ARCTIC
ECOLOGY AND ECONOMY
RESEARCH AND INFORMATION-ANALYTICAL MAGAZINE

Editorial Board

Abstracts

Contribution of the Russian Academy of Sciences to Modern Exploration and Development of the Arctic

N. P. Laverov, Academician of RAS

Russian Academy of Sciences

The main activities of the country's leadership in modern exploration and development of the Arctic are represented. Some of the results of research works of the Russian Academy of Sciences in 2013 to ensure implementation of the "Strategy for the Development of the Russian Arctic and National Security for the period up to 2020" are shown.

Keywords: *Arctic zone of the Russian Federation, scientific research in the Arctic, RAS research fleet, the Arctic shelf.*

The features of emergencies in the Arctic zone of Russia and a way to response on the basis of risk concept [1]

N. A. Makhutov, RAS Correspondent Member

Working Group on risk analysis and safety issues under RAS President

M. M. Gadenin, Ph. D.

Blagonravov Institute of Engineering Science of RAS

M. P. Lebedev, RAS Correspondent Member, *A. M. Bolshakov, Doctor of Sciences, A. P. Ammosov, Doctor of Sciences, A. S. Syromyatnikova, Ph. D, M. I. Zakharova, P. P. Permyakov, Doctor of Sciences*

Larionov Institute of Physical and Technical Problems of the North, Siberian Branch of RAS, Yakutsk

Yu. S. Glyaznetsova, Ph. D, O. N. Chalaya, Ph. D., S. H. Lifshits, Ph. D., I. N. Zueva, Ph. D.

Institute of Oil and Gas Problems of the Siberian Branch of RAS, Yakutsk

Modern development of the fundamental theory of safety justifies the necessity of introducing a safe work conditions during operation of the technosphere and the environment (including the conditions and climatic features of the northern regions and Siberia) and normalized parameters of risks and safety based on criteria for reliability, durability, resource, survivability of exploited technical systems. The methodology of analysis of emergency risk specific to the Arctic areas is considered. The results of studying the conditions of such situations including the destruction of pipelines and storage facilities, spills of oil products and soil pollution, floods and related damages, pipeline subsidence in permafrost zones, etc. are given, and the response methods are describes.

Keywords: *Arctic zone, climatic factors, emergency, safety theory, technological safety, risk, damage, risk monitoring, technosphere objects, limit states, the destruction of pipelines, flood, flooding, thawing of soil, oil pollution, ground mapping, emergency forecast and prevention.*

[1] Based on the reports at the VI Eurasian Symposium on strength of materials and machines for cold climate regions, dedicated to 75th anniversary of Academician V. P. Larionov. Yakutsk, June 24–29, 2013.

Evaluation of thermal action of underground nuclear low-power station on the permafrost rocks

N. N. Melnikov, Academician of RAS, *P. V. Amosov, Ph. D., S. A. Gusak, Ph. D., N. V. Novozhilova, S. G. Klimin*

Institute of Mines of the RAS Kola Scientific Center

Analysis of the results of numerical experiments to evaluate the thermal state of permafrost rocks, taking into account the phase transition «ice-water» for underground nuclear low-power plant, is presented. The possibility of placing the low-power reactor installations in remote northern regions of Eastern Siberia (Yakutia, Chukotka) is examined.

Keywords: *nuclear low-power plants, permafrost rock, numerical modeling, phase transition, thermal effect.*

Comprehensive monitoring – an integral part of safety of the Russian Arctic

A. Yu. Bolshagin, A. I. Vyalyshev, Doctor of Sciences, *V. M. Dobrov, A. A. Dolgov, Ph. D., S. V. Zinovyev, I. Yu. Oltyan*

FSUE Research Institute for Civil Defense and Emergencies

V. V. Gorbatsky

FSUE Krylov State Scientific Center

The structure of integrated system to control the emergencies in the areas of development of hydrocarbon fields on the Arctic shelf is reported. The information-analytical subsystem that is a structural element of the system which provides acquisition, processing, storage, transfer and analysis of aggregate data of remote and contact measurements is described.

Keywords: *Arctic shelf, field development, oil spills, environmental monitoring, control system, ground station, submersible, emergency.*

The Problems of Scientific Support of Maritime Activities in the area of the Northern Sea Route

G. G. Matishov, Academician of RAS, S. L. Dzhenyuk, Doctor of Sciences

Murmansk Marine Biological Institute, the Kola Scientific Center of the Russian Academy of Sciences

The state and prospects of research activities in the area of the Northern Sea Route (from the Barents Sea and the White Sea to the Bering Strait) which are related to the development of economic activities, climate change trends and ice cover, anthropogenic stresses are considered. A concept is suggested and the tasks are set for three areas of fundamental research: dynamics of climate-forming factors and scenarios of climate change, adaptation of marine and terrestrial ecosystems to changes in the Arctic environment, development of the strategies for socio-economic growth of the Arctic regions based on optimization of environmental management.

Keywords: *research, the Northern Sea Route, climate, ice cover, ecosystems, marine activities, strategy.*

Simulation of circulation of the Kara and Pechora Seas through the system of express diagnosis and prognosis of marine dynamics

N. A. Diansky, Doctor of Sciences

Zubov State Oceanographic Institute, the Institute of Computational Mathematics of RAS

V. V. Fomin

Zubov State Oceanographic Institute, the Moscow Physical-Technical Institute

I. M. Kabatchenko, Doctor of Sciences

V. M. Gruzinov, Doctor of Sciences

Zubov State Oceanographic Institute

A system for express diagnosis and prognosis (EDPS) of hydrometeorological characteristics of the Kara and Pechora Seas, implemented in the Zubov State Oceanographic Institute, is described. It includes the calculation of atmospheric impact using the WRF model, calculation of flows, level, temperature, salinity of sea and sea ice using the INMOM model and calculation of sea roughness parameters using Russian atmospheric and wave model. The results of verification of hydro and meteorological parameters got by EDPS for the Kara and Pechora Seas are presented. In addition, retrospective calculations of thermohydrodynamic characteristics of these waters for the ice-free period from 2003 to 2012 were made with the help of this system. The important features of water circulation in the Kara and Pechora Seas and the structure of water exchange between them in the ice-free period are shown.

Keywords: *Arctic Sea, Arctic Ocean, ocean circulation, sea ice, express simulation, numerical methods.*

The Problems of Elimination of Accumulated Environmental Damage in the Chukotka Autonomous Okrug

O. A. Safonova

Committee for Nature and Environmental Protection of the Department of Agriculture policy and nature of the Chukotka Autonomous Okrug

Economic activity in the second half of the twentieth century in the Chukotka Autonomous Okrug was conducted without environmental management, which led to environment pollution by waste of mining entertaments, abandoned machinery and barrelware. The Government of Chukotka is making efforts to minimize the accumulated environmental damage both using their own financial and material resources and resources within the federal target programs.

Keywords: *elimination of accumulated environmental damage, metal barrelware, cleaning of the Arctic seas and areas from pollutants.*

The problem of floating maintenance base “Lepse”

M. P. Filppov, A. N. Abramov, M. M. Kashka
FSUE “Atomflot”, Murmansk
K. N. Kulikov, Ph. D., *R. A. Nizamutdinov*
NIPTB “Onega”, Severodvinsk, the Archangelsk Region

The issues of creation and decommissioning of the first ship designed to recharge the reactors of nuclear icebreakers – floating maintenance base “Lepse”– are reported. The history of international cooperation in resolving the problems of nuclear and radiation safety at the stages of preparation to decommissioning and decommissioning of one of the most radiation-hazardous facilities in the North-West of Russia is described. The present status of decommissioning of the ship is presented.

Keywords: *spent nuclear fuel, floating maintenance base, radioactive waste, spent fuel assembly, international cooperation in decommissioning of nuclear and radiation hazardous facilities.*

Extending the Lifetime of Reactor Plants of the Nuclear Icebreakers. Safety Ensuring in the Extended Period

O. E. Darbinyan, S. V. Filimoshkin
FSUE “Atomflot”, Murmansk
Yu. P. Fadeev, A. N. Pakhomov, V. I. Vasyukov, T. V. Molokova
Afrikantov Experimental Design Bureau of Machine Building JSC, Nizhny Novgorod

The experience of extending the operation time of icebreaker reactor plants is reviewed and summarized; the current state and prospects for future work are described, impact of the work on nuclear and radiation safety is discussed.

Keywords: *nuclear icebreakers, reactor plant, specified lifetime, lifetime extension, safety of operation.*

Effect of change in oil viscosity to spill characteristics in cold marine environment

M. P. Lobachev, Ph. D.,
K. E. Sazonov, Doctor of Sciences
FSUE Krylov State Scientific Center

An impact of thermal effects on the characteristics of oil spill in the ice conditions, primarily due to the temperature-dependent oil viscosity, is discussed. Estimates are obtained showing that it is needed to take into account the changes in oil viscosity for more accurate determination of the size of spill area.

Keywords: *oil spill, constant flow mode, constant volume mode, viscosity, temperature.*

Centenary of the «Master of the Two Poles» (for the anniversary of A. F. Treshnikov)

L. M. Savatyugin, Doctor of Sciences
State Scientific Center of the Russian Federation “Arctic and Antarctic Research Institute”
I. N. Sokratova, Ph. D.
Russian Academy of Sciences, Department of the Earth Sciences

The article deals with the 100th anniversary of Academician A. F. Treshnikov, who is the eminent oceanologist and geographer, the Arctic researcher of worldwide reputation, talented organizer of science. The principal milestones of his biography, scientific data and field activities are described. Information about the anniversary events is given.

Keywords: *biography of A. F. Treshnikov, Arctic, Antarctica, Arctic and Antarctic Institute.*