



Environmental safety of mineral resources exploration on the Arctic shelf

Spring semester, 2019-2020

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Credits	3 ECTS (optional course), 54 in-class hours
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Level	MSc
Host institution	Russian State Hydrometeorological University , Department of Ecology and Bioresources
Course duration	January 21 – June 8, 2020

Summary

This 3 ECTS course is elaborated for graduate students studying ecology and environmental management. The purpose of the discipline "Environmental safety of mineral resources exploration on the Arctic shelf" is the formation of a complex of scientific and practical knowledge of modern environmental problems arising from the implementation of various types of marine economic activities related to the work of sea transport, the development of hydrocarbon resources of the shelf and their solutions in order to ensure the ecological safety of water areas.

Target student audiences

MSc students in ecology and environmental management

Prerequisites

Required courses (or equivalents):

- Ecology and Evolution of the Biosphere;
- Physical Geography;
- Geoecology;
- Hydrology of inland waters;
- Physics;
- Chemistry;
- Basics of Nature Management;
- Environmental Monitoring;
- Law.

Goals and objectives

The main course objective is to develop in students the ability to develop typical environmental protection measures and conduct an environmental impact assessment of planned facilities or other forms of economic activity; and the ability to use regulatory documents governing the organization of industrial and technological environmental work and methodically competently



develop an action plan for environmental audit, monitoring compliance with environmental requirements, environmental management of production processes.

General learning outcomes:

As a result of mastering the discipline "Ecological safety of the development of mineral resources on the Arctic shelf" the successful student will:

- Know:
 - o theoretical foundations of ecology, resource use and resource conservation, as well as human ecology, social ecology, applied ecology;
 - o theoretical foundations of environmental monitoring, regulation and reduction of environmental pollution.
- Be able to do:
 - o summarize the results obtained in the context of previously accumulated knowledge in science;
 - o use theoretical knowledge of the basics of environmental monitoring, regulation and reduction of environmental pollution, competently use models of natural-technical systems, as well as methods for processing geo-ecological and ecological information;
 - o methodically competently develop an action plan for environmental audit, monitoring compliance with environmental requirements, environmental management of production processes.
- Master:
 - o knowledge of modern computer technologies used in the collection, storage, processing of information;
 - o ability to actively communicate in the scientific, industrial and social and public spheres of activity; the ability to freely use Russian and foreign languages as a means of business communication;
 - o the main methods, methods and means of obtaining, storing, processing information, have skills in working with a computer as a means of managing information.

Overview of sessions and teaching methods

The discipline program consists of lecture-type classes (36 hours) and seminars (18 hours). Individual studies (54 hours) are arranged by exploring theoretical course and accomplishing practical tasks available at e-course platform. Tasks are developed for both group and individual work (case-studying, various data analysis and generalization). The process of individual studies is very convenient as the students are provided with a diverse range of electronic resources (tutorials, scientific articles, cartographic material, databases, video sessions) enabling them to learn and analyze various information.

The student's independent work is based on studying educational materials from teacher's recommended lists of basic and additional educational literature, studying an electronic course of lectures in the form of slide presentations, visiting recommended Internet resources, including the official websites of the largest specialized domestic and foreign scientific organizations, studying recommended scientific publications for the preparation of reports at the seminar.



Examples of tasks: review of the rules for carrying out activities for the protection and preservation of the marine environment, natural resources of the continental shelf according to Federal Law No. 187 “On the Continental Shelf of the Environment in the Russian Federation”, review of regulations of the Russian Maritime Register of Shipping in the field of ensuring the environmental safety of maritime economic activities, etc.

Guidelines about tasks completion and response placement procedure shall be presented in the task description message. The quality point shall be awarded for each assignment (test, interactive lecture, exercise, case analysis) during semester period with all the points summarized in the end. Monitoring of individual studies shall be organized at the time of classroom activities and by means of e-learning course (tasks attachments, test tasks performance, scientific papers reviews, essays, etc.)

Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
In-class activities			
Lectures	Understanding theories, concepts, methodology and tools	Class participation	18
Moderated in-class discussions	Understanding various policies and management contexts and common problems in communication in environmental governance	Class participation and preparedness for discussions	36
Independent work			
E-course: - the study of theoretical material and development of group and individual assignments in the online environment	The ability to analyze and interpret data from various information resources, own methods of processing and interpreting environmental information during scientific and industrial research	Class participation, creative and active contribution to discussion	44
Settlement tasks	Solution of settlement tasks, situational tasks using the knowledge gained	Analysis and interpretation of settlement results	10
Total			108

Grading

The students' performance will be based on the following:



- level of readiness to participate in classroom discussions and seminars (50%)
- contribution to group tasks (20%)
- individual calculation tasks (30%)

Course schedule

Module 1 The main types and objects of marine economic activities on the Arctic shelf	
Topic 1.1	Introduction. Goals and objectives of the course
Topic 1.2	The main types and objects of marine economic activities on the shelf
Topic 1.3	Classification of environmental problems arising from the development of the mineral resources of the shelf
Module 2 Legal documents to ensure environmental safety in the development of the mineral resources of the shelf	
Topic 2.1	Federal laws of the Russian Federation. Main provisions
Topic 2.2	International Maritime Organization (IMO). The main provisions of the International Conventions
Topic 2.3	Environmental provisions in the draft International Code for ships operating in Polar Waters (Polar Code)
Module 3 Environmental safety of the offshore oil and gas sector in the Arctic	
Topic 3.1	Regional features the functioning of the oil and gas sector in the Arctic
Topic 3.2	The objects of marine technology for work on the shelf and maintenance of drilling platforms and their features
Topic 3.3	Ensuring the safety of offshore pipelines and facilities in the oil and gas fields of the Arctic continental shelf
Module 4 International Protection Cooperation the marine environment of the arctic shelf	
Topic 4.1	Procedures and methods for environmental impact assessment (EIA) on the Arctic shelf
Topic 4.2	The main international organizations that develop joint solutions in the field of environmental safety of the development of shelf resources.

The content of the sections

Module 1 The main types and objects of marine economic activities on the Arctic shelf. Introduction. The goals and objectives of the course. The main types and objects of marine economic activity. Classification of environmental problems arising from the implementation of marine economic activities. Analysis of the modern structure and prospects for the development of maritime economic activities of the leading maritime powers - Russia, the USA, Japan and China. Classification of environmental problems arising from the implementation of various types of maritime economic activity, in relation to the spatial and temporal scale of negative impact, sectors of the economy, the severity of environmental damage, and the possibilities of its prompt elimination. The concept of dangerous and non-hazardous effects in the implementation of various types of maritime economic activity.

Module 2 Regulatory documents to ensure environmental safety in the development of the shelf's mineral resources. The main provisions of the federal laws of the Russian Federation, the



Guidelines of the Russian Maritime Register of Shipping (RMRS) in the field of ensuring the environmental safety of marine economic activities. The main provisions of the Federal Laws of the Russian Federation "On the Continental Shelf of the Russian Federation (No. 187-FZ)", on "Environmental Protection" (No. 7-FZ), as applied to ensuring the environmental safety of marine economic activities. Guidelines and regulations of the Russian Maritime Register of Shipping (RMRS) in the field of ensuring the structural reliability and environmental safety of marine equipment and those engaged in the extraction of hydrocarbons on the Arctic shelf. Guidelines and regulations of the Russian Maritime Register of Shipping (RMRS) in the field of ensuring the constructive reliability and environmental safety of river-sea vessels that fly on inland waterways.

Module 3 Environmental safety of the offshore oil and gas sector in the Arctic. Ensuring environmental safety in the functioning of the ports, the implementation of hydraulic construction and dredging in the coastal marine zone. The main environmental problems in coastal zones of Russia. The concept of coastal natural and man-made complexes. Ports and port facilities. Measures to prevent pollution of the marine environment in the process of loading and unloading of transport vessels - tankers, bulk carriers, etc. Technologies and equipment for environmental safety in the process of bunkering of marine fuel. Plans for the elimination of accidental spills of oil and petroleum products. Technologies and equipment for collecting oil and oil products from the surface of open water and in chipped ice. Technologies and equipment for the collection of oil and oil products when the coast is polluted. Concept of environmentally friendly seaport. Possibilities of satellite remote sensing technology for detecting spills of oil and petroleum products in the coastal marine zone.

Technologies and equipment to ensure environmental safety in the process of industrial production of oil, natural gas and methane hydrates in offshore fields. The location of the main offshore oil and gas regions within the exclusive economic zone and territorial waters of the Russian Federation in the waters of the Barents, Kara, Bering, Okhotsk. Modern activities for the development of hydrocarbon resources on the shelf of the Arctic seas. Drilling platforms and coastal offshore oil export terminals ("Varandey", "Arctic Gates"). Supply vessels and rescue support to drilling platforms, icebreakers and features of their operation. Underwater mining complexes and features of their operation. Technologies and equipment for environmental safety in the process of industrial oil production. Technologies and equipment for environmental safety in the process of industrial production of natural gas. Technologies and equipment for ensuring environmental safety in the process of potential industrial production of methane hydrates in offshore fields, based on the experience of Japan. The activities of public services and private companies to ensure environmental and technospheric safety in the development of the mineral resources of the Arctic.

Organizational and technological measures for rescue operations of ships in distress. Global satellite alert system for ships in distress. Possibilities for rendering assistance to ships in distress within the borders of the natural waters of states and in neutral waters. Specialized rescue vessels. Rescue helicopters and seaplanes. Organization and equipment of emergency rescue centers of the Ministry of Emergency Situations in the Arctic.

Module 4 International cooperation in the protection of the marine environment of the Arctic shelf

The main provisions of the International Conventions in the field of environmental safety of maritime economic activities under the auspices of the International Maritime Organization (IMO). International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and its Annexes. Convention on the Salvation of Human Life at Sea "(SOLAS 74), Concept of the Areas of



Restriction of Anthropogenic Activity (ROAD). The International Polar Code and its importance in the field of the protection of the marine environment from pollution and prevention of emergency situations.

Course assignments

Assignment #1 Consideration of the specifics of the implementation of the main types of maritime economic activities in the waters of the Baltic and Black Seas. Consideration of the main emerging environmental problems associated with maritime economic activities in the Baltic and Black Sea areas.

Assignment #2 Individual task. The main provisions of the Federal Law of the Russian Federation "On the Continental Shelf of the Russian Federation (No. 187-FZ)" in relation to ensuring the environmental safety of marine economic activities. Examples of realization. The concept of organizing an environmentally friendly seaport (based on the implementation of joint projects of the RSHU with Finland). Examples of realization.

Assignment #3 Individual task. The main provisions of the International Convention for the Prevention of Marine Pollution from Ships (MARPOL 73/78). Examples of implementation. The main provisions of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWC 2004). Examples of implementation. The International Polar Code and its importance in the protection of the marine environment from pollution and emergency prevention.

Assignment #4 Individual task. Supply and rescue vessels for drilling platforms, icebreaking fleet and features of their operation. Underwater mining complexes and features of their operation. Technologies and equipment to ensure environmental safety in the process of industrial oil production. Technologies and equipment to ensure environmental safety in the process of industrial extraction of natural gas.

Assignment #5 Individual task. Modern system of long-distance satellite communications "Inmarsat" and its capabilities for data transmission in the field of environmental and technospheric safety in the open ocean. Satellite communication system "ShipSat" and its capabilities for data transmission in the field of environmental and technospheric safety in the open ocean. The satellite communication system "Iridium" and its capabilities for data transmission in the field of environmental and technospheric safety in the Arctic.

Assignment #6 Individual task. Equipment and capabilities of modern domestic and foreign specialized rescue vessels to ensure the environmental and technospheric safety of navigation and offshore resource development activities, including in the arctic. Specialized rescue helicopters and seaplanes. Organizing and equipping emergency rescue centers of the Ministry of Emergency Situations in the Arctic.

Literature

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