



MODERN REQUIREMENTS FOR ECOLOGICAL TRAINING OF MARINE SPECIALISTS IN INSTITUTIONS OF HIGHER MARINE EDUCATION IN UKRAINE: REALITY AND PROSPECTS

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Abstract

Sea and river transport is international branch and the most important for the transport industry, but it is also the most dangerous, which is associated with a significant risk to the health of seafarers, when transporting dangerous goods, as well as with a high probability of causing significant damage to the environment. According to the conducted researches, seawater pollution in certain water areas of the coastal strip exceeds the maximum permissible concentrations of oil products, phosphorus, and phenols by an average of five times, which causes the death of animals and plants. A careful study of the causes specifies the impact of the quality of training and retraining of sailors on the preservation of the surrounding marine and river environment.

Keywords: ecological danger, maritime education of Ukraine, ecological awareness of a specialist.

Introduction

According to the United Nations Conference on Trade and Development (UNCTAD), 80% of goods and cargo by volume and 70% by value are transported by sea transport, which is more than 68,000 sea vessels. From the point of view of the ecological condition of the Azov and Black Seas, it remains extremely unsatisfactory. Volumes of discharge of polluting substances on the territory of Ukraine alone reach about 350,000 tons every year. The level of seawater pollution in certain water areas of the coastal strip exceeds the maximum permissible concentrations of oil products, phosphorus, and phenols by an average of five times, which causes the death of animals and plants [1]. The maritime doctrine of Ukraine for the period until 2035 defines that the most important national interests of the state at sea are meeting the needs of society, the economy, and the state in the use of sea resources, strengthening Ukraine's position among the leading maritime states, as well as ensuring security by:

prevention of pollution of the marine environment, effective environmental monitoring; achieving a state of the marine natural environment in the territorial waters and in the exclusive maritime economic zone of Ukraine, which corresponds to the concept of "good ecological state" in the sense of the Framework Directive of the European Union on Maritime Strategy, and maintaining such a state in the long term [5].

The hostilities consequences in the waters of the Black Sea and the accident of the fleet also significantly affect the environment and the ecological state of the environment, which is a critical factor for the world economy and the object of close attention of insurers. Multiple attacks on civilian and military ships, hostilities on and around Zmiiny Island, rocket attacks on gas drilling rigs, the impact of military operations on the population of sturgeon and other fish species in the Danube Biosphere Reserve led to the deterioration of the recreational conditions of the Black Sea. According to the results of a joint study of the Black Sea in 2019, the EU/UNDP project "Strengthening ecological monitoring of the Black Sea: selected measures" (EMBLAS - Plus) and the Ministry of Ecology and Natural Resources of Ukraine was published, the conclusions of which stated that the ecological state of the Black Sea is as follows: 83% of the garbage in the sea is plastic: polyethylene bags and bottles. The large rivers of Ukraine, the Danube, and the Dniester, carry from 6 to 50 units of garbage into the sea per hour. In the deposits, at a depth of 2000 meters, concentrations of some major harmful compounds were found, which pose a threat to the lives of marine animals and people and exceed accepted toxicity standards. Such compounds include benzopyrene, pesticides, mercury, and flame retardants. Additionally, compounds that are harmful to marine ecosystems have been identified, including persistent organic pollutants, metals, pesticides,



biocides, pharmaceuticals, and household chemicals. The concentration of these substances in seawater was not previously controlled, but now it is proposed to include them in regular studies (Urgent needs of education and science of Ukraine).

Military actions hinder ecological monitoring of the Black and Azov seas and damaged industrial facilities and settlements can be important sources of chemical pollution of the coastal and marine environment. Data from the "Ekodozor" platform indicate an increase in the number of reports of damage and destruction of coastal settlements with the development of military operations. They note that the main consequences of war for coastal and marine ecosystems include chemical and acoustic pollution, physical damage to natural habitats, and the decline of environmental protection activities.

Serious accidents due to the increase in the size of commercial sea vessels, namely container carriers, car carriers, and Ro-Ro vessels, have led to disproportionately high losses. According to statistics, such ships have a significantly high risk of emergency situations: fires, loss of containers, undeclared or incorrectly declared dangerous goods, too high costs for rescue operations, and other reasons make the problem of maritime safety the most priority and urgent in the assessment of the environmental safety of maritime shipping [2]. Sea and river transport is international and the most important among all the world's transport industries, and at the same time the most dangerous, which is associated with a significant risk to the health of seafarers, when transporting dangerous goods, as well as with a high probability of causing significant damage to the environment. The introduction into shipping of new information technologies, automated control systems, modern ship equipment, raising the requirements for the training of ship operation specialists, according to the official statistics of emergency events by the International Maritime Organization (IMO) to the level of emergency in the merchant fleet in recent years, did not change the situation.

The financial losses associated with environmental pollution during marine ship accidents were estimated at about 540 million US dollars per year [3]. However, some circumstances of accidents remain unexplained, which leaves expanse for new scientific research. In particular, along with such causes of accidents as weather conditions, ship's technical condition and equipment, dangerous cargo, the role of coastal infrastructure, force majeure situations require a more detailed development of the characteristics of the influence of the human factor. In addition, there are a number of studies that specify the impact of the quality of training and retraining of seafarers, as well as other professionals who are engaged in marine environmental protection activities.

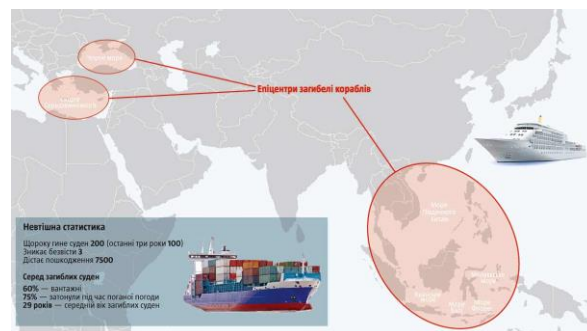


Fig. 1 Statistics of emergency situations on sea transport

The European Maritime Safety Agency (EMSA) notes that 67% of accidents are caused by operator errors [9]. Also, EMSA operates with such a definition as an incident and records the following "number of workplace incidents" for EU countries in annual terms: 2011 - 373, 2012 - 684, 2013 - 891, 2014 – 978 [8].

The purpose of our research is to determine modern approaches to the formation of environmental responsibility of future marine specialists in the process of vocational training in institutions of higher maritime education.

The maritime doctrine of Ukraine for the period until 2035 clearly stated that maintaining the personnel potential of Ukrainian seafarers at a competitive world level is possible only through proper: fulfillment of the requirements of the International Convention on the Training and Certification of Seafarers and Watchkeeping, the International Convention on Standards of Training, The STCW-F Convention, bringing national standards related to knowledge and specialties, according to which higher education students are trained, into compliance with the specified conventions; implementation of special training and advanced training of team members in higher education institutions; development and implementation of a comprehensive plan for updating the personnel potential of maritime transport in accordance with the innovative model of development of the maritime industry, restoration of the system of post-graduate training of specialists; ensuring high social standards for seafarers [4].

In order to preserve and increase the potential of the national higher education system and professional pre-higher education, according to the Operational Plan for the implementation in 2022–2024 of the Strategy for the Development of Higher Education in Ukraine for 2022–2032: the Order of the Cabinet of Ministers of Ukraine dated 23.02.2022 №. 286-r. for the ability to form high-quality human capital and ensure the innovative character of processes in society, it is necessary to make maximum efforts for:

- creation of an effective management system in the professional pre-university and higher education, transforming them into socially responsible branches of vocational training;
- formation of trust of citizens, the state, and business in the educational, scientific, innovative activities of educational institutions;

- ensuring the proper quality of educational and scientific activities of institutions of education, the competitiveness of the mentioned branches of education, their accessibility for different segments of the population (Urgent needs of education and science of Ukraine) [7].

Significant complication of the situation in the areas of the maritime water area of Ukraine, where hostilities are taking place and institutions of higher education of maritime transport are located (Odesa, Mykolaiv, Kherson, Mariupol) and many of which have been moved to other educational institutions in safe areas, while others have suffered considerable damage. Thus, maritime education of Ukraine turned out to be in difficult operating conditions.

However, maritime education continues to work on the fulfillment of the tasks, which are very important at this time and require significant efforts, namely:

- changing the approach to conducting classes using material related to environmental protection from professional disciplines, first of all, when working out laboratory and practical works;
- upgrading the training and material base with modern training equipment, simulation, and methodical support to meet the requirements of the 1978 International Convention on the Training and Certification of Seafarers and Watchkeeping (as amended) (Convention on the Training and Certification of Seafarers and Watchkeeping of 1978, 2012), as well as resolutions for the preservation of the environment and ecological safety;
- the use of production bases of enterprises and crewing agencies to acquaint students with environmental protection measures during technological and swimming practice, etc. [6].

Significant changes in maritime education are associated not only with the introduction of automated modern vessels but also with the increase in employers' requirements for the professional competence of maritime specialists, first of all: they must perform their duties clearly according to the requirements of the STCW Convention, taking into account the presence of hostilities in dangerous swimming areas; impossibility of long-term adaptation on the ship; familiarization in a short time with software and IT technologies on new generation ships; work in reduced ship crews from the minimum number, which caused an increase in responsibility for the ship's security system in the conditions of hostilities; significant sanctions for non-compliance with environmental safety requirements as part of their professional duties, as required by the International Maritime Dangerous Goods (IMDG) Code (as amended).

Referring to the decisions of the 18th IMO Assembly (1993), when Resolution A.741(18) adopted the "International Code for the Management of the Safe Operation of Ships and Prevention of Pollution" ISM Code (ISM Code), the purpose of which was to create a standard for the management system of

safe navigation ships, the introduction of the Management System Standard was supposed not only to guarantee the safety of ship navigation and environmental protection but also to significantly simplify the control over the preparation of the ship for the voyage. In addition, Resolution A.787 (19) was implemented in 1995, which defined the organizational principles of the ship control system, namely: "Port State Ship Control Procedures" (adopted on November 23, 1995).

Like the previous ones, this resolution set the main task of raising the standards of professionalism, achieving and maintaining high standards of maritime safety, saving human life and property at sea, and protecting the environment. However, such changes required additions to the standards of the maritime education system, changes to the assessment of competence and certification of seafarers, as well as the definition of requirements for crew members to ensure environmental protection at sea.

They were partially implemented, but they did not solve the problems of environmental protection and environmental safety. After all, during this period, a generation came to work, whose goal is mainly economic indicators, and not ecological results of their activities. This attitude, especially in the maritime industry, is reflected in the decision-making by shipowners when planning cargo transportation, not for the benefit of the environment, but for the company's profit. The experience of the past decades has clearly shown that it is impossible to overcome and even significantly reduce environmental hazards in the maritime industry by technical means alone. In order to change the tendency of increasing environmental disasters at sea, it is necessary to rebuild the way of thinking of specialists who will operate sea vessels, and this is possible only by introducing into the educational process scientifically based rules of human behavior in the environment and their gradual implementation starting from the first courses of study to obtaining a specialist diploma. There is no doubt that the modern system of maritime education will fully function according to the requirements and rules that suit the leaders of the industry, and they, due to political debates, disputes, distribution of profits, wars, pirate threats, ignore the proposals of scientists, educators, ecologists.

Despite this, institutions of higher maritime education work according to programs that clearly state international requirements for environmental protection in individual disciplines of the specialty 271. 01 "Management of ship technical systems and complexes", namely: "Human safety and environmental protection" on in the second year and "Prevention of pollution of the marine environment" in the third year. However, this is too little and does not solve the problem of environmental safety. At the Danube Institute of the National University "Odesa Maritime Academy" at the Engineering Department, a new approach to the formation of environmental awareness among future specialists in the specialty 271 "Marine and Inland Water Transport" was developed by supplementing each professional discipline with additional material on ensuring environmental protection under the conditions performance of professional duties on the

ship. Becoming a qualified specialist and forming an ecological worldview, thinking through the prism of environmental safety in the process of independently fulfilling the requirements of the STCW Convention, according to the experience of national and international shipping companies, is a rather complex and long process that requires the accumulation of certain work experience in the process of production and sailing practice on the ship, additional professional knowledge, abilities and skills in performing their functions in dangerous and emergency situations and, most importantly, developed personal qualities, such as making responsible decisions, business activity, energy, the ability to work in multinational crews and others. In accordance with the requirements of the minimum standards of competence of both the management level and the level of operation (tables A-II/1 and A-II/2), the Convention and the Code of STCW include competencies related to the ability to work in a team, preservation of the environment.

With this approach, the professors and teaching staff of the department had to solve the following tasks:

- to ensure the optimization of the educational process, which includes: updating of work programs from professional disciplines with correction for the final result on ecological protection of the environment;
- thorough updating of educational and methodological support due to the elimination of duplication of topics from other disciplines, on topics of environmental safety;
- a clear logical mastering of the educational component, guided by the addition of theoretical knowledge by demonstration methods for mastering means of marine environment pollution and situations that arise in the process of performing professional duties on a ship.

All optimization measures were carried out in compliance with the requirements of STCW.

It should be emphasized that the optimization of the educational process of forming the environmental consciousness of the future specialist takes place with the use of training equipment in the composition of ICT, in a special informational and pedagogical environment that requires significant didactic and methodical training, namely:

- the formation of maritime experience is based on maritime traditions, through interaction with practicing teachers who are participants in the educational process and are involved in professional education at the department and have significant experience working on modern-type vessels as part of multinational crews;
- identification of structural and logical connections between the information provided in theoretical classes about the environmental hazards of work on ships, where pollution of the water area is possible and ways to prevent it, during practical practice of these works on modern training equipment as part of ICT;

- future specialists making independent decisions and taking personal responsibility for actions in situations of environmental threats and demonstrating their elimination on training equipment;
- development and introduction into the educational process of integrated educational systems, complexes, and technologies of virtual reality, which enables the learner to enter the simulated computer world and interact not only with the virtual ship but also with the abstract external space (seawater area, other ships, weather conditions, emergency situations, etc.).

As part of a common approach to the formation of environmental awareness of future marine specialists, the "Methodological complex for ensuring environmental protection from engineering disciplines of the department" was developed as an aid to teachers in the educational process. Such a complex includes the following stages of environmental consciousness formation:

- preparation of the teacher to conduct classes taking into account the environmental requirements of this field;
- formation of a system of abilities and skills (competencies) and a strategy of interaction with the environment in order to act ecologically expediently in emergency and dangerous situations;
- formation of an adequate idea when studying a professional subject about relationships in the system "man - vessel - environment" in professional activity;
- formation of relationships during the study of a professional subject in the aspect of preparing future specialists to learn material from the following special disciplines;
- formation of the attitude of future specialists to the preservation of the environment when performing their professional duties during technological and swimming practice;
- the formation of independence and the desire to study the materials of conventions (STCW, MARPOL 73/78, etc.), resolutions (IMO MEPC.328 (76), IMO MEPC/Circ.368, IMO MEPC/ Circ.354, IMO MEPC/ Circ. 310, etc.) and memoranda (Paris MOU, WC MOU, etc.);
- formation of interest in environmental issues, value-ecological orientation, motivation to preserve the environment;
- participation in scientific and practical conferences, interdepartmental seminars, symposia, preparation of theses, reports, work in scientific research groups, etc.)

The introduction of this methodological complex for the formation of environmental awareness of the future marine engineers and navigators (specialty 271 "Marine and inland water transport"), through the solution of specific situations, according to the methods developed for different operating

conditions of the vessel, with the use of training equipment, provides an opportunity to combine theoretical knowledge and practical skills in the course of study through the assessment of formation according to the criteria and indicators provided in the "Demonstration methods" section of the STCW Convention. According to this approach, it is possible to form the environmental consciousness of a marine specialists as a certain type of engineering thinking and, subsequently, to develop and improve it in the process of gaining professional experience.

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