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ЭКОЛОГИЯ АРКТИКИ ПОД УГРОЗОЙ

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During recent years, prospecting for mineral and hydrocarbon resources has been significantly focused towards Arctic regions. The region above the Arctic Circle accounts for only about 6% of the Earth’s surface area, but it could account for as much as 20% of the world’s undiscovered but recoverable oil and natural gas resources. The existence of hydrocarbon resources in the Arctic has been known for decades, but only in recent years has the full-scale resource development and navigation become technically and economically feasible.

The United States Geological Survey released the first-ever wide-ranging assessment of Arctic oil and gas resources, estimating the region’s undiscovered and technically recoverable conventional oil and natural gas resources. According to the report, Canada (5%), Greenland (11%), Norway (12%), the United States(20%), Russia (52%) are the main winners concerning the hydrocarbon riches in the area. Russian Arctic opportunities may in fact be the biggest prize.

So far, Russian geologists have discovered more than ten commercial oil and gas bearing deposits on the Arctic shelfthat makes 25% of world reserves of hydrocarbons in the world. It is evident, that the region’s economic potential is impressive, and it calls for development. The development of deposits can change the life in the region completely. New jobs and contracts for business in the fields of mineral extraction and building infrastructure may bring economic gains. It will provide local people new opportunities in education and career.

“The Arcticwill for a long time be the driver of economic growth in Russia, it will be the next space program for the country”, Dmitry Kobylkin, governor of the Yamal-Nenets autonomous district, told the audience at the forum, held at the Russian Presidential Academy of National Economy and Public Administration.

However, it should be kept in mind that the development of Russia’s continental shelf is characterized by the most complicated working conditions and requires the use of new and unique technologies. At the same time, among the main constraints are extremely difficult natural climatic and engineering-geological conditions, lack of infrastructure, remoteness of extraction areas from coastal support bases, and the absence of proven technologies for the development of offshore oil and gas fields in the Arctic [3].

On the other hand, the natural surroundings in the Arctic region are very fragileand sensitive to outer impact. Here the role of environmentalists is impossible to overestimate. The decades of irresponsible exploration of Russia's mainland oil and gas fields, including Arctic portion, by oil and gas companies with disregard to safety and environmental protection prove that [2].

According to official Russian sources, Russia is undisputed world leader in the frequency and severity of pipeline spills caused by poorly constructed and maintained pipelines spilling oil from corroded and mismanaged systems more than 20,000 times per year in 2011-2012. Expert assessment of oil and petroleum products concentration within Siberian rivers make Greenpeace conclude that, at least, 500,000 tons of oil from these spills are annually carried by Siberian rivers to the Arctic seas. Currently, oil contamination within the Arctic Basin rivers has already reached high levels: "the contamination by dissolvable and emulsified oil products, and other components of "anthropogenic" origin, involve vast areas of the Lower Ob" [4].

Contamination of the soil with oil within the Yamal-Nenets autonomous region resulting from oil extraction, processing, transporting, and distribution exceeds maximum allowable rates many times Due to the oil contamination impacts, the Nadym river has completely lost its commercial fishing capacity.

The contamination of soil and ground waters (including drinking water) with hydrocarbons is a problem of great concern with oil and gas producing regions. If just 1 m^2 of oil is released into the soil – the potential area of the polluted surface layer and its associated ground water could be about 5 thousand m^2. Oil and oil products, phenols and other pollutants specific to oil production are present in the ground waters of Western Siberia oil and gas region in concentrations that exceed maximum allowable levels [4]. Unsatisfactory drinking water quality is also revealed in the Nenets and Yamal-Nenets autonomous regions, where the concentration of petroleum hydrocarbons in drinking water reaches from 10 to 35 times MAC (maximum allowable concentration) [4].

The situation within the Tyumen region is no better. About 97% of the total drinking water volume from the Vakhriver in Nizhnevartovsk (the region of active oil production by LUKOIL and TNK-BP) was contaminated with high concentration of oil products. This was also true for the drinking water taken via underground sources. In Nizhnevartovsk, the morbidity rate from dieases caused by poor environmental conditions is one of the highest among all Russian cities. The rate of cancer diseases is 2-3 times as high as in any other Russian region [2].

We don't speak here about other numerous environmental impacts of oil and gas exploration practices: landscape degradation, climatic impact, toxic pollution, impact on biodiversity, technical and safety risks. The risk of crucial environmental impact can only increase with the further growth of offshore Arctic oil drilling and transportation activities.

This prediction is based on decades of oil spills within the Russian Arctic and by the current unsafe operational practices of oil and gas companies at already developed and new fields.

Russia and the West have cooperated on Arctic development with oil giants such as BP (British Petroleum), Total (Great Britain), Shell (Royal/Dutch Shell), Statoil (Canada) and ExxonMobil (US) working on large-scale projects in the region. But the Ukraine conflict has provoked the worst crisis in Russia-West relations since the Cold war has turned partners into adversaries, with Western countries canceling or significantly downsizing their Arctic projects in Russia. Now even peaceful environmental exploration missions are in jeopardy. According to Terry Callagan, professor of Arctic Ecology at the University of Sheffield and president of the interact project that helps researchers from the European Union and Russia work at each other's 73 stations in the Arctic, the European Union stopped funding the Russian leg of the project in 2015 [1].

At the same time, we must admit that Russia cannot do without developing oil and gas deposits because the economy of this country completely depends on this branch of industry. Nevertheless, government should take measures to make it unprofitable or even impossible for extracting companies continue unsafe and irresponsible practices. First, it is necessary to develop higher exploration/production standards, which greatly increase costs, so that for the companies it would be too high risk not to accomplish responsibly. Second, companies should concentrate their efforts on developing innovative technologies for the safe and sustainable exploration and production of oil and gas especially for the Arctic climatic zone. Third, there is a strong call for developing an environmentally adapted infrastructure. The project must establish criteria and solutions for the safe and cost-effective application of materials for operation in the Arctic zone.

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ТРАНСПОРТНАЯ СИСТЕМА ЕВРОТОННЕЛЯ

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EUROTUNNELET SON SYSTÈME DU TRANSPORT

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Le tunnel sous la Manche est un tunnel ferroviaire reliant le sud-est du Royaume-Uni (Angleterre) et le nord de la France. Composé de deux tubes parcourus par des trains, et d'un tube de service plus petit, ilest long de 50,5 kilomètres[3] dont 38 percés sous la mer. Il estexploitépar la sociétéfranco-britannique Eurotunnel.

Sa construction a étéréalisée par TransManche Link (TML), consortium de dix entreprises de BTP (cinqbritanniques et cinqfrançaises). Ilestinauguré le 6 mai 1994 et ouvert au service commercial depuis le 1er juin 1994.

L'inaugurationofficielle du tunnel par la reine Elizabeth II et le président François Mitterrand a eu lieu le 6 mai 1994.

Le tunnel à sesdeuxextrémitésestrelié:

- au réseauautoroutier et routier;
- au réseau de chemin de fer «classique» (pas à grandevitesse);
- auréseau de chemin de fer à grandevitesse pour les trains à grandevitesse.

La construction du tunnel sous la Mancheestprincipalementréalisée à l'aide de tunneliers qui creusent le tunnel surunelongueurtotale.

Pour des raisons de sécurité, les galeriesferroviairessontéclairées par 20 000 luminaires et bordées par un trottoircontinu, du côté de la galerie de service, pour assurer l'évacuationéventuelle des voyageurs en tout point. Des antennesassurent la continuité des communications radio sol-trains.

Après plusieurstentatives, dontl'avantdernière en 1982–1985, l'idée de creuser un tunnel sous la Manchefutrelancée en 1984 avec unedemandeconjointe des gouvernementsfrançais et britannique pour des propositions de tunnels financés par le secteurprivé.

Une des difficultés de la solution en tunnel étaitl'incertitudegéologique et la gestion du risquesismique, difficultéamoindries pour la solution «pont», mais qui génèred'autresproblèmes (dontrisques de collision dans un détroit qui compteparmi les plus fréquentés au monde par le trafic maritime)

À l'issue du sommetfranco-britannique des 10 et 11 septembre 1981, un grouped'experts, présidé par Andrew Lyall et Guy Braibant, représentants des ministres des Transports français et Margaret Thatcher avaitaffirmésapréférence pour un franchissementroutierplutôtqueferroviaire. Avec l'exploitation du tunnel, ellecraignaitd'offrir à la British Rail, «trop soumise aux syndicats», unmoyen de pressionconsidérable.

Le 2 avril 1985, les gouvernementsfixent au 31 octobre la date limite pour que les promoteursproposent des liens fixes trans-manche pour véhiculesroutiersetferroviaires.

Quatreprojetsfurentproposés:

- Europont: ils'agissait d'un pont-tube de 37 km soutenu par 8 pylônes de 340 m de hauteur, faisantappel à des techniques nouvelles, avec des travéeslongues de 5 km suspendues à des câbles en kevlar. Le pontauraitdeuxniveaux de 6 voies chacun. Une liaison ferroviaireseraitfaite par un tunnel.
- Euroroute: c'étaitun ensemble routierpont-tunnel-pont. Les ponts à haubans avec des travées de 500 mètres de portée reliant des îlesartificielles à la côte, et un tunnel de 21 km sous le fond de la mer. Des rampeshélicoïdalespermettent le passage du pont au tunnel. Uneliaisonferroviaireindépendantepassepardeuxtunnels.

Transmanche Express: ceprojet a étéprésenté à la dernière minute par la société British Ferries. Ilcomprenait un ensemble de quatre tunnels (deuxroutiers et deuxferroviaires) unidirectionnels.

La possibilité de la création d'un deuxième tunnel sous la Mancheest à l'étude (routierouferroviaire), si le premier tunnel arrive à saturation.

УДК 624.131.4 +502.175

ОЦЕНКА ВЛИЯНИЯ СВАЛКИ ТВЕРДЫХ ПРОМЫШЛЕННЫХ ОТХОДОВ, РАЗМЕЩЕННОЙ В ОТРАБОТАННОМ КАРЬЕРЕ, НА СОСТОЯНИЕ ПОЧВЕННОГО ПОКРОВА

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Filling with production wastes of worked out quarries in the Urals is one of the most widespread forms of their recultivation. Such objects are located practically in all mining regions of the Urals. Transformation of former quarries into grounds of storage of production wastes took place in different technical and economic conditions defining various degree of their ecological safety. To estimate the level of influence onto the environment of carried out recultivation measures is possible only by realization of a system of full local (object) monitoring of the environment components.

The studied object is a dump of solid industrial wastes (SIW) "Prometheus", being located in a quarry on the site of organized discharge of sewage onto the relief of the left bank of the Iset river in the city of Kamensk-Uralskiy having the area as many as 5,8 hectares.

Soil testing on the object was carried out for definition of chemical composition, degree of pollution and assessment of background levels. The location of points of testing is shown in figure I.

The selected trials after corresponding preparation (drying, crushing, hashing) were analyzed on definition of the following harmful substances and indicators: zinc, copper, arsenic, lead, cadmium, mercury, nickel, chloride ion, ammonium ion, oil products, phenols, pH.

Soil tests selection points
Points of water testing
Observation well and its number

Figure 1 – Situational scheme of placement of observation points

During correlation, cluster and factorial analyses it was established that:

– soils of the object are polluted both with inorganic (heavy metals and arsenic) and organic (oil products, phenols, partly ammonia and chlorine) substances;

– the pollution is of technogenic character.

According to the requirements of Sets of Rules (SR) 11-102-97 chemical pollution of soils is estimated on a total indicator of chemical pollution representing the sum of coefficients of concentration of separate components.

The calculated values of coefficients of concentration and indicator of chemical pollution, testify that contents of cadmium, copper, nickel, lead, zinc, ammonia, phenols and oil products in the majority of tests exceed their background concentration.

As a whole, the values of a chemical pollution indicator exceed the criterion established at the level of 16 units at 13 points of testing that makes 72% of the investigated quantity (18 points).

The degree of soils pollution (taking into account a class of danger of an element and its maximum concentration limit) is assessed as very strong. Copper, nickel, zinc, lead, arsenic have higher values in pollution, cadmium and mercury having a lesser extent..

The analysis of indicators of pollution on soil profiles shows that distinct regularities in distribution of pollution into depth is not revealed.

According to measurements of power of an exposition dose of the gamma radiation (PED), it has been established that PED gamma radiation value within the studied territory varies from 4,00 to 11,32, μR/h, being significantly lower the sanitary standard amounting 30 μR/h.

As a result of atmo-geochemical research of the dump body it was established that the given soil is not fire-hazardous and dangerously explosive. The main indicators of gas-geochemical danger of soil are methane and carbon dioxide.

As a results of research it was established that realization of recultivation of the quarry and dump of solid industrial wastes may be recommended as the most effective measure for decrease of unfavorable consequences facilitating the restoration and improvement of the environment.

Besides, some measures must be provided to decrease risks in pollution of materials by inorganic and organic harmful substances:

– to exclude the use of soil for agricultural, garden and market–gardening needs as a material for site filling and dumping of platforms and embankments in residential zones;

–torecultivate polluted sites for prevention of atmosphere pollution as a result of deflation (wind erosion) of soils;

Considering that the dump of solid industrial wastes has a negative impact on various components of the environment it is necessary to provide works for ecologicalmonitoring of the surrounding, including:

–supervision over the state of the environment parameters, natural resources and sources of anthropogenous impact on them;

–assessment of objects state being under supervision;

–revealing the main sources of pollution for the purpose of qualitative and quantitative assessment of level of their influence onto components of the nature surrounding;

–assessment of efficiency of the nature protection measures for the purpose of management optimization of the nature use;

– providing the controlling and nature protection governing bodies with systematized data on the level of environmental pollution, the forecast of their changes and also the emergency information at sharp level increase of the content of polluting substances in the environment.

The obtained results of environmental monitoring must become the basis of information support for preparation and adoption of managerial decisions.

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МЕТАН УГОЛЬНЫХ ПЛАСТОВ: ПРОБЛЕМЫ, СВЯЗАННЫЕ С ПОПУТНО ДОБЫВАЕМОЙ ВОДОЙ

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COALBEDMETHANE: CHALLENGESOFCOALBEDWATERDISPOSAL

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Presence of methane in coal mines was discovered centuries ago. Coalbed methane (CBM) is prone to self-ventilating when disturbed and, until recently, the gas was regarded as a menace. Miners took canaries underground as an early mean of a safeguard. Coal mine methane, emitted during the process of underground mining, is both a safety hazard and a greenhouse gas that contributes to global warming. On the other hand, it has the potential benefit of use as a fuel. The high methane content of coal in Russian mines should make them attractive hosts for projects focused on methane recovery and use. Especially because Russian Federation possesses one of the largest coal resources in the world, most of which has a great methane content including the coal reserves in Western and Eastern Siberia, Vorkuta, Ural, Far East and Sakhalin. The methane content in the coal is almost double the world average, making it potentially viable for commercial production in the future. However, the territory of Russia is also incredibly rich in traditional natural gas reservoirs so what for the exploiting of unconventional fields of CBM? The answer is that CBM has potential as an abundant clean energy supply to help replace other diminishing hydrocarbon reserves.

CBM reservoirs are different from conventional reservoirs in a number of ways, but the primary differences are water production and gas-storage mechanism. Hydrocarbon-storage capacity in most oil and gas reservoirs is related to porosity because gas is trapped and stored in the pore systems of the matrix. Coals porosity is quite moderate, yet they can store up to six times more gas than an equivalent volume of sandstone at a similar pressure [1, p.6]. There are two possible origins of methane: in low-rank coals it can be the result of microbial activity and in higher-rank coals methane is generated during thermal maturation of organic compounds. Once generated, the methane is adsorbed, or bound by weak intermolecular attractions – van der Waals forces – to the organic materials that make up the coal. Storage capacity in coal is related to the pressure and adsorbed gas content commonly described by the Langmuir sorption isotherm measured from crushed coal samples [1, p.6]. Coal is considered as a dual or three porosity system comprised of micropores and macropores. The macroposity includes fractures and intergranular porosity while microporosity refers to coal matrix. Although the movement of gas and fluids through coal is still imperfectly understood, it is generally assumed that the macroporosity is responsible for the permeability of coal and microporosity is responsible for gas storage by adsorption. Gas production from CBM wells occurs in response to reduction of pressure in the reservoir by pumping water from wet coals. As pressure is reduced, gas desorbs from the coal matrix (as defined by the adsorption isotherm) and moves to the natural fractures or larger pores. The fracture system, which has a much higher permeability than the matrix, is generally initially water saturated and because of that during production occur changes of relatively permeability [2, p.3].

At present horizontal drilling and fracture stimulation are widely used for accessing CBM reserves. Connecting the naturally occurring fracture network to the wellbore provides a conduit through which water and gas are produced. Propped hydraulic fracturing of coalbeds has been successful in stimulating production, but the wells have generally underperformed those producing from fracture-stimulated sandstone reservoirs. However, danger of formation damage persists even with sparing hydraulic fracturing technologies. For example, the surfactants used with these processes can negatively impact the coal's naturalwettability and reduce the rate of dewatering [1, p.11].

There are some inherent challenges to producing CBM from any basin. These include economical, geological, logistical and operational issues. One of the primary considerations is dealing with produced water [1, p.6].

Normally, water must be removed from the coal to lower the pressure and to initiate methane desorption; however, near mining operations there may be only small amounts of water to produce. The operator can also anticipate largeamounts of water being produced early in the process but decreasing thereafter to an eventual low level. Therefore, water disposal problems decrease with time, and the greatest economic burden is placed on the operator in the first few years. So that is why before investing in a CBM process, a multiplicity of questions are to be answered concerning the water to be produced—questions concerning quantity, flow rates, chemical content, disposal means, monitoring, and environmental regulations. Perhaps no other factor affects the economics and feasibility of CBM projects as much as water removal and disposal. It has been suggested that a truer indicator of the value of a well would be a plot of gas/water ratio rather than gas production alone [3, p.421–422].

Complex chemical and quite toxic content of coalbed waters make their disposal a very difficult issue that must be solved wisely. Today there are a number of possible techniques to dispose of produced coalbed waters including discharger into surface streams, land application, membrane processes, etc. But from our point of view, the most effective way of produced waters utilization is well injection due to the high cost of most of the water treatment methods. Particularly it concerns horizontal wells with complex architecture drilled near producing wells to overcome the issue of low permeabilities. Now this method is not widely practiced in the world but we believe that it will find application in the nearest time as a method of formation stimulation. We suggest addition of surface-active reagents to the solution of coalbed water before its reinjection. As it was earlier mentioned relative permeabilities change and coal's natural wettability decreases during production of CBM. Thus special surface-active reagents can be useful for stimulation of the processes of adsorbed gas displacement by water solution from pores surface. We believe that this technique that is frequently used as enhanced recovery method for traditional reservoirs can be successfully applied in the CBM industry. However, obviously further investigations are to be made on this suggestion.

Coalbed water production is an integral part of the CBM process. The challenge of initial water purification and disposal that reduces efficiency of CBM recovery must be overcome to establish profitable methane production.

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УДК 614.8

УГРОЗЫ ПРОЯВЛЕНИЯ СКЛОНОВЫХ ПРОЦЕССОВ НА ТЕРРИТОРИИ УРУПСКОГО РАЙОНА КАРАЧАЕВО-ЧЕРКЕССКОЙ РЕСПУБЛИКИ

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Transformation of the environment under the influence of natural processes and human activities is characterized for mountainous areas. Anthropogenic transformation of mountain landscapes takes place along large river, creating of man-made environment, development of mineral deposits and agricultural areas. Karachay-Cherkessky Republic is an example of a region where exogenous geological processes and active human activity shows itself very quickly. The territory of the Urupsky region of the Karachay-Cherkessky Republic is located in the mountainous part of the Northern slope of Big Caucasian ridge. Due to the complexity of the terrain and climatic characteristics of the region, there are places subjected to dangerous exogenous geological processes. Mudflows in the Urupsky District occur in the mountainous areas where terrain slope angles total 50-90°. Such settlements as Urup, Kyzyl-Urup, Phiya, Rozhkao are often subjected to effects of mudflows (Figure 1).

Figure 1 – Mudflows inPregradnayast.

The majority of mudflows takes place in sparsely populated and unpopulated areas of the district and do not present a special threat to the population. Manifestation of secondary not favorable factors of mudflows may be noted: river pollution with suspended particles, appearance of blockage on major rivers, formation of not stable slopes along gullies and river valleys.

The mudslides as well as the majority of exogenous processes in Urupsky district do not threaten to the ecological situation. But negative manifestation of a number of factors due to the impact of debris flows on to the objects of national economy is quite possible:

– damage of mine drainage of Urupsky Mining Processing Plant;

– destruction of agricultural lands;

– blockage creation on the rivers and water inrush leading to possible flooding of residential areas;

– destruction of forests on slopes, which leads to change of plant species and development of other slopes processes (landslides, debris)

Landslide processes in the Urupsky district are presented by landslides-flows and creeps (creep is a displacement of loose cover down the slope under the influence of periodic changes in soil mass caused by variations in temperature, by alternating freezing and thawing, by shrinkage of the clayey component in humidifying and drying conditions).

From 2009 to 2014 years the activity of landslide slopes around the valley of the river BolshayaLaba not far from Rozkao village was observed.

In the area of the Pregradnayastanitsa a landslide-stream was active during heavy rains and it could transform into a mudslide, threatening to local population. For the environment, the landslides of Urupsky district may be of a direct threat only in the form of destruction of land within the ornithological reserve in stanitsaPregradnaya and destruction of agricultural, grazing areas(Figure 2).

Figure 2 –Landslide processes inornithological reserve

The landslide processes in tailings of Urupsky Mining Processing Plant in st.Pregradnaya are of the greatest hazard to the environment of Urupsky district.

On the territory of Urupsky region the collaps (prolapse) processes are widespread in the area of the Big Caucasus ridge, Peredovoy ridge and its spurs, Rocky ridge. Collapses (prolapse) processes in the area of Peredovoy ridge present a danger in the form of a bridging to rivers and streams in narrow valleys. Some zones near the villages Podskalnoye, Rozkao, Asiatsky, Pregradnaya and separate parts of highways Mednogorsky –Urup–Kurdzinovo –Phiya are located within the area affected by collapses (prolapse), the processes transformed into vast debris-flows.

On the ecological situation of Urupsky district, the collapses have a direct impact in the places of mining: abandoned quarries, tunnels, dumps. When such collapses (prolapse) occur a mine working outcrops, in future it is oxidized and breaks acidity of surface and underground waters.

Nowadays the development of the area is slow yet, but in the future, it is expected that the tempo of development will increase. It will result in the increase of industrial objects, the population growth, the increase in industrial and private build-up. At this stage of development it is recommended not to ignore engineering and geological conditions of the area, the impact parameters of existing and projected environmental loads, the possible consequences of technological transformation of natural landscapes of the Urupsky district.

УДК 550.8

ПРИМЕНЕНИЕ ГЕОФИЗИЧЕСКИХ МЕТОДОВ В АРКТИЧЕСКОЙ ЗОНЕ ВЕЧНОЙ МЕРЗЛОТЫ

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APPLICATIONOFGEOPHYSICALMETHODS IN ARCTIC PERMAFROST REGIONS

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During recent years, prospecting for mineral and hydrocarbon resources has been significantly focused towards Arctic regions. The region accounts for only about 6% of the Earth's surface area, but it could account for as much as 20 % of the world's undiscovered but recoverable oil and natural gas resources.

The existence of hydrocarbon resources in the Arctic has been known for decades, but only in recent years, it has become technically and economically feasible to develop them.

The United States Geological Survey (USGS) released the first-ever wide-ranging assessment of Arctic oil and gas resources, estimating the region's undiscovered and technically recoverable conventional oil and natural gas resources.

Russian Arctic opportunities may in fact be the big prize. Over the last few years, Russia has intensified the development of the vast hydrocarbon resources of its continental shelf, through state incentives aimed at stimulating offshore oil and gas production. The area of Russia's shelf and continental slope totals 6.2 million square kilometers, with the vast majority in the Arctic area. The resource base of Russia's Arctic zone is capable of supplying the country's demand for hydrocarbon resources, biological resources and other strategic raw materials. It is therefore necessary to organize an integrated study of the continental shelf and near shore territories and prepare to develop hydrocarbon raw material supplies on the basis of the government's exploration plan of the continental shelf [1].

The industrial development of northern regions, which is primarily related to mineral and oil deposit prospecting and exploitation, requires an expansion of geophysical methods to permafrost investigations. Under conditions of severe climate, limited accessibility, and highly sensitive ecosystems, these methods are often indispensable as they permit many problems of engineering, geology, construction, etc. to be solved at lower cost and practically without any damage to ecosystems. An efficient application of geophysical methods to permafrost investigations becomes possible due to comprehensive knowledge of geocryology, as well as physics and physical chemistry of frozen soils. Widely known advances in fundamental physics, in theory and practice of geophysical techniques permitting to solve many problems of geocryology, engineering, ecology, etc. in permafrost areas clearly indicate that a new branch of science and engineering practice has developed, and it is “permafrost geophysics” [1].

It should be noted that geophysical methods in permafrost investigations work under conditions other than in non-permafrost areas: first, unusual characteristics of the formation and evolution of physical properties of frozen soils; second, characteristic features of the frozen ground cryogenic structure, texture, composition and state. Moreover, under these conditions of field geophysical investigations there emerge problems connected with high and time-varying ground resistance and instability of electrode potentials; high values of electric permittivity; shielding effect of layers with high ice content; necessity of geophysical logging conducted in dry boreholes in permafrost. In addition, specific requirements must be claimed for measuring apparatus concerning sensitivity, testing, calibration, the reliability of operation over wide temperature range [1].

Other problems are connected with difficulties in the development of physical-geological models for the upper part of the permafrost section, which are necessary for correct interpretation of geophysical data because of instability in the medium properties and state of medium.

These and some other special features, explaining why neither the traditional physical-geological base, nor the techniques and tools developed and the immense experience gained by prospecting geophysics, can be directly expanded into permafrost areas. That calls for comprehensive special studies.

Applying geophysical techniques in Arctic regions includes a wide range of problems related to survey, engineering, geology, mining, etc. The principal goal is to translate measured geophysical parameters into engineering characteristics.

Considerable progress toward this goal has been made by Russian geophysicists-geocryologists (e.g. Krylov, Bobrov, Bogolyubov). Their works have been successfully employed in the Yamal Peninsula and Yakutia to map talik boundaries, zones of increased ice content, etc., as well as define the subdivision of frozen sediments in section into layers according to their lithology and cryogenic state. The methods are used to monitor and forecast of stress-strain in the foundations of large structures. They may also serve as an early indicator in seismic hazard. The techniques most commonly applied for these purposes are varieties of electrometry using static and alternating fields and seismoacoustics. Let us consider the following examples of permafrost adapted geophysical methods.

The recognition of cryopegs (underground lens of brine in Arctic regions) within frozen sediments is essential, in particular when surveying for construction. The most hazardous cryopegs are shallow intra-permafrost, which may seriously affect the stability of basements. This is the case on The Yamal Peninsula, where large-scale engineering and construction work is underway in connection with exploration for oil and gas [2].

Another field of application for these methods is surveying for construction of pipelines in rapid subdivision of the permafrost section. It is very important in order to choose the best location for boreholes. This permits interpolation of the frozen soil characteristics obtained by logging and standard sampling of the boreholes within the surrounding area.

Reliable identification of buried ice layers is of fundamental importance too. This problem may be approached using electromagnetic sounding and seismic surveying with shear waves. In permafrost areas, however, the best results are gained by gamma-ray spectrometry and magnetic susceptibility measurements in boreholes [2].

Nevertheless, there still exist many problems to be solved. First, it is necessary to investigate more comprehensively the nature of physical and physical-chemical processes and phenomena in permafrost areas. Second, it is important to make a thorough study of physical fields (stationary and time-variable) controlled by natural processes in permafrost areas and by anthropogenic impacts. Third, we must continue to study non-linear processes and mechanisms of mutual energy conversion of different physical fields in frozen media and to establish firm relationships between the different physical properties of frozen soil.

In conclusion, I would like to remind that though the application of geophysical methods is various the most important claims in permafrost areas are as follows: 1)Engineering- geological mapping of frozen sediments; 2)Surveys for construction;3)Handling civil-engineering, mining and other tasks related to surficial and underground large-scale construction; 4)Long-term ecological-geophysical monitoring aimed at global climatic changes and human impact on permafrost regions.

Since during recent years prospecting for mineral and hydrocarbon resources has been significantly focused towards Arctic regions developing “permafrost geophysics” is becoming one of top priority tasks.

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УДК 004.9

СОВРЕМЕННЫЕ ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ И ИХ ПРИМЕНЕНИЕ В МОНИТОРИНГЕ ОКРУЖАЮЩЕЙ СРЕДЫ

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MODERN INFORMATION TECHNOLOGIES AND THEIR APPLICATION IN ENVIRONMENT MONITORING

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Daily amount of accumulated data is steadily increasing, the information is constantly updated and recent knowledge becomes obsolete.

This applies to all spheres of human life from financial to spiritual. Besides, the process of storage and processing information as well as speed of its accumulation is accelerating. For processing such huge amounts of information it is necessary to automate the entire process from the very beginning up to its subsequent storage or transmission.

If we regard such an object as the Ural Federal District (UFD), which is about 11% of the territory of Russia and is the largest mineral resource base (the total volume of active UFD resources constitute about 80% of the total volume of all the resources of Russia), it becomes clear that the amount of accumulated information in this area is huge. This information concerns chemical and radiological analysis of wells, licensing data, the location of wells and some other aspects. The problem of environmental pollution as well as rational and safe utilization of the subsoil area are urgent for this region. It is necessary to study their condition and to forecast the processes taking place, in other words, to monitor the territory.

On the background of high anthropogenic impact there is an acute problem of ground waters pollution used for economic purposes which is the result of:

- industrial complex action (using of subsoil for storage of waste products and consumption; urbanization of areas.);
- influence of agrarian sector (irrigation of lands, water pollution by nitrates, nitrogen and other types of fertilizers);
- we should not forget about the social side (construction and operation of underground facilities, production of drinking water, etc.)

The sum of natural and technogenic contamination contributes to complicated comprehensive nature pollution covering all areas.

The most effective method to handle a large amount of input data is using information technologies.

A particular example of which are geographic information systems (GIS).

They are able to combine both spatial (location of the source of pollution or wells on the map) and attribute data (results of the chemical analysis etc.), which give a lot of advantages:

- convenience of working in this environment, which will undoubtedly lead to an increase in labour productivity, as well as to the speed of decision-making;
- presentation (the ability to take out the objects of interest and information (content maps));
- creating links and common databases of an object, even with heterogeneous
- databases or having different data sources;
- the possibility of spatial analysis and modeling anthropogenic factors;

In order to estimate any impact of industry on the territory, information preparation takes from 30 to 60% of the time, however, information systems are able to provide information quickly in convenient form.

The main purpose of information systems is to provide you with information on a specific problem or question, just as they help to reduce time spent by a specialist in solving various types of problems.

Most modern information systems include data repository as a means to implement various procedures. With a GIS it has become possible to carry out online:

- accounting of actual location of objects of monitoring;
- accounting status and utilization of natural resources, general economic activity of the territory;
- forecasting emergencies with assessment of possible consequences;
- optimizationoflogisticsproblems;
- optimal placement of objects (agricultural, residential facilities, etc.);

Specialists in the workplace can solve the problems of various spectrum on the basis of spatially referenced information such as:

- analysis of environmental change under the influence of natural and anthropogenic factors;
- rational utilization and protection of water, land, air, mineral and energy resources;
- damage reduction and prevention of technological disasters;
- ensuring security of people, protection of their health;

Thus, with the help of information technology it has become possible to predict possible locations of pipelines damage and to trace spreading of pollution on map and estimate probable damage to natural environment to calculate the amount of material resources necessary for elimination of accident consequences in real time.

With the help of GIS it is possible to select industrial enterprises carrying out emissions, to reflect the wind rose and groundwater in the surrounding area and to model the spreading of emissions in the environment. All this shows a great potential of information technology for environmental monitoring.

Summing up it is necessary to note that similar information systems to meet all the necessary parameters are ready for introduction at an enterprise. The problem consists in insufficient number of specialists of high qualification for working in the software medium in view of its complexity

УДК 628.543.1

ПРОЕКТ ОСНОВНОГО ОБОРУДОВАНИЯ УСТАНОВКИ ПО УДАЛЕНИЮ НЕФТЯНЫХ ЗАГРЯЗНЕНИЙ ИЗ-ПОДО ЛЬДА В УСЛОВИЯХ АРКТИКИ

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OILSLICKSREMOVINGUNDERICEBOTTOMINARCTICCONDITIONS

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The problem of removing pollutions from water becomes more and more actual. However, in spite of uncontested and understandable for everyone problem of saving clean water, continued the brutal exploitation of water bodies and the volume of irrecoverable losses increasing from year to year.

The most common wastewater contaminants are oil and oil products. According to UNESCO, this type of pollutants is among ten most dangerous pollutants. The total amount of oil-polluted waste, collected on individual objects is more than tensand hundreds of thousands of cubic meters.

In this regard, the creation of new efficient technologies and purification of water from petroleum and petroleum products will help to keep the ecological environment clean.

At present, there is a great research of different tools for removing oil slicks and oil films from water. There are a few basic methods to clean water surfaces from oil slicks and oil films. Each of these methods –chemical, mechanical, physical – has its advantages and disadvantages. However, the use of known technologies for removing oil slick from under ice in Arctic conditions is not effective.

Despite of active growth of oil production in Arctic regions, mainly in the marine waters of Arctic Ocean, till present there are no existing sustainable methods and tools for removing oil slicks from the ice bottom. Existing methods and equipment for collecting oil under ice bottom are usually time-consuming and inefficient. These methods include such operations as making a hole in ice surface or ice winch installation.

Important characteristics of the methods and tools for removing oil pollutions under ice bottom in the Arctic are high mobility and speed of deployment, the coverage of a large area, cost and high reliability. To ensure these characteristics specialists propose a new technique for collecting, locating and removing oil slicks under ice bottom in Arctic conditions.

To solve this problem I suggest the following technique. I developed it myself with the help of my scientific supervisor.

With specially created methods I determined the oil slicks layer thickness of the funnel. As we can see the thickness of oil layer depends on approximation to the center of the funnel. It is subject to a hyperbolic law and thickness is bigger near the center of the funnel. So, the oil slicks layer thickness of the funnel is in negative relationship to the radius of the funnel.

Figure 1 shows oil slicks layer thickness depending on the proximity to the center of the funnel, h – the thickness of the radius of the funnel, R – the radius of the funnel, mm.

To the first approximation, based on the graph, the equation depending on the thickness of the funnel in its radius was obtained:

$$h = 51{,}495 \cdot e^{-0{,}365R}.$$

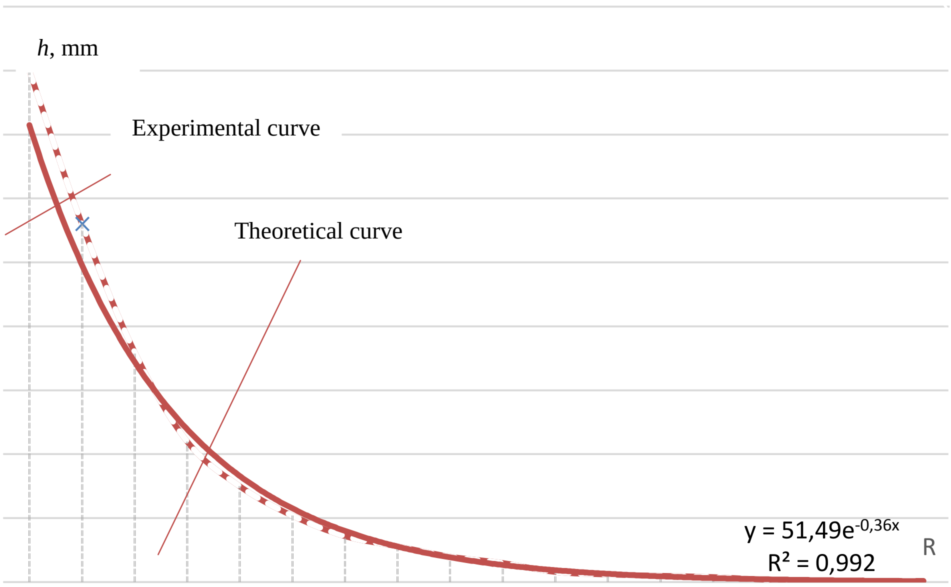

Figure 1 – Oil slicks layer thickness depending on the proximity
to the center of the funnel

In conclusion I would like to say that researches of oil slicks removing in the Arctic at present will help us to elude ecological catastrophes in the future.

УДК 621.7.014.2:66.023.23

ПРОЕКТИРОВАНИЕ ПАРАМЕТРИЧЕСКОЙ ТВЕРДОТЕЛЬНОЙ МОДЕЛИ АППАРАТА КОЛОННОГО ТИПА

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DESIGNINGPARAMETRICSOLIDCOLUMNMODELS

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Currently, there are many software programs for designing and calculating technological equipment. The main advantages of these programs are:

• significant reduction in the time from the beginning of the calculation before it is completed;

• visualization of the final result.

Each column is unique unit, which has its own design features. Specialists are constantly coming up with constructive solutions to increase the yield of the product or reduce final metal structure without losing productivity, and therefore its cost. On this basis, we can’t produce this equipment on commercial level, each new machine requires a separate calculation.

As we know, there are many standards to develop these techniques, but the process is time consuming and resource-intensive. In addition to this, as described above, sometimes new constructive solutions are not always easy to understand.

In my report (and this is a part of my masters’s dissertation) I suggest step by step designing and calculating parametric solid column model in the software SolidWorks.

SolidWorks allows you to visualize, and most importantly to quickly create a three-dimensional model of technological apparatus.

Basis for the work was taken of column K-3, which is located in Ufa refinery plant. Then I was studied the basic methods of three-dimensional modeling in SolidWorks and calculation principles of technological equipment in this software program. Then parametric solid column model was designed.

At the end of the work was calculated stress-strain state of column from the action of internal pressure. Unfortunately, the program has simplified the machine to a primitive level, and only then made calculation. The calculation model was introduced deformed vessel and designated maximum, minimum and allowable stress.

In conclusion of the work done –SolidWorks is one of the most advanced software for three-dimensional designing of technological equipment, but for serious calculation of pressure vessels do not fit.

УДК 811.111-26

МЕЖКУЛЬТУРНЫЕ АСПЕКТЫ АНГЛОЯЗЫЧНОГО ПОЛИТИЧЕСКОГО ИНТЕРВЬЮ

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Речевое воздействие – это воздействие на человека при помощи речи и сопровождающих речь невербальных средств для достижения поставленной говорящим цели. Общение – это обмен поступками, жестами, словами. Общение – не просто взаимодействие, но совместная деятельность (кооперация) для получения результата.

К способам речевого воздействия относят доказывание, убеждение, уговаривание, внушение, принуждение.

В зависимости от целей собеседник (журналист, интервьюер и т.д.) выбирает разные коммуникативно-речевые тактики, также необходимо понимать, какие тактики выбирает ваш собеседник. Языковым манипулированием занимались в основном психологи – Г.Тард, О.Есперсен, Стуртеван, М.Ралея. Рассмотрим несколько наиболее хитрых уловок при диалоге:«Неожиданность», «Апелляция к авторитету»,«Провокация», «Внесение элемента неформальности», «Да-да-да», «Юмор».

Интервью – целенаправленная, зафиксированная беседа, предназначенная для распространения в печати, на радио, на ТВ. Особенность жанра интервью в том, что все формы высказываний корреспондента направлены только на получение информации: обращение-вопрос, обращение-сообщение,обращение-побуждение к действию. Эти действия используются в интервью, помогают донести до читателя дополнительную информацию. Жанр интервью является одним из самых популярных в современных средствах массовой информации, это объясняется некоторыми факторами.

Диалогичность в интервью выступает не только как способ построения газетного текста, но и как способ организации материалов на газетной полосе, социально-психологический портрет личности (человек и время), анализ актуального события, социального явления, общественной проблемы через призму индивидуального мнения авторитетного лица. Определим форму «классического интервью» как цепочку из звеньев «вопрос-ответ». Для получения чисто фактических сведений личность собеседника важна журналисту только с точки зрения лёгкости общения с ним: охотно ли предоставляет информацию, как понимает вопросы, насколько логично и ясно отвечает, мотивация общественной значимости проблемы, либо свидетельство компетентности, мнения интервьюируемого, та или иная форма представления.

В любом интервью происходит процесс восприятия и оценки собеседниками друг друга, он начинается в момент первого контакта интервьюера и собеседника и действует в течение всей беседы.

Конечный же результат интервью в значительной степени зависит от взаимоотношений между участниками беседы. В связи с этим уже в период подготовки интервьюер должен обдумать, как охотно интервьюируемый будет сотрудничать.

Интервью подходит к концу. Этот момент психологически интересен тем, что интервьюируемый расслабляется, напряжение спадает, он чувствует себя свободнее. В это время он может припомнить что-то важное, обронить какие-то интересные замечания, дополнить свой рассказ. Нужно быть внимательным к заключительным словам, не пропустить того значительного, что может в них содержаться.

Наиболее интересные тактики ведения интервью представляет Лукина М.М. во второй главе книги «Технология интервью». Интересны, например, интервью с Джен Псаки, официальным представителемГосударственного департамента США,на которых в полной мере раскрываются тактики интервью.

Таким образом, интервью выступает особым жанром политического дискурса, отличающимся большим разнообразием. Исследование интервью не может быть сведено к общим принципам, так как каждое интервью имеет отличную культурную ситуацию. В настоящее время в связи с популярностью данного жанра его границы расширяются, и интервью переходит из специфически политической коммуникации в общую среду политического дискурса.

УДК 614.72

СЕРОВОДОРОД. ОПАСНОСТЬ ДЛЯ ЖИЗНИ

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HYDROGENSULFIDE.HAZARDTOLIFE

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This paper documents impacts on human health caused by exposure to hydrogen sulfide (H_2S) associated with oil and natural gas development. The article gives abrief background on hydrogen sulfide, its presence in oil and natural gas, and possible emission sources from various oil and gas operations. Areview of literaturefrom available public health, epidemiology, and industrial health publications, as well as of sources from regulatory and environmental agencies, that addresses human health impacts from exposure to H_2S is represented in the final part.

Approximately 90 percent of the sources that emit hydrogen sulfide into the air are natural [1].Hydrogen sulfide is released into the air as a product of the decomposition of dead plant and animal material,especially when this occurs in wet conditions with limited oxygen, such as in swamps. Hot springs, volcanoes, and other geothermal sources also emit H_2S [2].

Anthropogenic releases of H_2S into the air result from industrial processes, primarily from the extraction and refining of oil and natural gas and from paper and pulp manufacturing,but the gas is also present at sewage treatment plants, manure-handling plants, tanneries, and coke oven plants.

Hydrogen sulfide is a naturally occurring component of crude oil and natural gas. Petroleum oil and natural gas are the products of thermal conversion of decayed organic matter (called kerogen) that is trapped in sedimentary rocks. High-sulfur kerogens release hydrogen sulfide during decomposition, and this H_2S stays trapped in the oil and gas deposits.

Hydrogen sulfide emissions from oil and gas development may pose a significant human health risk, as the studies discussed below reveal. Workers in the oil and gas industry are trained to recognize and respond to high-concentration accidental releases of H_2S. People living near oil and gas development sites may be chronically exposed to much lower, but nonetheless dangerous ambient H_2S levels, as well as to accidental high- concentration releases.

Human health effects of exposure to hydrogen sulfide, an irritant and an asphyxiant, depend of the concentration of the gas and the length of exposure. Background ambient levels of H_2S in urban areas range from 0.11 to 0.33 ppb, while in undeveloped areas concentrations can be as low as 0.02 to 0.07 ppb.A rotten egg odor characterizes H_2S at low concentrations, and some people can detect the gas by its odor at concentrations as low as 0.5 ppb.About half of the population can smell H_2S at concentrations as low as 8 ppb, and more than 90% can smell it at levels of 50 ppb.Hydrogen sulfide, however, is odorless at concentrations above 150 ppb, because it quickly impairs the olfactory senses [3].Prolonged exposure to concentrations below150 ppb can also cause olfactory fatigue [4].This effect of disabling the sense of smell at levels that pose serious health risks and possibly are life-threatening is one especially insidious aspect of hydrogen sulfide exposure. Odor is not necessarily a reliable warning signal of the presence of H_2S.

Most effects to humans occur from inhalation, though exposure generally also affects the eyes. Because most organ systems are susceptible to its effects, hydrogen sulfide is considered a broad spectrum toxicant.The organs and tissues with exposed mucous membranes (eyes, nose) and with high oxygen demand (lungs, brain) are the main targets of hydrogen sulfide [5].Hydrogen sulfide acts similarly to hydrogen cyanide, interfering with cytochrome oxidase and with aerobic metabolism.Essentially, hydrogen sulfide blocks cellular respiration, resulting in cellular anoxia, a state in which the cells do not receive oxygen and die. The human body detoxifies hydrogen sulfide by oxidizing it into sulfate or thiosulfate by hemoglobin-bound oxygen in the blood or by liver enzymes.Lethal toxicity occurs whenH_2S is present in concentrations high enough to overwhelm the body's detoxification capacity [3].

At levels up to 100 to 150 ppm, hydrogen sulfide is a tissue irritant, causing keratoconjunctivitis (combined inflammation of the cornea and conjunctiva), respiratory irritation with lacrimation (tears) and coughing.Skin irritation is also a common symptom. Instantaneous loss of consciousness, rapid apnea (slowed or temporarily stopped breathing), and death may result from acute exposure to levels above 1,000 ppm [3].At these higher levels, hydrogen sulfide is an asphyxiant.

The literature on human health and hydrogen sulfide reveals serious and lasting physiological and neurological effects associated with acute exposure. The health effects of chronic exposure to lower levels of H_2S, as documented in several studies, also include persistent physiological and neurological disturbances. Oil and gas facilities can be expected to accidentally and routinely emit hydrogen sulfide in concentrations that span a wide range and are associated with a variety of health effects.

Living near oil and gas sites, emissions of H_2S may be routinely compromising human health.

The fact that concentrations of H_2S to which people are exposed are often not known does not imply that hydrogen sulfide is not the cause of the observed health effects.

Some technological options exist that may help mitigate the effects of hydrogen sulfide on the health of people who live near emission sources. One advanced technology for odor control, consisting of a dry scrubbing system with multiple beds of engineered media (made by soaking, or on a rotating agglomeration disk), removed hydrogen sulfide at a wastewater treatment facility with an efficiency of 99.94 %.This odor control technology reduced the peak inlet hydrogen sulfide concentration of 108.0 ppm to 0.061 ppm [6].Such odor abatement technologies could be required at all facilities that emit hydrogen sulfide, including oil refineries and gas processing plants. At points of oil and gas extraction and processing, requiring high efficiency flares would ensure that less hydrogen sulfide (and other pollutants) escape into ambient air unburned. In light of the information presented here on the health effects associated with exposure to hydrogen sulfide, even though rigorous data on the dose-response relationship is lacking, it is amiss to delay making some public policy decisions that would help protect human health.

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УДК 624.131

ПОВТОРНАЯ ПРОМЫВКА ПЛАТИНОНОСНОЙ РОССЫПИ В УСЛОВИЯХ ОАО «АС АМУР»

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For repeated washing of placer deposits, it is necessary to determine the content of platinum particles in the washed tails and their distribution on the slope of the primary hydraulic dump of sand washing (PHDSW).

The purpose of the study is definition of the distribution of platinum particles on the slope PHDSW.

Objectives of the study is calculation of distribution of washed tails by size on the Hoppe slope; - calculation of the distribution of platinum particles on the slope PHDSW.

According to the results of studies at the laboratory of the Department of RMOS (the development of deposits by open mining), a method was developed for calculation of distribution of particles on size on the slope PHDSW. It was established that the particles distribution of individual fractions placement near the center may be approximated by a normal distribution of casual variables, with a normalized parameter t:

$$t = \frac{3(x - 0,01R_i)}{0,01R_i}, \quad (1)$$

where*x* – the relative distance from the edge of the hydraulic dump to the section under consideration; R_i – the total output (balance) of rock particles (sand), %.

In practice, concentration and classification of granular materials of different size and density the characteristics of equally-falling (the same drop) particles is used. Particles having the same deposition rate in calm water (equal hydraulic size) are called equally-falling and the ratio of their equivalent diameters is called the coefficient of equal-falling. Under equal conditions of deposition:

$$e_{G_к} = \frac{d_л}{d_т} = \frac{\rho_т - 1}{\rho_л - 1}, \quad (2)$$

where $e_{G_к}$ is a coefficient of equal-falling for particles of size greater than 1 mm; $d_л$ – equivalent diameter of a larger size and lighter particle with the density of (t/m^3), mm; $d_т$ – equivalent diameter of a finer heavy particle with the density (t/m^3) mm.

Knowing the particle diameter of the certain density $d_п$, washed into the drain of any classifier, and the coefficient of equal fall e_{Gk}, we can calculate the particle size of any density $d_т$ washed down into the drain, using the formula:

$$d_т = \frac{d_п}{e_{Gk}} \cdot (3)$$

For slurry flow moving along the gateway P.V. Lyaschenko introduced a characteristic of motion of particles with similar speed – ratio of equal speed. It is the ratio of the size of grains of different density, which begin to move along the bottom of the gateway at the same speed as the speed of slurry or water. According to P.V. Lyaschenko, this coefficient *e*is equal to the coefficient of equal falling e_{Gk}, multiplied by the ratio of the coefficients of friction of heavy and light grains on the surface of the gateway:

$$e_V = e_{G_к} \frac{f_Т}{f_Л}, (4)$$

where$f_Т$, $f_Л$ – coefficient of friction of a heavy and light grain.

According to the results of research at the laboratory of the Department of RMOS the dependence was established of calculation of distribution of gold particles on the size of rock mass particles on the slope on coefficient equal falling HDSW:

$$d_{\mathrm{Au}} = 0{,}163\left(\frac{d_{п}}{e_{Gк}}\right)^{0{,}185}, \quad (5)$$

where d_{Au}, $d_{п}$ – size of gold particles and rocks, settled on a section, mm; $e_{Gк}$ – coefficient of equal falling.

By analogy of distribution of gold particles, we can derive a formula of dependence of size of deposited platinum particles on the size of deposited rock particles and the coefficient of equal falling:

$$e_{G_к} = \frac{d_л}{d_т} = \frac{\rho_т - 1}{\rho_л - 1} = \frac{19{,}3 - 1}{2{,}65 - 1} = 11{,}09,$$

where in $\rho_т = 19{,}3$ – platinum density (t/m^3), $\rho_л = 2{,}65$ – rock density (t/m^3).

$$d_{\mathrm{Pt}} = 0{,}163\left(\frac{d_{п}}{e_G}\right)^{0{,}185} = 0{,}163\left(\frac{d_{п}}{11{,}09}\right)^{0{,}185} = 0{,}163\left(0{,}09017 \cdot d_{п}\right)^{0{,}185} = 0{,}104\left(d_{п}\right)^{0{,}185},$$

$$d_{\mathrm{Pt}} = 0{,}104\left(d_{п}\right)^{0{,}185}. \quad (6)$$

Thus, using the method of calculation of particles distribution on the size on the slope of the primary hydraulic dump washing , through normalized parameter (1), the coefficient of equal falling (the same drop) (2), as well as using the formula of dependence of size of deposited platinum particles on the size of deposited rock particles (6) the distribution of platinum particles on the slope PHDSW may be determined.

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ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В КАРОТАЖЕ СКВАЖИН. МАГНИТОРЕЗОНАНСНЫЙМЕТОД (MRI)

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INFORMATION TECHNOLOGIES IN WELL LOGGING. MAGNETIC RESONANCE IMAGING (MRI)

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MRI Logging – Magnetic Resonance Imaging (MRIL), introduced in 1991, takes the medical Magnetic Resonance Imaging (MRI) or laboratory magnetic nuclear resonance (NMR) equipment and turns it inside-out. So, rather than placing the subject at the centre of the instrument, the instrument itself is placed in a well bore, at the centre of the formation to be analyzed [1].

At the centre of an MRIL tool, a permanent magnet produces a magnetic field that magnetizesformation materials. An antenna surrounding this magnet transmits into the formation precisely timed bursts of radio-frequency energy in the form of an oscillating magnetic field. Between these pulses, the antenna is used to listen to the decaying "echo" signal from those hydrogen protons that are in resonance with the field from the permanent magnet. Because there is a linear relationship between the proton resonance frequency and the strength of the permanent magnetic field, the frequency of the transmitted and received energy can be tuned to investigate cylindrical regions at different diameters around an MRIL tool. Thus tuning an MRI probe so that it can be sensitive to a specific frequency, allows MRI instrument to image narrow slices of either a hospital patient or a rock formation.

MRIL-Prime tool was introduced in 1998. The diameter and thickness of each thin cylindrical region are selected by simply specifying the central frequency and bandwidth to which the MRIL transmitter and receiver are tuned. The diameter of the cylinder is temperature-dependent, but typically is approximately 14 to16 in.

MRIL Acquisition Data Sets. The unique capacity of the MRIL logging tool to measure multiple quantities needed for prospect evaluation and reservoir modeling depends on making multiple NMR (nuclear magnetic resonance) measurements on the "same" rock volume using different activations. These different activations can usually be used during the same logging run with a multiple-frequency tool such as the MRIL Prime. Three general categories of activation sets are in common use: total porosity, dual polarization time (TW), and dual inter-echo spacing (TE) [1].

A total porosity activation set acquires two echo trains to obtain the total porosity. To acquire one of the echo trains, the tool uses TE=0.9 or 1.2ms and a long TW to achieve complete polarization. This echo train provides the value of "effective porosity". To acquire the second echo train, the tool uses TE=0.6ms and a short TW that is only long enough to achieve complete polarization of the fluids in the small pores. The second echo train is designed to provide the porosity contributed by pores of the same size as clay pores. Dual-TW activation is primarily used to identify light hydrocarbons (gas and light oil). Typically, measurements are made with TW=1 and 8 s, and TE=0.9 or 1.2 ms. The water signal is contained in both activations, but light hydrocarbons (which have long T1 values) have a greatly suppressed signal in the activation with TW=1 s. The presence of a signal in the difference of measurements is a very robust indicator of gas or light oils. Dual-TE activation is primarily used to identify the presence of viscous oil, which has a small diffusion constant relative to water. For this set, the fluid with the larger diffusion constant (water) has a spectrum shifted more to earlier times than the fluid with the smaller diffusion constant (viscous oil). The presence in the spectra of a minimally shifted portion identifies high-viscosity oil in the formation.

All information from the tools can then be integrated at a reservoir decision centre to give a more complete analysis [2].

A MRIL tool responds to the materials in a series of cylindrical shells, each approximately 1mm thick. Borehole or formation materials outside these shells have no influence on the measurements, a situation that is similar to medical MRI. Hence, if the MRIL tool is centralized in the well bore, and the diameter of any washout is less than the diameter of the inner sensitive shell, then the tool will respond solely to the properties of the formation. In other words, borehole rugosity and moderate washouts will not affect MRIL measurements.

NMR logging application summary. Case studies and theory have shown that MRIL tools yield important data for:

- evaluating complex-lithology oil and/or gas reservoirs;
- identifying medium-viscosity and heavy oils
- studying low-porosity/ low permeability formations
- determiningresidualoilsaturation

In particular, NMR data provide the following valuable information:

- mineralogy-independentporosity;
- porosity distribution, complete with a pore-size distribution in water-saturated formations;
- hydrocarbon typing, contrasts for water, gas, and/or oil
- NMR enhanced water saturation calculations for the virgin zone

NMR tools are also used in other areas of prospecting and reservoir characterization process. They are used for early reservoir identification, properties estimation, advanced formation testing, fluid property information at down hole reservoir conditions, etc.

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