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PROFESSIONAL COMPETENCE OF SHIP'S OPERATORS AS CHEMICAL SAFETY PREDICTOR IN THE MARITIME DANGEROUS GOODS TRANSPORT

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ПРОФЕССИОНАЛЬНАЯ КОМПЕТЕНТНОСТЬ СУДОВЫХ ОПЕРАТОРОВ КАК ПРЕДИКТОР ХИМИЧЕСКОЙ БЕЗОПАСНОСТИ ПРИ МОРСКИХ ПЕРЕВОЗКАХ ОПАСНЫХ ГРУЗОВ

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ПРОФЕСІЙНА КОМПЕТЕНТНІСТЬ СУДНОВИХ ОПЕРАТОРІВ ЯК ПРЕДИКТОР ХІМІЧНОЇ БЕЗПЕКИ У МОРСЬКОМУ ПЕРЕВЕЗЕННІ НЕБЕЗПЕЧНИХ ВАНТАЖІВ

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Резюме (Summary)

Морские перевозки опасных грузов связаны с профессионально обусловленным контактом с вредными химическими факторами, высоким риском для здоровья и жизни моряков, а также интенсивным загрязнением окружающей среды. Поэтому процесс формирования профессиональной компетентности членов судовых экипажей, в первую очередь, операторов, должен включать в себя ряд здоровьесберегающих компетенций, информативной характеристикой которые, наряду с медицинскими показателями, является психофизиологический статус моряка. По результатам исследований разработаны и внедрены в практику рекомендации по повышению эффективности формирования у курсантов и плавсостава здоровьесберегающих компетенций путем углубленного изучения особенностей химической опасности на судах разных типов, ее индикации, мер домедицинской помощи при отравлениях, способов профилактики, повышения устойчивости к стрессу на основе современных технологий сохранения здоровья моряков.

***Ключевые слова*:** моряки, химическая опасность, опасные грузы, оценка здоровьесберегающих компетенций, профессиональная компетентность, психофизиологические паттерны.

Морські перевезення небезпечних вантажів пов'язані з професійно обумовленим контактом з шкідливими хімічними факторами, високим ризиком для здоров'я і життя моряків, а також інтенсивним забрудненням навколишнього середовища. Тому процес формування професійної компетентності членів суднових екіпажів, в першу чергу, операторів, повинен включати в себе ряд здоров'язберігаючих компетенцій, інформативною характеристикою яких, поряд з медичними показниками, є психофізіологічний статус моряка. За результатами досліджень розроблені і впроваджені в практику рекомендації щодо підвищення ефективності формування у курсантів і плавскладу здоров'язберігаючих компетенцій шляхом поглибленого вивчення особливостей хімічної небезпеки на судах різних типів, її індикації, заходів домедичної допомоги при отруєннях, способів профілактики, підвищення стійкості до стресу на основі сучасних технологій збереження здоров'я моряків.

Ключові слова: моряки, хімічна небезпека, небезпечні вантажі, оцінка здоров'язберігаючих компетенцій, професійна компетентність, психофізіологічні патерни.

Maritime transport of dangerous goods is associated with occupationally conditioned contact with harmful chemical factors, a high risk for the health and life of seafarers, as well as intensive pollution of the environment. Therefore, the process of forming the professional competence of ship crew members, primarily, ship operators, have to include a number of health-saving competences, an informative characteristic that, along with medical indicators, include the psycho-physiological status of seaman. Based on the received results of the research, recommendations have been developed and implemented into the practice to improve the effectiveness of the health-saving competencies formation through in-depth study of the chemical hazard on various types of ships, its indications, measures of home-care for poisoning, prevention methods, increasing resistance to stress on the basis of modern technologies preservation of seamens' health.

Key words: seafarers, dangerous goods, chemical hazard, health-saving competence, professional competence assessment, psycho-physiological patterns

Introduction

The outstripping growth of all types of transport is one of the requirements for the sustainable world economic development in the first half of the 21st century. Seven of the 17 of the United Nations goals for this period include one or more items dealing with transport. They cover such aspects of safety as maintaining the health of workers and the population, and reducing the risk of environmental pollution [1]. Since more than 80 % of international shipments are conducted by sea, the safety problem in this sector of the transport means is extremely urgent. The modern merchant marine has about 75,000 vessels, which annually transport more than 7 billion tons of cargos, 2/3 of them refer to the category of hazardous [2].

To the dangerous goods (OG), in accordance with both national and international regulatory documents, include substances, materials and goods with hazardous properties, the manifestation of which in the transport process can lead to human disease, trauma, poisoning, radioactive exposure, death, as well as to

explosion, fire and structures, vehicles damage and environmental pollution [3]. Therefore, one of the main tasks solved by the ships' crew in the course of their professional activities during DG transportation, along with the safety of navigation, efficiency of the transport process, the timely delivery and safety of the cargo, is to ensure the safety of people, the vessel and the environment in conditions of increased potential risk of chemical danger.

Already the heterogeneity of transport facilities itself (universal and specialized ships), sources of danger (more than 10000 items carried in bulk, containers and packaging of DG), differences in hazardous physical and chemical properties and toxicity, make the task of comprehensive safety complex and multispectral. However, as analysis of emergent situations on maritime transport shows the dominant role of crew members' errors (mainly ship operators) in average of 70 % of all maritime accidents, due to the "human factor". [4]. This rating for many years has circled round and round from one publication to another practically without revealing the essence of the phenomenon. This fact is one of the explanations that for decades accidents in the international maritime industry remain high, but the cause-and-effect relationships are still uncertain. The task of quantitative and qualitative chemical hazard assessment, the role of the human factor in relation to the marine fleet, and even more to the maritime complex as a whole, remains unresolved, although many attempts are being made to create similar methods and models [5]. There are a number of limitations that hinder the solution of this problem. Among them, such as a significant number of different in nature, pattern and time of impact, initiating the development of an emergency situation of natural, industrial and personal factors; the degree of the ship's operators professional competence and training, the coherence of the work of the ship's crew, economic interests and the relationship of the shipping company, cargo owners and other involved organizations. A multilink logistics chain is built up, in which the properties of the cargo being transported, the transportation technologies, the type of vessel and the many other conditions, are closely interconnected [6].

The initial position in this scheme by the carried dangerous goods is taken. If on universal dry-cargo vessels the crew contacts with the stowed DG practically only in emergency situations, then on specialized ships (bulk carriers, gas carriers, tankers, chemical carriers), it takes place even in regular operating conditions, since there is practically constant contamination of the air environment of ship spaces by harmful vapors, gases, aerosols, the appearance of which is determined by the type and properties of the goods and transportation technology. This paradigm, reflecting the specifics of modern maritime labor, deals with the problem of the transportation of exhaust gases, since the dominant chemical danger leads not only (and not so much) to a change of professionally important competences, as to the need to revise their revision of their semantic content and transfer of accents (reordering) of some components of professional competence of ship's operator. In the operational plan (in each specific voyage), it is necessary to update certain competencies, including, first of all, taking into account the dangerous properties of the goods being transported and the features of the navigation area. However, from the EMSA reports (European Maritime Safety agency) [7], from the results of conducted by H.L Hansen et al. [8], X. Baur et al. [9], B. Loddй et al. [10] and other authors the meta-analysis, it is possible to make a conclusion that pre-training and current work on the formation and maintenance of a professional dynamic stereotype to ensure collective and personal security (train-

ings, training alarms) sometimes are conducted formally and in a very limited scope. At the same time, the list of functional duties of the members of the reduced to a minimum ship's crew significantly increases. Therefore, the cases of injuries, poisoning and death of people are often not directly related to the causes, technical conditions and scenario of emergencies, but with inadequate actions (or lack of them) on the part of the crew members, i.e. to the "human factor" that has been already mentioned above. This important aspect of the problem, despite the research conducted in different countries, remains very uncertain.

Its integrated solution requires further systematic work of scientists and specialists of various profiles, including the formation and maintenance of professional competence, ensuring the continuous professional development of the crew members, and, above all, the command level — ship's operators in chemical safety issues.

Therefore, ***the purpose*** of this research was to study the conditions of the transport of exhaust gases on vessels of different types as sources of chemical hazards, their impact on the actualization of the substantive and operational components of the professional competence of ship operators to improve the effective protection of seafarers' health and prevent marine pollution from ships.

Materials and methods

The research was conducted among 242 seamen, aged 19-40 years, including 65 ship navigators (SN), 68 ship mechanics (SMCH), as well as 209 cadets (CAD) of the National University "Odessa Maritime Academy" — NUOMA (94 navigators and 115 mechanics) were under observation; held the work practice on specialized marine transport vessels (bulkers, oil tankers, gas and chemical carriers). All those surveyed on a voluntary basis in compliance with the requirements of bioethics [11], filled out questionnaires on working conditions, various aspects of life activity in the ship's team, and underwent a comprehensive psycho-physiological survey on the computerized program "Mortest" in the modification "Spas-14" [12]. In addition to the obtained indices, with the help of the "Mortest" program the integral coefficient of stress resistance (ICSR) was calculated [13]. Moreover, the data from the experts' assessment of the training and production activities of surveyed seamen and cadets made by NUOMA lecturers and ships' administration, personal data on the results of determining the content of harmful fumes, gases and aerosols in the air of ship spaces and in the area of cargo operations, the state of health of seamen on ships of a specialized fleet were used in the research. The results were processed statistically by variation and correlation analysis methods using a standard software package in Microsoft Excel [14].

Results and discussion

As shown by the materials of our earlier studies [15] and literature data [16,17], among ship's sources of chemical hazard (exhaust gases and aerosols in the operation of main and auxiliary engines, process fluids, paint, polymer and synthetic materials, dangerous goods), the last (DG) for the source's power, the variety of hazard types, toxicological-hygienic and ecological importance exceed the others significantly. Moreover, if on universal dry cargo vessels and container ships, the release of cargo of harmful chemicals in active concentrations dangerous for human health and life takes place only in emergency situations, than on ships of a specialized fleet where the process of migration of harmful vapors and gases occurs almost continuously at all stages of transportation, and on gas carriers, chemical tankers and tankers with non-carbonated tanks, even when they are in ballast. Therefore, the concept

of transport danger should be differentiated according to the nomenclature of transported DG in accordance with the UN classification [18], types of vessels, stages of the transport process (loading — crossing the sea with cargo on board — unloading — crossing by sea in ballast — cleaning of holds — washing and decontamination of tanks).

In this context, the chemical danger for crew members and other categories of workers in contact with DG (dockers, inspectors, workers of neighboring cargo complexes, etc.) is defined as the risk of acute and chronic poisoning, diseases of chemical etiology, disability and functional health disorders, hindering effective labor activity, regulated by official professional duties and normative documents, first of all, STCW 78/95 [19]. The high risk of chemical hazard in emergency situations on specialized vessels depends on the number of one-time on-board exhaust gas (thousands of tons), which initially determines the attribution of such accidents to the category of large-scale probable consequences, material losses, as well as the number of injuries, poisonings, diseases and people deaths. At the same time, as a rule, the number of people who received physical, chemical and mental injuries is 2-3 times more than the number of deaths. Chemical hazards in emergency situations on the board of ships can be secondary (the toxicity of combustion products in the air of ship premises, vapors of fire extinguishers, the accumulation of intermediate and final combustion products, chemical and biological oxidation (CO, CO_2, NO_2, SO_2, H_2S, etc.).

Over the past decades, thanks to the innovative technologies, mechanization and automation of cargo operations and means of managing of the cargo system, improvement of the collective protection systems, it has been possible to significantly reduce the levels of chemical pollution in the ship's premises and on the open decks of tankers, gas carriers and chemical tankers. The data of the long-term studies carried out with the participation of the authors, can be served as an illustration of this provision summarized in Table 1.

From the data presented in the table it can be seen that thanks to the collective efforts of shipbuilders, operators and hygienists, the level of chemical danger on gas-carrier ships has decreased by an inhalation component in normal operating conditions by almost an order of magnitude. Nevertheless, the determined indicators are very dynamic and vary significantly depending on the area of navigation (temperate latitudes, tropics), meteorological factors (temperature and humidity, wind direction and speed), and the stages of the voyage.

The last statement clearly illustrates the results of the determination of the concentrations of ammonia in the air of the ship's premises during the voyage on the "Lensovet" gas carrier (Fig.1). The general view of the graph is consistent with data on other gas carriers, as well as chemical carriers like the "V. Merkuriev", tankers type of the "Pablo Neruda" type and other oil tankers for various types transportation of dangerous goods.

On bulk carriers transporting bulk cargo, a harmful chemical factor is associated primarily with high dust content during handling operations in ports. However, the constantly increasing grain transportation, which as a rule requires fumigation (gas disinfestation for the destruc-

Table 1

Average daily concentrations of ammonia in the air of ship spaces on gas carriers of three generations in voyages

Premises of the ship	Ships-gas carriers 1 — 3 generations		
	"Kegums"	"Jurmala"	"Mossovet"
Production	11,2 ± 1,45	8,5 ± 1,12	1,2 ± 0,24
Service	4,6 ± 0,61	0,84 ± 0,057	0,34 ± 0,032
Residential	1,3 ± 0,18	0,48 ± 0,073	0,15 ± 0,011

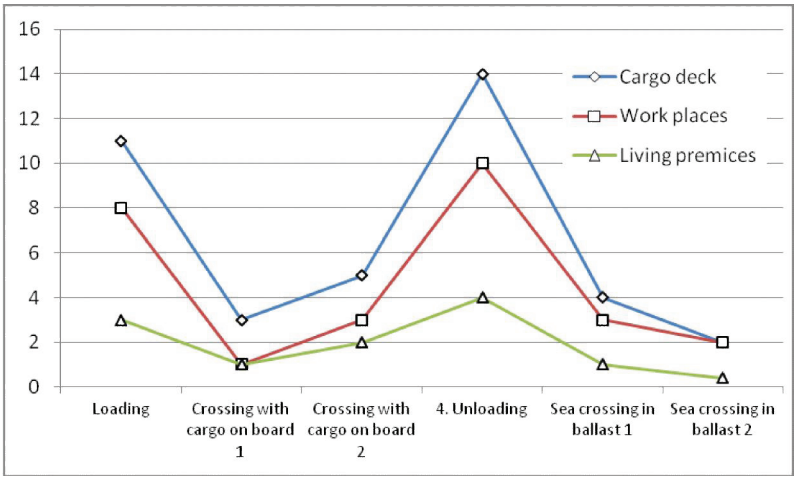

Fig. 1. Dynamics of ammonia concentrations (mg/m^3) in the ship's spaces of the gas carrier at different stages of the voyage.

tion of insects — pests of stocks), led to the emergence of an additional dangerous chemical factor — fumigants, which are highly toxic chemicals (phosphine, bromomethyl, sulphuryl fluoride etc.) [20]. They have high volatility and with insufficiently reliable sealing of cargo holds can flow into the living and service spaces of the vessel, creating a danger for the health and life of the crew members. It is the presence of cumulative high risks that affects the indices of subjective evaluation of working conditions and labor process on specialized transport vessels on a voyage by seafarers (Tabl. 2).

The surveyed seamen are clearly watching the appearance of the signal (concepts, images) that are associated with the notion, meaning "ship's harmful factor" (the first four columns of the table), or the performance-oriented side of professional activity (the last two columns). The revealed differences are caused either by professional importance or by a previously formed view of the degree or danger of the observed factor. The higher estimation of noise and vibration factors is explained by SMCH not only from the point of view of personal safety (higher levels in the engine room), but also taking into account the use of the sound signals perceived by the acoustic analyzer and the rhythmic vibrations of the ship hull as indicators of the quality and operating mode of the main engine, generators and other noise and vibrations generating systems. Chemical and dust factors in this regard have a lower rating for SMCH, since the main sources of harmful chemicals release are on open decks and directly affect the composition of the air

Table 2

Respondents' assessments of the harmful production factors impact on well-being and work performance according to 5-point scale

Type of vessel	Respondent	Chemical air contamin.	Dust	Noise	Vibration	Labor severity	Labor intensity
Bulk carrier	SN	2,12 ± 0,182	3,16 ± 0,168	2,48 ± 0,140	2,37 ± 0,151	2,81 ± 0,142	2,98 ± 0,150
	SMCH	2,63 ± 0,194	2,89 ± 0,166	3,01 ± 0,166	2,78 ± 0,164	2,75 ± 0,175	2,56 ± 0,169
Gas carrier	SN	3,33 ± 0,530	1,29 ± 0,102	2,20 ± 0,224	2,20 ± 0,224	2,60 ± 0,671	3,20 ± 0,248
	SMCH	3,00 ± 0,293	0,84 ± 0,063	3,19 ± 0,286	2,94 ± 0,333	3,19 ± 0,316	3,13 ± 0,296
Oil tanker	SN	2,86 ± 0,201	1,08 ± 0,072	2,89 ± 0,412	2,00 ± 0,193	2,44 ± 0,400	2,78 ± 0,295
	SMCH	3,00 ± 0,265	1,46 ± 0,174	3,04 ± 0,300	2,63 ± 0,205	2,75 ± 0,303	3,14 ± 0,300
Chemical carrier	SN	3,33 ± 0,530	1,02 ± 0,084	2,13 ± 0,148	2,47 ± 0,170	2,49 ± 0,173	2,82 ± 0,172
	SMCH	2,94 ± 0,312	1,16 ± 0,097	3,05 ± 0,187	2,84 ± 0,182	2,93 ± 0,161	2,95 ± 0,163
Container ship	SN	1,67 ± 0,156	1,42 ± 0,136	2,78 ± 0,224	3,00 ± 0,233	2,94 ± 0,242	4,13 ± 0,237
	SMCH	2,35 ± 0,215	1,76 ± 0,175	3,33 ± 0,216	3,18 ± 0,209	2,87 ± 0,185	3,02 ± 0,283

environment of the navigation complex.

From the presented in the table data, it can be seen that seafarers' assessment of working conditions on sea transport vessels varies over a wide range of values (the differences are ± 3.39 points). This indicates their differentiated perception of the factors of the ship's environment and the labor process, as well as the desire of the respondents to cooperate with researchers in the being carried out work. There is a clear correlation between assessments with the type of vessel and the profession of the operator. Thus, the labor intensity of SN on container ships is 1.5 times higher than in tankers, noise at SMCH workplaces is estimated at 25 % than SN. This puts forward the task of taking into account the specifics of the type of vessel and profession in training seamen to ensure safety and the implementation of health-saving competencies in sea voyages.

It is also important to note that the understanding of ship operators of the degree of danger, in particular, chemical factor, is mainly in the field of occupational safety at a quite uncertain attitude with regard to the probability of poisoning, diseases, risk for life, especially among the crews of bulk carriers and container ships. Lack of a clear health-competence in this category of seafarers corresponds with cases of poisoning, including fatalities, for example, during fumed transportation of grain and dangerous goods in containers. Thus, according to J. Ellis [21], up to 15 % of all fatal accidents among the crew are accounted for by container ships. The author draws attention to incorrectly stated documents, placement on board containers and non-professional actions of crew members. More than 27 % of all recorded serious incidents on board container vessels in 2013-2014 were due to improper acceptance of goods, i.e. also in connection with the "human factor". Proof of the correctness of this conclusion is the sad experience of the fire on board the container ship "Charlotte Maersk", caused by the ignition of calcium hypochlorite, which was transported in containers called "bleaching powder", "bleach" or simply "disinfectant", which led to a series of fires in a number of container ships. The discrepancies between the IMDG Code and ship documents did not cause any reaction from brokers or responsible crew members [22]. A similar situation was studied by the authors of this article in analyzing the consequences of a container explosion with fumigant preparations (aluminum phosphide and zinc) on board a container vessel "Maersk Kinloos" in the port of Chernomorsk (Illichevsk), where the documentation also did not match the DG in the container [23]. The cargo security control of the members of the container ships' crews is primarily associated with the need for rational placement (stability of the ship) and fastening (displacement and threat of falling overboard) of the containers. Hazardous chemical air pollution, fire and explosion hazard are usually assessed as less critical characteristics, mainly "from own experience". In this regard, often manifests compensatory substitution tendency as the lack of knowledge and experience leads to illegal actions, whether it is a careful analysis of documentation on the exhaust-gas holding operating personnel training, the use of personal protective equipment, etc.

Almost the same situation occurs when grain is fumigated on board of bulkers. Not by chance, that exactly in such cases there are emergency situations on board and poisoning among crew members, including fatalities. Authors of this article (together with Prof. E. Belobrov and Ph.D. S. Sidorenko) collected and summarized the statistical data on phosphine poisoning in the ports of Ukraine in marine fumigation, which are given in Table. 3.

The first feature resulting from the table is the absence of phosphine poison-

ing among fumigators (passing special courses, personal safety and maintaining health as a dominant professional activity). In seafarers, even working on bulk carriers with a high risk of PH_3 poisoning, there is practically no readiness for activities in extreme situations (health-saving competence). In this case, the appearance of the first symptoms of poisoning, as a rule, does not cause the seamen to properly mobilize, activate and adequately act. Lost time is a sad result.

The second position: significant claims are also to the administration of ships and fumigators on the technology of disinsection at all stages of the process. And the third. Carrying out cargo operations in ports with dusty DG is associated with high dustiness of the air. However, even the watchmen at the ship gangway do not use respirators or other personal respiratory protective equipment (PRPE), which creates the risk of respiratory diseases.

The conducted analysis of the documentation and selective survey of crew members showed that with satisfactory overall professional competence of seafarers, the presence of necessary professional qualities, personal safety issues, knowledge of dangerous properties of transported goods and fumigants, readiness for the first self- and mutual assistance in poisoning and other emergency situations (fire, explosion), i.e. health-saving competencies, remain virtually unresolved. This is manifested in low rates of psycho-physiological status and stress resistance in 15-20 % of seamen and cadets.

Confirmation of the productivity of the concept of professional competence as an integrated product of professional education and work experience on ships is the consideration of assessments of the same indicators of working conditions and labor process by cadets of marine academies during their sea working practice. The analysis of the materials of the questionnaires testifies the presence of a number of features in the responses compared to the crew members of vessels of the same types. The main feature is the heterogeneity of the general orientation of cadets' assessments of working conditions, which made it possible to subdivide them into the groups: with a predominantly positive (76.4 ± 8.2 %) or negative (22.6 ± 3.5 %) overall assessment and a desire to work in the future on ships of specialized fleet. At the same time, the level of negativism (lower scores) correlated mainly with the age of the ship, while the cadets' assessments are more closely related to certain types of vessels (gas carriers and chemical carriers operating on the "short shoulder").

The chemical factor dominates sharply in the questionnaires of cadets who have been working on gas carriers, chemical tankers and oil tankers, while on other types of vessels this factor is not statistically significantly different from other industrial hazards. And in these cases, assessments of the impact on the body of the factors of the ship's environment are significantly different for those who have been practicing on regular positions like a crew member (K-1), and those who

Table 3

Examples of seamen poisonings by phosphine (PH_3) during maritime fumigation in the ports of Ukraine

Port, ship, cargo, number, place of fumigation	Contingents, number of poisoned	
	Fumigators	Seamen*
Yalta, m / v "Roksolana", bran 3000 t, fumigated in Mariupol	0	9/2
Lom, Bolgpria, mais 5000 t, fumigated in port Berislav	0	14/0
Yuzhny, m / v "St. Stefan ", barley, 48000 tons, Yuzhny	0	6/2
Mariupol, "DM-1000" barge, vessel degassing	0	2/2
Total:	0	22/4

Note: * / — num. — total poisoned, denom. — incl. fatal

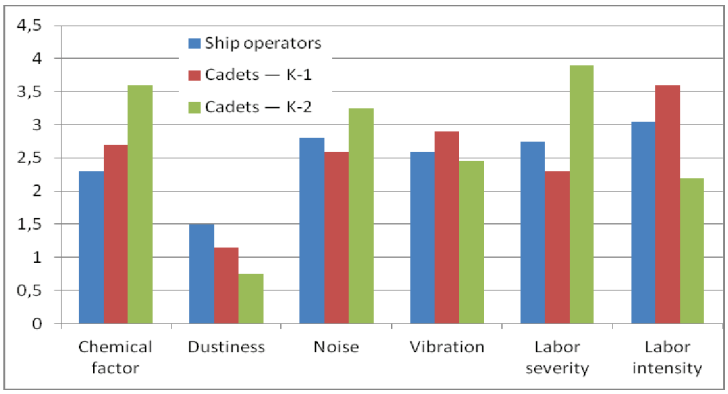

Fig. 2. The results of the assessment of the effect of working conditions on the cadets' organism during the sea practice, compared with ship operators (the chemical factor for gas carriers, tankers and chemical carriers).

sailed as the trainee (K-2), as it seen in Fig. 2.

From the presented in Figure 2 data, there are flow out not only two clear positions regarding the differences in assessments of working conditions between cadets and crew members, as well as between trainees in established positions and K-2 cadets, but also a number of important conclusions about the chemical component of professional competence. At first, the overall negative evaluation of working conditions for the position of cadets is much higher ($p < 0.05$) than for crew members. Secondly, the sequence (ranks) should be correlated with the values of other individually assessed factors. In particular, the cadets of both groups react more intensively to chemical air pollution in the ship's premises then on the deck. Thirdly, subjective assessments by the cadets of the negative impact on health and working conditions of working conditions and labor process were correlated back to the ICSR (integral coefficient of stress-resistance; r = -0.67 — -0.83, $p < 0.05$). This allows us to consider the coefficient as a promising marker in assessing the professional competence of future ship officers. Fourthly, on the question: "Do you want to work on ships of this type?" the respondents gave a negative response in the group K-2 in 78,3 % of cases. This may be indicative not so much of really dangerous and harmful working conditions as of the lack of professional competence of future seamen for successful work in the chemical component of the transport process (on specialized courts.) Unfortunately, there is a poor knowledge of the nature and conditions for the realization of the danger of the goods being transported, and the availability and full use of reliable means of collective and individual protection (taking into account the requirements of safety and preventive measures).

This conclusion also follows from the results of a special questionnaire survey on chemical safety, as well as comparative psychophysiological studies on the previously proposed scheme during the preparation and delivery of offsets in full-scale simulators. The questionnaires contained 15 questions, differentiated into three groups: cargo, ship, chemical safety. The answers were evaluated on a 5-point system and after addition they gave a low (< 45), medium (46-60) and high (> 60 points) assessment. The results are shown in Table. 4.

From the data presented in the table it can be seen that the main contingent of cadets after passing through the practice showed good knowledge of chemical safety on ships carrying DG (near 90 %). In the same time, only 75.4

Table 4

Distribution of cadets by groups in terms of chemical safety competence formation after passing the sea practice

	Group K-1		Group K-2	
Level of competece	Number of points	Distribution by groups %	Number of points	Distribution by groups %
1. Low	42,5 ± 3,5	10,3	36,8 ± 3,1	19,3
2. Medium	56,4 ± 3,9	38,1	53,4 ± 3,7	55,4
3. High	71,1 ± 4,4	51,6	64,1 ± 4,2	25,3

% of SN and 64.4 % of SMCH showed satisfactory knowledges, which corresponded with expert assessments of lectures and ship administration. Probably, the mobilization of psychophysiological functions and the actualization of professionally important qualities associated with getting on the voyage, the implementation of the practice program, the daily training and communication in the international crew, as well as participation in the everyday training programs and ship alarm training, contributed to the implementation of the competencies established in the maritime university, professional competence of the ship's operator. The inviolability of the concept that individual and professional qualities, as well as professional competence (professionalism), are manifested in working practice, is convincingly confirmed by the results of psychophysiological studies among the surveyed contingent.

Conclusion

1. Despite the achievements of scientific and technical progress in shipbuilding, the improvement of technologies and the introduction of new methods for ensuring the safety of crew members of ships of the marine specialized fleet (bulk carriers, oil tankers, gas carriers, chemical carriers, container carriers), the growth of the number of species, dangerous and toxic properties of dangerous goods carried by sea in the basis of increased chemical danger for seafarers, which calls for the formation and maintenance of preparedness of special health-saving competencies.
2. Mobilization of psychophysiological functions and actualization of professionally important qualities associated with getting on the sea voyage, carrying out a program of practical training, daily training and communication in an international crew, as well as participating in work and training alarms, contribute to the realization of the increased chemical danger on specialized sea vessels and container carriers laid down in the process of studying at the maritime high school of health-saving competences and the formation of professional competence of the seaman and ship's officer as a whole.
3. Psychophysiological patterns of professionally conditioned behavior reflecting the level of psychoemotional stress, the degree of mobilization of adaptive reserves and the formation of a functional system of stress resistance are informative markers of actualization of the health-saving competencies and professional competence of the seaman as a whole and can be successfully used in assessment, diagnostic and prognostic purposes.

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