Abstracts

The pressing problems of prevention and removal of oil spills in the Arctic and the methods of assessment of environmental damage to coastal areas

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Specific features of environmental changes in the Arctic due to the prospects of large-scale development of hydrocarbons of the Arctic shelf and coastal areas, and regulatory framework of the Arctic states for environmental assessment and methods of calculating the damage caused by oil spills are discussed.

Key words: the natural environment of the Arctic, oil spills, oil flow and transformation, damage assessment, simulation.

Justification of generation of gas emission craters in the Arctic by mathematical modeling

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The results of mathematical modeling of generation of gas emissions craters in the Arctic are given. The crater, discovered on the Yamal Peninsula to the south of the Bovanenkovo field in 2014, is selected as the factual basis.

Key words: *gas emissions, craters, the Yamal Peninsula, Yamal lake, permafrost, permafrost rock, Bovanenkovo field, mathematical modeling.*

Assessment of effect of the approach channel to the port of Sabetta to changes in hydrological conditions of the Gulf of Ob using numerical modeling

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The changes in salinity conditions in the area of planned approach channel in the northern part of the Gulf of Ob, which can be caused by changes in bottom topography as a result of channel construction, are assessed. The experiments on sensitivity of salinity conditions to topography change caused by the approach channel for the maximum, minimum and mean climatological flow of Ob, Nadym, Pur and Taz rivers are carried out using numerical modeling.
The experiments show that the greatest increase in the annual average salinity takes place in the in the area of the channel. Effect of the channel is significantly reduced at a distance from the channel.
Calculations have shown that the natural inter-annual and intra-annual variability of salinity is much higher than its variation caused by the approach channel.

Key words: *the circulation of the Arctic seas, the Gulf of Ob, numerical modeling, hydrological regime.*

Organization of geo-environmental monitoring of gas emissions in the Arctic: methods and prospects of advanced wireless technologies

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The tools and techniques to monitor emission of greenhouse gases in the Russian Arctic are discussed. The limitations of traditional methods of gas monitoring are defined on the basis of observations of lithosphere hydrogen and methane in the Khibiny and Lovozero tundra and published data. It is proposed to use new monitoring methods based on wireless sensor systems. The whole set of problems of monitoring in Arctic conditions are considered by the example of the central part of the Kola Peninsula. The main problem to be solved for construction of such systems is the development of specialized low-energy gas sensors. The important point is the integration of complex hardware and software technologies into integrated effective monitoring system.

Key words: *monitoring, gas emission, monitoring methods, wireless sensor systems.*

Calculation of hydraulic size of suspended substances to simulate dynamics of concentration of suspended substances in the estuarine areas of the Arctic seas by the example of the White Sea

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The technique of calculating the hydraulic size of particles in aqueous medium to simulate the dynamics of concentration of suspended solids by the example of dredging and ground dumping are considered. The various approaches to calculation of dynamics of suspended solids concentration are reviewed, and the basic input parameters of the model are defined. A model of horizontal dispersion of pollutants and method of calculation of particle precipitation rate, based on the theoretical and empirical formulas, are proposed. The conclusions on universality of the empirical formula and possibility of combination of Stokes' formula for laminar and turbulent modes are made by comparison of the calculation results.

Key words: *environmental impact, mathematical model, model parameters, dynamics of concentration, suspended substances, method of precipitation rate calculation.*

Research activities of the USA in the Arctic: organizational approach and military programs

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The organizational approach of the USA to development of scientific research system in the Arctic as a key tool for ensuring national interests in the region is considered. The results of the systematization and brief analysis of military research and development programs focused on the Arctic region are given.

Key words: *The Arctic, the United States, scientific research, national interests,military programs, safety.*

Geotechnological paradigm of integrated development of mineral resources in the Arctic zone of Russia

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Development of Arctic territory and mineral resources within the constraints of ecological imperative is caused by urgent need of innovative ideas in the field of integrated development of mineral resources in the region and innovative geotechnologies of mining of various minerals. The article deals with the methodological side of the problem. Specific technological solutions are in the process of actualization in accordance with the requirements of the geological conditions of the specific native and alluvial deposits in the permafrost zone of Russia.

Key words: *permafrost, arctic biomes, cross-border transfers, ore deposits, technologically altered minerals, biogenic principles, ecogeotechnologies, selective excavation, temperature resource, cryogenic waste management, environmental impact.*

Creation of multi-level system of geodynamic monitoring of mining and oil and gas facilities in the western part of the Russian sector of the Arctic

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With regard to mining engineering and oil and gas facilities in the western part of the Russian sector of the Arctic, creation of a system of multilevel geodynamic monitoring of the geological environment based on the principle of multi-disciplinary research is justified.

Key words: *the Arctic, mining engineering companies, oil and gas facilities, safety, geodynamic monitoring, system, multidisciplinary research, organization.*

New experimental capabilities of the Krylov State Research Center for study of ice impact on marine equipment

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The experimental capabilities of new experimental ice basin of the Krylov State Research Center are shown. The main technical parameters of the new pool are given, used ice models are described. The characteristics of the main types of model tests are given.

Key words: *ice model basin, ice conditions, ice model tests, simulated ice.*

Structural materials as an important element of reliability and environmental safety of infrastructure in the Arctic

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Some new structural materials, ensuring reliability and environmental safety of Arctic sea structures and hydrocarbons pipelines are discussed. The high efficiency of combination of fundamental and applied research is shown. New technologies and corresponding reequipment of domestic steel enterprises allow cancelling the import deliveries and producing the entire range of Arctic structures using domestic materials only. The further ways of development of advanced materials for the Arctic are discussed.

Key words*: the Arctic, reserves and resources, gas ships, oil and gas platforms, field and header pipe, cold-resistant materials, the reliability of welded structures.*

Year-round navigation in the port of Sabetta

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Recently, both the Russian leadership and private capital shows intense interest in the Arctic. The port of Sabetta is an example of such interest. It is a unique project of Arctic development, striking by scale, task difficulty and wise decisions. The results of development of new technologies of vessels entry and exit from the port of Sabetta in ice conditions using icebreakers are described. The state of and prospects of year-round navigation along the Northern Sea Route using this major expanded port are discussed.

Key words: *nuclear icebreakers, Sabetta seaport, JSC "Yamal SPG", liquefied natural gas, the Northern Sea Route, icebreakers steering, JSC "NOVATEK", tug, moorage, infrastructure.*

Forecasting of ice conditions and optimal route of the ships in the Arctic for safe navigation

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The issues of the use of remote sensing data to monitor ice conditions in the waters of the Arctic seas are discussed. The authors generated a number of proposals needed to create a large-scale system for steering and ice navigation along the Northern Sea Route based on techniques and developments used for information and navigation support of maritime polar expeditions,.

Key words: *space monitoring, Arctic floating university, marine polar expeditions, geoinformation support.*

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