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**Comparative analysis of the features (differences)
of the Middle Jurassic and Lower Jurassic gases
in order to consider the theory of the deep origin of oil and gas
on Berdakh swell territory of the Ustyurt oil and gas region**

¹*M.Kh. Iskandarov, ²Sh.A.Umarov, ¹N.M.Kabilov, ¹T.D. Masudov,*

³*S.S. Khabibullaev, ⁴I.N. Khakimzyanov, ²A.U. Mirzaev*

¹*Joint-Stock Company «O'ZLITINEFTGAZ», Tashkent, Uzbekistan*

²*Navoi Branch of the Academy of Sciences, Navoi, Uzbekistan*

³*Ministry of Mining and Geology, Tashkent, Uzbekistan*

⁴*TatNIPIneft Institute - PJSC TATNEFT, Bugulma, Russia*

E-mail: shakhumarov@gmail.com

Abstract. This article is devoted to scientific research on the study and comparative analysis of the features (differences) of the Middle Jurassic and Lower Jurassic gases in order to consider the theory of the deep origin of oil and gas in the territory of the Berdakh swell of the Ustyurt oil and gas region.

Based on the research work carried out at the State Institution “IGIRNIGM”, as well as the research of the authors of this article and drilling data along the Berdakh shaft in the territory of the Ustyurt oil and gas region, the results of a comparative analysis of the chemical composition of the Middle and Lower Jurassic gases were obtained.

Through our analysis of actual data and results, we were able to draw conclusions about the future composition of gas in the study area. We also made predictions about areas prepared for exploratory drilling based on our findings.

Key words: *gas, methane, propane, butane, hydrocarbon raw materials, field, deposit, deep drilling, Middle Jurassic and Lower Jurassic deposits, Berdakh swell, Ustyurt oil and gas region*

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EDN CWORMD

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Applied basis of the approach to geological and field data processing and improvement of complex oil reservoir geometrization efficiency

¹*O.V. Tyukavkina, ²V.L. Shuster, ³I.S. Permyakova, ⁴I.L. Kapitonova*

¹*Sergo Ordzhonikidze Russian State University for Geological Prospecting, Moscow, Russia*

²*Institute of Oil and Gas Problems, Russian Academy of Sciences, Moscow, Russia*

³*OOO DallAlyance, Moscow, Russia*

⁴*Peoples' Friendship University of Russia, Moscow, Russia*

E-mail: tov.sing@mail.ru

Abstract. The issues of structuring the complex of geological and field information, the development of applied research methods, which are based on the integration of geophysical survey data and the previously obtained results of laboratory studies of the Lower-Middle Jurassic non-anticlinal deposits, are based on the example of long-term developed fields of the West Siberian oil and gas province. The purpose of the research is to identify a certain sequence of data processing, which will allow systematizing and structuring the obtained commercial material for a particular deposit. As a result of research, it shows the data of statistical processing of parameters of reservoir properties (software package "Statistica-base"); algorithms for identifying possible errors in data processing are shown; it shows the errors that affect the quality of interpretation of well logging (based on qualitative and quantitative comparison), establishing the boundary values of the α PS value as reservoir criteria, comparing laboratory data and well logging results, etc. The authors analyzed the change in the α PS amplitude, resistivity values in the oil reservoir, oil saturation values (K_n , K_{ov}) in the established zones of oil-water contact (OWC): maximum oil saturation ($K_n = 1 - K_{ov}$), reduced oil saturation ($0 < K_n < 1$), full water saturation ($K_n = 0$), etc. Applied basis for data processing includes the construction of dependences of the parameters of reservoir properties.

Key words: *non-anticline reservoir, complex reservoir, reservoir properties, algorithm*

For citation: O.V. Tyukavkina, V.L. Shuster, I.S. Permyakova, I.L. Kapitonova *Prikladnyye osnovy metodiki obrabotki geologo-promyslovykh dannykh i povysheniya effektivnosti geometrizatsii slozhnopostroyennykh zalezhey nefti [Applied basis of the approach to geological and field data processing and improvement of complex oil reservoir geometrization efficiency]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 18-42. DOI <https://doi.org/10.25689/NP.2024.3.18-42>. EDN CWORMD (in Russian)*

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EDN EKPYTU

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Lithological control of the placement of hydrocarbon deposits in the Triassic sediments of the Southwestern Turanian Plate

V.I. Popkov, I.V. Popkov

*Federal State Budgetary Educational Institution of Higher Education Kuban State University,
Krasnodar, Russia*

E-mail: geoskubsu@mail.ru

Abstract. The presence of two oil and gas bearing formations in the Triassic section of the South Mangyshlak trough was established - the Upper Triassic terrigenous and volcanogenic-carbonate Upper Cenek-Middle Triassic. They are separated by the volcanogenic mudstone strata of the Middle Triassic, which is a regional cover. The role of the constituent oil and gas formations of individual lithological strata in the localization of hydrocarbon accumulations has been clarified. The boundaries of the areal distribution of Triassic oil and gas complexes have been determined, which allows a more differentiated approach to assessing the prospects of oil and gas potential of both the territory of Southern Mangyshlak as a whole and individual local uplifts identified in various tectonic zones.

Key words: *lithology, stratigraphy, formations, oil and gas, porosity, permeability, prospects of oil and gas potential*

For citation: Popkov V.I., Popkov I.V. Litologicheskij kontrol' razmeshcheniya zalezhej uglevodorodov v triasovyh otlozheniyah yugo-zapada Turanskoj plity [Lithological control of the placement of hydrocarbon deposits in the Triassic sediments of the Southwestern Turanian Plate]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 43-66. DOI <https://doi.org/10.25689/NP.2024.3.43-66>. EDN EKPYTU (in Russian)

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EDN FCLRSD

УДК 550.834

Applying simultaneous inversion data to predict net reservoirs in the Triassic acid volcanic rocks of the southern periphery of West Siberia

A.V. Shakhov, O.V. Elisheva, N.N. Kondrashova,

U.V. Shilova, M.N. Melnikova

Tyumen Petroleum Scientific Center LLC, Tyumen, Russia

E-mail: ovelisheva@tnnc.rosneft.ru

Abstract. The interest in hydrocarbon accumulations in the interval of the Pre-Jurassic basement of the West Siberian Basin is not fading, despite the fact that most of the discoveries in this interval are still unsystematic. In most cases, only a few reservoirs are put into commercial development, the reason being the difficulties related to reservoir prediction and their localization in geospatial space. Specialists solve the problem using different approaches. In this paper, one of the approaches is proposed based on the integration of well data and 3D CDP seismic materials. It was used on the Kirilkinsky Area of the Uvat District in the south of the Tyumen Region, where oil accumulations have been discovered in the volcanic rock of the Triassic. To implement the approach, the general structure of the Pre-Jurassic interval was studied as part of the work. In the zone of the volcanic rock development within which is adjacent to the bottom of the sedimentary cover, the interval of the Pre-Jurassic basement is divided into two levels: the lower one is the unchanged rocks of various composition, and the second one is the rocks that have undergone secondary metasomatic change. According to the material composition analysis, six main macro-petrotypes have been identified. Five of them are classified as reservoirs of varying properties, and one is classified as non-reservoir. In uncored wells, the material composition was restored using neural network modeling based on Kohonen maps. To interpret net reservoirs, an approach was used based on a comparison of the inflow profiles recorded in the perforated intervals, well logging interpretations, geophysical surveys, and electric microscanner data. The identified pore-vuggy type of reservoirs in the highly modified volcanic rock es made it possible to use the results of simultaneous inversion for net-reservoir prediction. The results of the study allowed to localize reservoir development zones within the Kirilkinsky Area in the interval of the Pre-Jurassic basement and to build seismogeological models of existing discoveries in order to book the reserves.

Keywords: *net-reservoirs of the Pre-Jurassic basement, neural network modeling of the Kohonen map, simultaneous inversion and predictions in the Pre-Jurassic complex, petrotypes of the Pre-Jurassic basement of the West Siberian Basin, prediction technologies in the Pre-Jurassic basement*

For citation: A.V. Shakhov, O.V. Elisheva, N.N. Kondrashova, U.V. Shilova, M.N. Melnikova Opyt prognoza kollektorov v kislykh effuzivakh triasa yuzhnoy periferii Zapadnoy Sibiri po dannym sinkhronnoy inversii [Applying simultaneous inversion data to predict net reservoirs in the Triassic acid volcanic rocks of the southern periphery of West Siberia]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 67-95. DOI <https://doi.org/10.25689/NP.2024.3.67-95>. EDN FCLRSD (in Russian)

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EDN HFKOXX

УДК 622.276.001.5

Control over filtration zones and coverage coefficient based on tracer studies of the interwell space

R.L. Budkevich, T.T. Belova, I.A. Alenkin

Almetyevsk State University of Technology – Higher Petroleum School, Almetyevsk, Russia

E-mail: budkevichrl@yandex.ru

Abstract. To ensure the rational development and selection of the most effective method of influencing the formation, it is important not only to identify filtration zones and determine their conductivity, but also to assess the activity of these pathways, fixing those areas (zones) that remain either weakly active or inactive under the existing reservoir pressure increase system (PPD). By itself, the presence of such sites causes inefficient maintenance of the energy state of the deposit and negatively affects the coverage ratio of oil reservoirs. However, in such areas of the reservoir that are not covered by flooding, there may be undeveloped oil reserves. According to the results of the work, it was found that the presence of inactive zones is determined by tracer studies of the deposit based on the low concentration of the tracer, its prolonged output and the correlation of the dynamics of its removal with the movement of the indicator in the filtration model; to identify the presence of the tracer and conduct a reliable interpretation, a spectrum survey is required to exclude the possibility of attributing natural fluctuations (noise) to the indicator signals; to increase the accuracy of tracer identification when removing the spectrum, it is recommended to adjust the pH value of the solution depending on the type of luminescent tracer used.

Key words: *tracer studies, fluorescein, carbon quantum dots (UCTS), ecological and hydrogeological studies, studies using markers*

For citation: R.L. Budkevich, T.T. Belova, I.A. Alenkin Kontrol' nad zonami fil'tratsii i koeffitsiyentom okhvata na osnove trassernykh issledovaniy mezhskvazhinnogo prostranstva [Control over filtration zones and coverage coefficient based on tracer studies of the interwell space]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 96-109. DOI <https://doi.org/10.25689/NP.2024.3.96-109>. EDN HFKOXX (in Russian)

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EDN HYAAIE

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Selection of optimal filtration temperature regime to increase oil displacement coefficient in reservoir conditions

E.A. Burlutsky

Almetyevsk State University of Technology – Higher Petroleum School, Almetyevsk, Russia

E-mail: e.burluckiy@agni-rt.ru

Abstract. At present, there are different technologies for extraction of heavy hydrocarbons and natural bitumen, which differ in technological and economic indicators. Thermal methods of extraction of heavy hydrocarbons and natural bitumen seem particularly promising today.

The author's work describes the methodology and studies with bulk core samples at temperatures of 23, 95, 300°C. The object of study is fine-grained bituminous saturated sandstone. To determine the oil displacement coefficient, a filtration unit PIK-OFP-EP-K-T manufactured in Russia by Geologika was used. In three different experiments this coefficient ranged from 0,5 to 0,91 d.u. Determination of the most effective mode of thermal influence is the purpose of these experiments to determine the oil displacement coefficient. Laboratory experiments on the filtration unit were carried out according to OST 39-195-86.

Key words: *oil recovery method, oil recovery factor, bulk model, filtration-capacitance properties of rock, core material, filtration studies*

For citation: E.A. Burlutsky Vybor optimal'nogo temperaturnogo rezhima fil'tratsii dlya povysheniya koeffitsiyenta vytesneniya nefi v plastovykh usloviyakh [Selection of optimal filtration temperature regime to increase oil displacement coefficient in reservoir conditions]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 110-122. DOI <https://doi.org/10.25689/NP.2024.3.110-122>. EDN HYAAIE (in Russian)

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EDN LOBMLY

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Reservoir pressure calculation in producing wells using machine learning methods

A.A. Gaysin, N.K. Isroilov, A.Kh. Gilyazov

TatNIPIneft Institute – PJSC TATNEFT, Almeteyevsk, Russia

Almeteyevsk State University of Technology – Higher Petroleum School, Almeteyevsk, Russia

E-mail: GaysinAA@tatneft.ru

Abstract. Reservoir pressure is a critical factor that determines energy potential of a producing reservoir and overall well and reservoir productivity. Reservoir pressure refers to the pressure of hydrocarbons (oil, gas, and water) contained within the reservoir voids. Changes in reservoir pressure should be continuously monitored. Once reservoir pressure decreases, methods for supplementing the natural reservoir energy are applied; particularly, reservoir pressure maintenance. Reservoir pressure decline rate depends on fluid (oil, water, and gas) production rates according to field development plan and implementation of reservoir pressure maintenance methods, if any. According to Operational Guidelines RD 153-39.0-109-01, downhole reservoir pressure measurements should be conducted every six months. However, some of these measurements may turn out to be unreliable, thus reducing the available reservoir energy state data. Moreover, direct measurements of reservoir pressure may require extended well shutdown periods to result in oil production losses and potential technical issues during well startup.

In this paper, machine learning methods for reservoir pressure prediction are considered. The present research effort is peculiar in that it presents comparative analysis of a variety of machine learning methods for specific production target, as well as reveals an optimal set of features for model training.

The results of the present research can be used to analyze the development status of hole sections in absence of reservoir pressure measurements, justify initial data adjustments for reservoir simulation modeling, and to prepare a list of wells for reservoir pressure studies aimed at objective evaluation of producing reservoir energy state while minimizing oil production losses.

Key words: *machine learning, reservoir pressure, downhole pressure, algorithms, features*

For citation: A.A. Gaysin, N.K. Isroilov, A.Kh. Gilyazov Raschot plastovogo davleniya v dobyvayushchikh skvazhinakh pri pomoshchi metodov mashinnogo obucheniya [Reservoir pressure calculation in producing wells using machine learning methods]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 123-136. DOI <https://doi.org/10.25689/NP.2024.3.123-136>. EDN LOBMLY (in Russian)

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EDN MGZBJC

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Laboratory and experimental studies of methods for improving oil recovery efficiency by a combined gas injection at TATNEFT's assets

¹R.H. Sadreeva, ²E.A. Burlutsky, ³A.A. Zalyatdinov, ⁴M.I. Amirkhanov,
⁵F.M. Akhmetzyanov

^{1,2,3} *Almetyevsk State University of Technology – Higher Petroleum School, Almetyevsk, Russia*

^{4,5} *TatNIPIneft Institute - PJSC TATNEFT, Almetyevsk, Russia*

E-mail: roza.hatipovna@yandex.ru

Abstract. Reduction of harmful effects of industrial emissions into the atmosphere are important issues of the fuel and energy complex. In connection with this problem, injection of flue gases into oil fields for enhanced oil recovery can be considered as an environmentally safe and economically rational way to reduce emissions and beneficial use of greenhouse gases. Flue gases generated at power plants or in other industrial processes associated with combustion of fossil fuels - natural gas, fuel oil, coal, etc. - can be used for injection into the reservoir.

When steam is used in oil production, high oil displacement ratios are achieved, but problems often arise due to high costs of steam production and treatment of produced water. The problem arises when these costs become unprofitable. The problem can be solved by reducing the volume of injected steam by using flue gas.

Purpose of research: study of influence of vapor-gas impact modes on oil displacement efficiency.

Object of research: unconsolidated core samples from well X of PJSC Tatneft.

Research methods: OST 39-195-86. Oil. Method for determination of oil displacement coefficient in laboratory conditions.

Research results: Analysis of oil displacement coefficient under the following exposure modes: oil displacement by steam and steam with flue gases at different ratios of steam and gas. Determination of the optimal ratio of steam and flue gas for effective oil displacement.

Key words: *flue gases, oil recovery enhancement method, oil displacement factor, unconsolidated core, vapor-gas impact, granulometric composition, bulk model, core holder, sand fraction, steam generator*

For citation: R.H. Sadreeva, E.A. Burlutsky, A.A. Zalyatdinov, M.I. Amirkhanov, F.M. Akhmetzyanov Laboratorno-eksperimental'nyye issledovaniya sposobov povysheniya effektivnosti dobychi nefti metodom kombinirovannogo gazovogo vozdeystviya na ob'yektakh PAO Tatneft' [Laboratory and experimental studies of methods for improving oil recovery efficiency by a combined gas injection at TATNEFT's assets]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 137-152. DOI <https://doi.org/10.25689/NP.2024.3.137-152>. EDN MGZBJC (in Russian)

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EDN NSCCUO

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Ultrasonic exposure as a method of reducing the viscosity of heavy oils and bitumen

¹D.I. Valeev, ¹A.V. Dengaev, ²R.K. Khairtdinov, ³R.R. Khaziev

¹Gubkin State University of Oil and Gas, Moscow, Russia

²Closed (joint-stock) company "Kara-Altyn Enterprise", Almet'yevsk, Russia

³Institute of Ecology and Subsoil Use Problems of TAS, Kazan, Russia

E-mail: radmir361@mail.ru

Abstract. The purpose of this work is to study the effect of an acoustic field on a sample of heavy oil. In the course of the study, the choice of the optimal oil temperature when exposed to ultrasound was justified, a theoretical scheme of a field reactor for ultrasonic exposure to oil was given, and the effectiveness of its application was proved. Various methods of dealing with problems caused by heavy oils were considered, such as the use of special chemical reagents, physical methods, mechanical and thermal methods. Each method has been described in detail. As a result of the study, the following conclusions were obtained: the effect of acoustic fields on oil has not been fully studied and requires further research, however, at the moment the potential of oil treatment with ultrasound is already visible, associated with cavitation processes that occur in oil under ultrasonic exposure and contribute to the improvement of both physical and chemical properties of oil.

Key words: *natural bitumen, ultrasonic exposure, oil properties, oil viscosity, cavitation, oil field, dependence graphs*

For citation: D.I. Valeev, A.V. Dengaev, R.K. Khairtdinov, R.R. Khaziev Ul'trazvukovoye vozdeystviye kak metod snizheniya vyazkosti tyazhelykh neftey i bitumov [Ultrasonic exposure as a method of reducing the viscosity of heavy oils and bitumen]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 153-164. DOI <https://doi.org/10.25689/NP.2024.3.153-164>. EDN NSCCUO (in Russian)

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EDN YVTIVM

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Study of oil losses with account of structural phase transition in oil during field development based on history matching of model parameters

R.Kh. Nizaev, A.I. Kirillov, V.M. Khusainov, A.Kh. Kabirova, G.V. Aleksandrov

TatNIPIneft Institute - PJSC TATNEFT, Almet'yevsk, Russia

E-mail: razrcmg@tatnipi.ru

Abstract. Bobrikovskian reservoirs of the field under consideration were discovered in 1956. From 1970 to 1974, pilot development was conducted. Commercial development started in 1975. In this study, the main purpose of modeling is evaluation of oil losses during cold water injection. Model parameters were history matched to historical production data and temperature conditions with account of PVT fluid properties, including temperature of structural phase transition of oil in the near-well region. Numerical studies on digital fluid flow model of terrigenous sediments of Bobrikovskian production target have demonstrated that cumulative oil production of target well during injection of water at 18 °C agrees with historical cumulative oil production data. Estimated oil losses considering hysteresis of relative permeabilities are provided as of 1 January 2024.

Key words: *geological, reservoir simulation modeling, model parameters history matching, temperature of structural phase transitions in oil, oil saturation, relative permeabilities, displacement efficiency, residual oil saturation, hysteresis*

For citation: R.Kh. Nizaev, A.I. Kirillov, V.M. Khusainov, A.Kh. Kabirova, G.V. Aleksandrov Issledovaniye poter' nefi s uchetom strukturnogo fazovogo perekhoda v nefi v protsesse razrabotki zale-zhey na osnovanii adaptatsii parametrov modeli [Study of oil losses with account of structural phase transition in oil during field development based on history matching of model parameters]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 165-182. DOI <https://doi.org/10.25689/NP.2024.3.165-182>. EDN YVTIVM (in Russian)

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EDN NYPSYG

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Studying the effect of seasonal changes in injected water temperature on production data

¹R.Kh. Nizaev, ¹A.I. Kirillov, ¹G.V. Aleksandrov,

¹V.M. Khusainov, ¹A.Kh. Kabirova, ²D.V. Kliymenko

¹TatNIPIneft Institute – PJSC TATNEFT, Almet'yevsk, Russia

²Rock Flow Dynamics Company, Moscow, Russia

E-mail: razrcmg@tatnipi.ru

Abstract. The paper discusses oil losses during cold water injection in Bobrikovian horizon in one of the oil fields in the Republic of Tatarstan. Reservoir simulation model was built using a tNavigator software. The results of history matching were used with due regard for fluid PVT data. The paper presents the simulated results for cumulative oil production variation and temperature distribution at various temperatures of the injected water during reservoir production. Oil losses are estimated relative to oil production during injection of water with temperature of 25°C which is equal to the initial reservoir temperature.

Key words: *tNavigator software, cold water injection, oil losses estimate, oil saturation distribution, oil phase transition temperature, relative phase permeabilities, residual oil saturation factor, oil recovery factor, hysteresis of relative phase permeabilities*

For citation: R.Kh. Nizaev, A.I. Kirillov, G.V. Aleksandrov, V.M. Khusainov, A.Kh. Kabirova, D.V. Kliymenko Issledovaniye vliyaniya sezonnykh izmeneniy temperatury zakachivayemoy v plast vody na tekhnologicheskiye pokazateli razrabotki [Studying the effect of seasonal changes in injected water temperature on production data]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 183-203. DOI <https://doi.org/10.25689/NP.2024.3.183-203>. EDN NYPSYG (in Russian)

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EDN ZBFZAP

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Reconstruction of reservoir pressure maintenance system (RPMS) with automation of decision-making processes using a digital model

M.M. Aliev, A.A. Dyakonov, Z.F. Ismagilova, A.M. Gimranov

Almetyevsk State University of Technology – Higher Petroleum School, Almetyevsk, Russia

E-mail: ismagilovazf@agni-rt.ru

Abstract. The main purpose of reservoir pressure maintenance planning is not only additional production, but also the reduction of capital and operating costs. For example in PJSC TATNEFT, the specific electricity consumption for the production of one ton of crude oil is 49.3 kWh/t. Basically, electricity is spent on: artificial oil lift – 51 %; reservoir pressure maintenance system – 34 %; costs associated with the organization of production at the enterprise – 9 %; oil treatment – 6 %.

The key issue of the article is to create a tool that allows to optimize the system of pressure maintenance during reconstruction with minimal efforts. The text gives a valuable information on the use of fiberglass pipelines and volumetric pumping equipment. Petroleum Experts software is used to automate decision-making processes.

In the process of research created models of reservoir pressure maintenance systems, developed and implemented algorithms for selecting the diameter of pipelines and calculating capital and operating costs for various reconstruction option. Approbation of the developed methods and models was carried out at the PJSC TATNEFT objects.

Key words: *reservoir pressure maintenance, reservoir pressure reconstruction, reservoir pressure optimization, non-productive costs, fiberglass pipes, digital model*

For citation: M.M. Aliev, A.A. Dyakonov, Z.F. Ismagilova, A.M. Gimranov Rekonstruktsiya sistemy podderzhaniya plastovogo davleniya (SPPD) s avtomatizatsiyey protsessov prinyatiya resheniy pri pomoshchi tsifrovoy modeli [Reconstruction of reservoir pressure maintenance system (RPMS) with automation of decision-making processes using a digital model]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 204-221. DOI <https://doi.org/10.25689/NP.2024.3.204-221>. EDN ZBFZAP (in Russian)

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EDN UMJFSS

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Selection features, test results and establishment of criteria for the effective use of foaming agents in horizontal wells

¹*E.B. Guseynov*, ²*A.T. Zaripov*, ³*R.R. Sultanbekov*, ⁴*D.Y. Soloviev*

¹*Almetyevsk State University of Technology – Higher Petroleum School, Almetyevsk, Russia*

²*TatNIPIneft Institute - PJSC TATNEFT, Almetyevsk, Russia*

³*St. Petersburg Mining University of Empress Catherine II, St. Petersburg, Russia*

⁴*NOVATEK STC LLC Tyumen, Russia*

E-mail: elkin-93@mail.ru

Abstract. The article presents the progress and results of laboratory studies of surfactants on “live” samples of formation fluid. Existing methods for supplying surfactants are considered and calculations are carried out on candidate wells for lowering a capillary polymer-metal pipe into the horizontal part of the well (the middle of the perforation interval) in a special hydrodynamic simulator to an effective depth to achieve the greatest effect of the foam agent with the formation fluid.

Key words: *well equipment, polymer-metal capillary pipe, KPMT, surfactant, well, flooding, gas condensate well, laboratory research*

For citation: E.B. Guseynov, A.T. Zaripov, R.R. Sultanbekov, D.Y. Soloviev Osobennosti podbora, rezultaty ispytaniya i ustanovleniye kriteriyev effektivnogo primeneniya pe-noobrazovateley v gorizontaľnykh skvazhinakh [Selection features, test results and establishment of criteria for the effective use of foaming agents in horizontal wells]. Neftyanaya Provintsiya, No. 3(39), 2024. pp. 222-248. DOI <https://doi.org/10.25689/NP.2024.3.222-248>. EDN UMJFSS (in Russian)

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EDN SGKIZL

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Features of rheological properties of polyacrylamide gel during loading and unloading

¹V.A. Iktisanov, ¹N.A. Gordimanov, ²A.V. Iktisanov, ³K.G. Sahabutdinov

¹"St. Petersburg Mining University of Empress Catherine II", St. Petersburg, Russia

²Moscow Institute of Physics and Technology (National Research University), Dolgoprudny, Russia

³TatNIPIneft Institute - PJSC TATNEFT, Bugulma, Russia

E-mail: iktisanov_va@pers.spmi.ru

Abstract. Using the previously proposed rheological models, a description of the main characteristics of PAA solutions was made with a high degree of accuracy during loading and unloading. It has been shown that the description of flow curves can be performed both when setting a constant viscosity for a specific shear rate and when considering viscosity as a function of time-varying stress. In the latter case, in addition to viscoelastic properties, the thixotropic properties, i.e., the destruction and recovery of the structure, are additionally taken into account. It has been found that the coefficients of model, which are well-known rheological parameters from the Maxwell and Kelvin-Voigt equations, have a physical meaning and correlate with a high degree of accuracy among themselves and from the steady-state stress and shear rate. The commonly used terms "stress relaxation" and "shear delay" are only applicable for unloading. Under loading, both stress and shear increase. Therefore, in general, the parameters of the Maxwell and Kelvin-Voigt models have a wider range of applicability. In this case, additional (secondary) shear and shear rate occur almost immediately after loading or unloading, rather than after a certain time has elapsed, as commonly believed. An unexpected effect was observed - the secondary shear during PAA loading was maximal for small steady-state stresses and minimal for large stresses. Conversely, when unloading, the opposite trends were observed.

Key words: *viscoelastic properties, nonlinear viscous properties, thixotropy, polyacrylamide, additional shear, modulus of elasticity*

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Classification and review of methods for determination of the causes of well flooding

R. V. Ryzhov

Almetyevsk State Technological University – Higher Petroleum School, Almetyevsk, Russia

E-mail: rom.ryzhoff2011@yandex.ru

Abstract. The paper presents an analysis of Russian and foreign literary sources covering the problem of determining the causes of well flooding. The main classifications of factors causing the increase in water production were studied. Literature search was conducted in electronic literature databases: Russian scientific electronic library elibrary.ru and foreign scientific knowledge bases researchgate.net and onepetro.org. Literature search date was limited to the recent 25 years. The analysis was conducted with increased focus on analytical approaches and methods enabling determination of the most likely causes of well flooding using field data and indirect evidence. The analysis revealed the main current approaches based on numerous variations of the construction and analysis of Chen and Hall plots and machine learning methods (highlighted in the latest publications). An integrated approach combining statistical-analytical methods and geological and reservoir simulation modeling is also widely presented.

Key words: *water cut, water flow rate, causes of flooding, machine learning, coning, high-permeability channels, cross flows behind the casing, Chen plot, Hall plot, field data analysis, geological and reservoir simulation model, production well, injection well*

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**Technological aspects of oil treatment, associated produced
reservoir water and water for flooding of oil reservoir production
facilities (reservoir pressure maintenance system PPD)
Volga-Ural oil and gas province of Buzuluk oil and gas region**

N.V. Ovinnikov, E.V. Deriglazov, N.V. Strizhov

Research Center GasInformPlast LLC, Tomsk, Russia

E-mail: Ovinnikovnv@tomsk.oilteam.ru

Abstract. The modern direction for all oil producing companies is to increase the profitability of the fields being developed by reducing capital costs and early monetization of the products produced.

In this regard, at the early stages of field development, as a rule, due to insufficient knowledge of borehole fluids, technological problems arise in the separation of material flows and the preparation of marketable products. This is especially important in the preparation of well products containing hydrogen sulfide, sulfur compounds, carbon dioxide, highly concentrated brines, salts in the dispersed phase (the presence of salts in oil in the absence of water). Such a set of complicating factors is possessed by the fluids of the oil and gas bearing formations of the Buzuluk oil and gas region of the Volga-Ural oil and gas province. At the same time, especially at the early stage of field development, subsurface users cannot always take into account the complicating factors that are initially absent and manifest themselves quite a long time after the start of operation.

This article, intended for a wide range of specialists involved in field development, well product preparation, design of oil (condensate), gas and produced reservoir water treatment facilities, outlines the main aspects that complicate the separation and preparation of well products to the required parameters, and recommendations on methods to overcome them for the Volga-Ural oil and gas province of Buzuluk the oil and gas region.

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Key words: *oil treatment plants, water treatment plants for the PPD system, complicating factors of oil and water treatment, salt precipitation, Volga-Ural oil and gas province, Buzuluk oil and gas region*

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Results of numerical simulation of hydrodynamic flow of washing liquid in the vibrance of a turbine centrator

D.R. Nabiullin, A.A. Dyakonov, L.B. Khuzina

Almetyevsk State University of Technology – Higher Petroleum School, Almetyevsk, Russia

E-mail: lbhuzina@agni-rt.ru

Abstract. The paper presents the results of laboratory tests of a drill pipe centralizer-turbulator developed at the Department of Oil and Gas Well Drilling of the Almetyevsk State Technological University. Laboratory tests were conducted on a laboratory stand for simulating inclined-horizontal drilling (INGD) for four values of fluid flow rate: 0,001 m³/s; 0,003 m³/s; 0,005 m³/s; 0,007 m³/s. During laboratory tests of a prototype of a drill pipe centralizer-turbulator, the following dependencies were determined: frequency and amplitude of turbulent flow on fluid flow rate. It was found that the peak amplitude of the turbulent flow at a flow rate of 0,003 m³/s without the experimental sample of the centralizer is equal to 0,0001 mm/s, with the experimental sample it is equal to 0,001 mm/s, which indicates the operability of the experimental sample of the centralizer capable of creating a turbulent flow of liquid, which can reduce the possibility of sludge settling in inclined and horizontal sections of the well.

Key words: *well drilling; centralizer - turbulator for drill pipes; turbulent flow; numerical modeling*

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Improving the methodology for predicting the curvature of oil wells during drilling using rotary steerable systems

I.D. Mukhametgaliev, A.H. Agliullin

Ufa State Petroleum Technical University, Ufa, Russia

E-mail: ilmir8787@mail.ru

Abstract. To predict the dog-leg severity (DLS) of well during drilling using RSS for oriented drilling of wells with horizontal section, the differential equations of the elastic line of the BHA have not been calculated and the forces arising from the interaction of the BHA with the well wall, depending on the axial load on the drill string, have not been determined. At the same time, the current trend in the development of the directional drilling industry involves the active introduction of rotary steerable systems (RSS) as high-tech equipment that allows to multiply the length of horizontal sections of oil and gas wells and thereby increase the drainage zone of the productive reservoir.

At the same time, the development of domestic measurement while drilling (MWD) tools the localization of their production are actively developing. Russian RSS developers have a unified approach to the design of the system, which consists in the possibility of using various MWD modules in conjunction with the developed RSS. The reason for this approach is the prevalence of a sufficiently large number of MWD operating on the basis of a hydraulic communication channel. The obvious task is to find a solution for the selection of a non-magnetic drilling collars (NMDC) for MWD module for RSS according to the technical and technological conditions of drilling. A calculation based on the results of an analytical study of the interaction of NMDC with RSS with the well wall is presented, assumptions for even models are determined, and the values of the force on the bit and the force on the RSS dies with different axial loads on the drill string are compared.

Key words: *differential equations, dog-leg severity, well construction, BHA, rotary steerable system*

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