interval. The paper presents the results of comparing the efficiency of multistage and standard fracturing, determines the criteria for obtaining a higher increase in oil production with a decrease in the level of water cut after fracture.

Key words: *Hydraulic fracturing, Western Siberia, Hydraulic fracturing technologies, two-stage hydraulic fracturing, three-stage hydraulic fracturing, multi-stage hydraulic fracturing, deviated well, injection water front, IWF, injection front, water cut reduction, Vanden formation, BV₈*

For citation: D.L. Dobrovinskiy, M.N. Vilkov Povyshenie jeffektivnosti gidrorazryva plasta v naklonno-napravlennoj skvazhine metodom mnogostadijnoj zakachki proppanta v uslovijah blizosti fronta nagnetanija [Improving the efficiency of hydraulic fracturing in a deviated well by the multi-stage injection of proppant in conditions of proximity of the injection water front]. Neftyanaya Provintsiya, No. 4(32), 2022. pp. 223-238. DOI <https://doi.org/10.25689/NP.2022.4.223-238>. EDN DXYBFQ (in Russian)

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EDN FOMKZU

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Methodology of automated selection of well candidates for hydraulic fracturing at Kharampurneftegaz fields

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Abstract.

Introduction. Creating methods for automated search of well candidates for well interventions is becoming popular among reservoir engineers. Such methods allow to define clear rules (criteria) for assessing the well intervention potential at certain development targets and reduce the labor costs of subject matter experts.

The **purpose** of the study is to create a software product for automated selection of well candidates for hydraulic fracturing in the conditions of reservoirs developed by Kharampurneftegaz.

Materials and Methods. The study is fundamentally divided into two parts: running a statistical analysis of historical data (the entire history of well interventions at the studied target) and assessing the potential of hydraulic fracturing for the future development period of the target. The first part is based on mathematical statistics methods. Further, based on the mathematical analysis data, a software product based on Microsoft Excel using Visual Basic for Applications (VBA) was created which allows to assess the potential of hydraulic fracturing in the wells of the development target.

Results. The statistical analysis of field historical data allowed to determine the criteria for assessing the potential of wells for hydraulic fracturing. The created software product made it possible to reduce the labor costs of subject matter experts for selecting well candidates.

Conclusion. The use of automated selection of well candidates for hydraulic fracturing has been confirmed in the field in the conditions of reservoirs developed by Kharampurneftegaz. The purpose of further research is to create a similar methodology for other types of well interventions applied in the fields in question.

Key words: *well interventions, automated selection of well candidates, criteria for selecting wells for hydraulic fracturing*

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Gisneiro 2.0 program package's well logging interpretation capabilities allow involving huge number of wells

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Abstract. A novel domestic software product Gisneiro 2.0 is a complex of machine well logging interpretation algorithms to improve interpreting of a bulk of well logging data that have been gathered during life cycles of a huge number of wells.

Automated interpretation of well logs accelerates the process of well data analysis by orders of magnitude utilizing the geological information available to the fullest extent at that, thus, significantly improving the efficiency of well logging interpretation.

The machine learning and statistical methods employed by the Giseiro 2.0 software allow automated stratigraphic breakdown and lithology differentiation, calculation of reservoir properties, determination of net thicknesses and types of saturation.

The software designer and the TATNEFT Company have tested the Gisneiro 2.0 program package within the framework of a pilot project involving creation of a database, interpretation of well logs, analysis and statistical interpretation of well logging and core data. The results of well logging interpretation in the semi-automatic mode were obtained, in that number, stratigraphic breakdown, boundaries of net thicknesses, reservoir characteristics, and core analysis.

Key words: *machine stratigraphic breakdown, machine interpreting, multi-histogram, multi-cross plot, clusterization, classification*

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Determination of the optimal time for the introduction of injection wells in barrier flooding

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Abstract. The article describes the main factors affecting the low efficiency of barrier flooding: late implementation, low injection volumes, large distance between production and injection wells, gas bypassing the created barrier. The influence of the delay in the implementation of barrier flooding on gas breakthroughs is considered in detail. Production wells are commissioned several months earlier than injection wells, during which time the gas, due to its high mobility, has time to break through to the bottomholes and leads to a decrease in oil production rates. On the example of a real field, it is shown how such wells can be "reanimated" by continuous water injection and the creation of a water barrier. The paper considers in detail the technology of barrier flooding from the standpoint of determining the optimal time for the introduction of injection wells to create a barrier. Estimation of the injection wells commissioning time in the barrier waterflooding element was made on a series of calculations on a hydrodynamic 3D model of the Verey object in the Chutyrskaya area. According to the results of calculations, it is shown that the most effective time for this object is the simultaneous launch of production and injection wells, or the start of injection three months before the start of production wells.

Key words: *barrier flooding, gas cap, gas breakthrough, oil rim, hydrodynamic model*

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Man-made processes in residual oils using physico-chemical methods to increase oil recovery: a review of research

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Abstract. The article is devoted to the generalization of the experience of geochemical studies of oil transformations of the Devonian deposit of the Romashkinskoye field under the prolonged influence of intracontane flooding. A brief overview of research works using reservoir geochemistry methods to assess the mechanisms of pre-displacement of residual oil under the influence of reagents and technologies is given.

Key words: *residual oil, field, reservoir, in-circuit flooding, technogenesis, oilfield geochemistry, assessment of residual oil displacement processes, methods of increasing oil recovery*

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