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INDICATORS AND CRITERIA FOR EVALUATING THE CAPABILITIES OF THE FORCES OF THE NATIONAL GUARD OF UKRAINE ENGAGED TO PERFORM TASKS DURING THE DESTRUCTION OF HYDROTECHNICAL STRUCTURES

The main indicators and criteria that make it possible to evaluate the effectiveness of the tasks performed by the National Guard of Ukraine in the event of an emergency caused by the destruction of a hydraulic structure are determined. The selected indicators are ranked.

The weighting coefficients of the main indicators that affect the ability to perform tasks in these conditions are determined by the method of expert evaluation.

The main indicators and criteria established using a systematic approach and methods of operations research are proposed.

Keywords: *indicators, criteria, state of emergency, emergency situation, expert evaluation, performance criteria, effectiveness of service and combat missions, destruction of hydraulic engineering structures, capabilities of the National Guard of Ukraine to eliminate the consequences of an emergency.*

Statement of the problem. The National Guard of Ukraine (NGU) is a military formation with law enforcement functions and is intended to perform tasks to protect and safeguard the lives, rights, freedoms and legitimate interests of citizens, society and the State from criminal and other unlawful encroachments. The tasks of the National Guard of Ukraine, which require the involvement of significant forces and material resources, are set out in the Law "On the National Guard" [1].

The National Guard of Ukraine performs service-combat (combat) tasks as part of military patrols, subunits, units, formations and groupings of troops (forces). The most complex, multifunctional, resource-intensive and time-consuming tasks are performed by the groupings of troops (forces) of the National Guard of Ukraine in the event of man-caused or natural emergencies that result in significant losses among the civilian population. The occurrence of an emergency due to an accident at hydraulic engineering structures places high demands on the efficiency of the National Guard of Ukraine's performance of tasks. The current guiding documents do not define indicators and criteria for the effectiveness of the National Guard of Ukraine in the event of an emergency caused by the destruction of a hydraulic engineering structure, and do not form a system of such indicators and criteria for individual tasks, functions and modes of operation in such cases.

The problematic situation is related to making an informed decision given the intensity of information flow and its significant volumes under time constraints.

Analysis of recent research and publications. The issue of the effectiveness of groups of troops (forces) of different types of the Armed Forces and branches of the Armed Forces, interagency groups is considered in many scientific works [2–8].

For example, in article [2], the author proposes a system of criteria and indicators for making a decision on the use of internal troops in case of introduction of the legal regime of the state of emergency and ensuring its effectiveness.

Order [3] developed a procedure for assessing the performance of combat (service-combat) tasks by operational-territorial associations, formations, military units and subdivisions of the National Guard of Ukraine outside the permanent deployment points.

Issues related to the formation of criteria and performance indicators of the command and control system of a group of troops are considered in the scientific work [4]. The authors propose an approach based on the fact that the hierarchy of criteria and indicators of management effectiveness is built in accordance with the general goals and essence of the basic law of armed struggle.

Article [5] investigates the issues of forming a system of indicators of the effectiveness of a grouping of troops in accordance with the provisions of the basic law of armed struggle.

Indicators for blocking a given area, which make it possible to assess the capabilities of the National Guard of Ukraine to block the emergency area based on the analysis of a set of partial indicators of the effectiveness of the border control system, are considered in the article[6]. The procedure for assessing the effectiveness of the tasks of protecting the state border, which makes it possible to predict the effectiveness of the tasks of protecting the perimeter of the emergency zone, is given in the following articles [7, 8].

These publications consider certain performance indicators and criteria and general approaches to their evaluation, but do not take into account the nature of the tasks performed by the National Guard of Ukraine during the elimination of the consequences caused by the destruction of a hydraulic structure. In addition, there is no system of indicators and criteria for assessing the effectiveness of the National Guard of Ukraine's performance of tasks in such conditions.

The purpose of the article is to determine the indicators and criteria for assessing the capabilities of the National Guard of Ukraine involved in performing tasks in the event of destruction of hydraulic engineering structures.

Summary of the main material. The effectiveness of the National Guard's performance of tasks is recognized as the ability to perform tasks and achieve the required (desired) result with the least amount of time, material and human resources. The effectiveness of the use of forces is understood as the degree of influence on the achievement of the set goal of the operation (combat mission, solving a general operational task).

The effectiveness of the performance of service and combat tasks by the National Guard of Ukraine in the area of an emergency caused by an accident at a hydraulic engineering structure will depend on the ability to perform partial tasks assigned to the NGU forces. The tasks performed by the forces of the National Guard of Ukraine during the elimination of the consequences of an emergency caused by an accident at a hydraulic engineering structure are defined in the Law of Ukraine "On the National Guard" [9].

For each individual task, performance criteria are selected, which usually establish qualitative or quantitative values of an indicator that determines the properties of the system. The following requirements are set for the system of indicators and criteria for assessing the effectiveness of the National Guard of Ukraine in the conditions of an accident at a hydraulic structure:

– timely notification of personnel within a certain time;
– timely arrival of personnel;
– efficiency of the control system;
– timeliness of isolation and restrictive measures;
– timeliness (efficiency) of evacuation of the population from the emergency area;
– stability of public order in places of temporary residence of the resettled population;
– timely receipt of intelligence information;
– reliability of Public Security in the emergency area;
– timeliness of restoration and liquidation works;
– completeness of tasks fulfillment of service and combat activities.

For each partial task, a group of experts formed indicators that characterize the ability to complete the partial task. More than 100 indicators characterizing the effectiveness of the task as a whole were obtained. After determining the entire list, the expert evaluation method was used to identify the indicators and obtain their weighting factors that most significantly affect the ability to perform tasks in the specified conditions. The list included 29 capability indicators.

The impact of groups of capability indicators (CI) for performing individual tasks by the National Guard of Ukraine on the effectiveness of the task is generally depicted in the form of an Ishikawa diagram (Figure 1). Approaches to the use of the Ishikawa diagram to determine the effectiveness of the National Guard's task performance are given in [10].

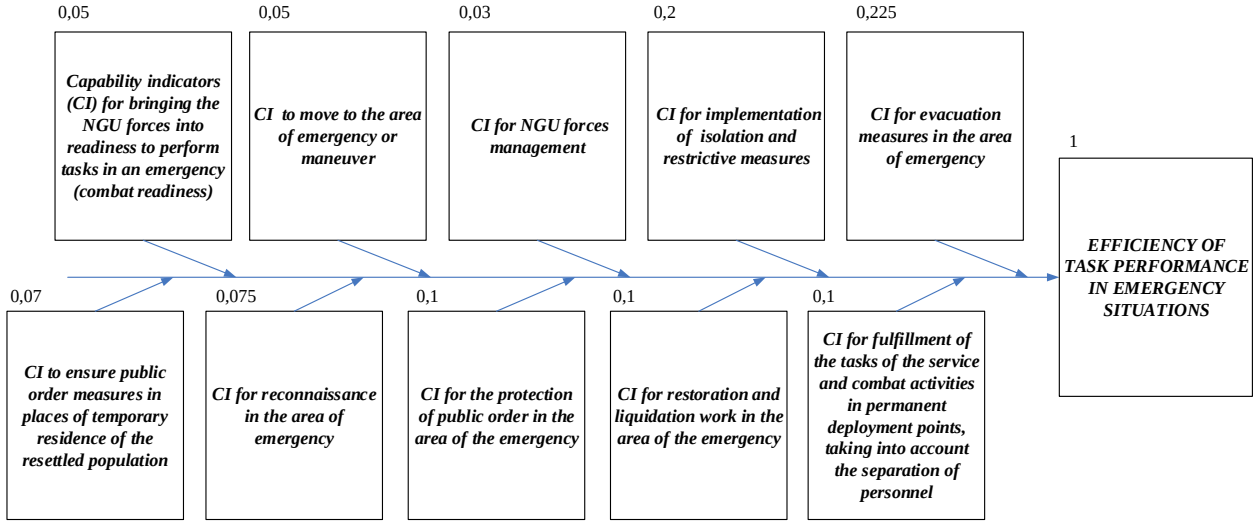

Figure 1 – Diagram of determining the effectiveness of the NGU forces in the event of the destruction of hydraulic structures

Table 1 shows the main indicators of the NGU forces' capabilities determined by the expert group and their weighting coefficients obtained by the expert assessment method.

Table 1 – Main indicators of the NGU forces' capabilities

CI for bringing the NGU forces into readiness to perform tasks in the event of an emergency (combat readiness)		
1.7	Probability of alerting all personnel within a certain time	0.0196
1.8	*Probability of arrival of military personnel within a certain time*	0.0304
CI for movement to the area of an emergency or maneuver		
2.2	The duration of the maneuver by the NGU forces while moving in different ways in a given time	0.016
2.3	*The probability that the NGU forces will move within a certain period of time*	0.0224
2.6	Amount of material resources spent during the maneuver	0.0116
CI for NGU forces management		
3.6	*Time for making (clarifying) a decision to participate in the disaster response*	0.01395
3.7	Time to communicate information to units	0.00775
3.13	The efficiency of the management system is the probability of solving a problem in the time available	0.0083
CI for implementation of isolation and restrictive measures		
4.4	The duration of isolation and restrictive measures by the NGU in the area of operations	0.062
4.5	*Probability of blocking the area to ensure isolation and restrictive measures*	0.079
4.6	The number of forces and means that the NGU forces can engage in isolation and restrictive measures	0.059
CI for evacuation measures in the area of emergency		
5.5	Duration of NGU search operations in the area of evacuation measures	0.029
5.6	*Probability of evacuation by NGU forces*	0.117
5.7	The number of forces and means that the NGU forces are able to deploy for evacuation activities	0.079

CI to ensure public order measures in places of temporary residence of the resettled population		
6.4	Duration of public order measures	0.0163
6.5	*Probability of preventing offenses in places of temporary residence*	0.034
6.8	Number of forces and means involved in ensuring public order	0.0197
CI for reconnaissance in the area of emergency		
7.5	Time spent collecting intelligence and bringing it to management	0.0236
7.8	*Probability of detection of victims by reconnaissance groups of the NGU forces*	0.0259
7.11	The number of units of the NGU forces allocated to conduct reconnaissance at the same time	0.0255
CI for the protection of public order in the area of emergency		
8.4	Time required to perform public order tasks	0.0163
8.5	*Probability of preventing offenses in the area of emergency*	0.0478
8.8	Number of NGU units allocated to perform public order tasks	0.0359
CI for restoration and liquidation work in the area of the emergency		
9.3	Time required to complete the tasks of restoring and eliminating the consequences of an emergency	0.0221
9.4	*The probability of performing restoration work in the designated location*	0.0405
9.8	Number of recovery teams working simultaneously	0.0374
CI for fulfillment of the tasks of the service and combat activities in permanent deployment points, taking into account the separation of personnel		
10.2	Scope of daily tasks	0.035
10.5	Probability (quality) of the implementation of the service and combat activities in the event of personnel separation to perform tasks related to the occurrence of an emergency	0.0182
10.8	*The total number of personnel involved in the implementation of the service and combat activities, taking into account its changes*	0.0468

Note. The indicators in italics are determined for decision-making in the methodology for justifying the involvement of the NGU forces in performing service and combat tasks in emergencies in the event of an accident at hydraulic engineering structures.

The unambiguous choice among the main indicators for each of the tasks was made according to the criterion of the highest value of the weighting coefficient determined by the method of expert evaluation. In the future, these indicators will be used in the methodology for justifying the involvement of the National Guard of Ukraine in performing service and combat tasks in emergencies in the event of an accident at hydraulic structures. These indicators include.

1. Probability of arrival of military units within a certain time, which is characterized by the average time of arrival of military units to their locations and depends on the timeliness of notification of personnel and the time required for the arrival of military personnel. The criterion for the probability of personnel arrival should not be less than the time specified in the governing documents [11].

2. The probability that the NGU forces will move within a certain period of time is determined by the time required to move to the place of performance of the task. It depends, in particular, on the speed of movement of the military unit's vehicles, the distance of the task area from the permanent dislocation of military units, the available road junction system, main and reserve routes. The criterion for the probability that the NGU forces will move within a certain period of time should not exceed the calculated value of the time for movement.

3. The time for making (refining) a decision to participate in disaster liquidation is characterized by the time of receiving information about the occurrence of an emergency, the time of delay of information, the time required for processing information, the time for developing decision options, and the time for making (refining) a decision. The criterion of time for making (clarifying) a decision to participate in disaster liquidation should not exceed the standard time established by the plan (Emergency Response Plan of the governing bodies of the territorial subsystem of the unified state civil protection system) for the first two stages of operational planning, the duration of which depends on the time available for preparing for the tasks.

4. The probability of blocking the area to ensure isolation and restrictive measures is characterized by the perimeter of the flood zone, the perimeter that can isolate a certain type of military unit, terrain, vegetation,

and surveillance conditions. The criterion for the probability of blocking the area in order to ensure isolation and restrictive measures should be greater than the probability of the required isolation of the area, which is determined by the chief (geographic information model of isolation and restrictive measures) during the implementation of joint disaster prevention and response measures.

5. The probability of evacuation by the National Guard is determined by the timeliness of warning the local population in the areas of possible flooding, the method of evacuation, the number of people to be evacuated, the distances from the evacuation points to the places of temporary residence, the speed of evacuation measures, and the number of evacuation means. The criterion for the probability of evacuation by the NGU forces should be higher than the required probability of evacuation (understood as the number of available evacuation means and the number of required evacuation means determined by the head of the emergency response [11]).

6. The probability of preventing offenses in places of temporary residence of the population is characterized by the number of offenses committed and the number of offenses that were prevented. The criterion for the probability of preventing offenses in places of temporary residence of the population should be maximized. The value of the mathematical expectation and variance of offenses at a similar population density over a similar period of time is determined by analyzing and synthesizing statistical data from the reports of the National Police of Ukraine.

7. The probability of detecting victims by the NGU reconnaissance groups is determined by the area of reconnaissance to search for victims in the emergency zone, the speed of movement of the NGU reconnaissance groups, and the time required for reconnaissance by the operational situation. The criterion for the probability of detecting victims by reconnaissance groups of the National Guard forces should be maximized to detect victims in accordance with the capabilities of the human body [12].

8. The probability of preventing offenses in the emergency area is characterized by the number of offenses committed and the number of offenses that were prevented. The criterion for the probability of preventing offenses in places of temporary residence of the population should be of maximum importance.

9. The probability of performing restoration work at the designated location is determined by the amount of work to be performed, the time required to perform restoration work, the regulatory indicators for conducting restoration work, and the composition of forces and means involved in performing restoration work. The criterion for the probability of performing restoration works in the established place shall be maximum or greater than the value of the measurable indicator of restoration works.

10. The number of personnel involved in service and combat activities, taking into account its change, is characterized by the number of military units involved in the performance of daily tasks, the time of performance of daily tasks, and the scope of service of daily tasks. The criterion for the number of personnel involved in the implementation of the combat mission, taking into account the change of servicemen, should be less than the number of personnel performing combat missions in everyday activities.

Conclusions

The article analyzes existing approaches to the formation of indicators and criteria for assessing the capabilities of the National Guard of Ukraine forces involved in performing tasks in the event of the destruction of hydraulic engineering structures.

In the course of the study, a set of indicators was formed, the total number of which increased the time for calculations, which negatively affected the efficiency of decision-making on the performance of tasks in these conditions. Therefore, using the method of expert evaluation, the indicators were ranked and the number of indicators was reduced. This makes it possible to increase the validity of decisions and reduce the time for making decisions on the execution of tasks without compromising their quality. This allows increasing the validity of decisions and reducing the time for making decisions on the execution of tasks without compromising their quality.

The obtained indicators and criteria for assessing the capabilities of the National Guard of Ukraine forces involved in performing tasks in the event of the destruction of hydraulic structures allow us to choose the most appropriate and reasonable solution. In the future, the selected indicators will be used in the methodology for justifying the involvement of the National Guard of Ukraine in performing tasks in the event of accidents at hydraulic structures.

The approach to determining the methods of accomplishing tasks by the National Guard of Ukraine can be practically implemented during the justification of simultaneous or sequential execution of (operational) service-combat tasks assigned to the National Guard. This applies to exercises and combat training, with the aim of concentrating or dispersing the efforts of National Guard forces, service-combat actions of specialized units, groups, etc.

The direction of further research is the development of techniques and methods for using the obtained indicators and criteria to calculate the forces and means of the National Guard of Ukraine involved in performing tasks in the event of an accident at hydraulic structures.

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ПОКАЗНИКИ І КРИТЕРІЇ ОЦІНЮВАННЯ МОЖЛИВОСТЕЙ СИЛ НАЦІОНАЛЬНОЇ ГВАРДІЇ УКРАЇНИ, ЗАЛУЧЕНИХ ДО ВИКОНАННЯ ЗАВДАНЬ У РАЗІ РУЙНУВАННЯ ГІДРОТЕХНІЧНИХ СПОРУД

Визначено основні показники і критерії, які дають змогу оцінити ефективність виконання завдань силами Національної гвардії України у разі виникнення надзвичайної ситуації, спричиненої руйнуванням гідротехнічної споруди. Проведено ранжування вибраних показників. Методом експертного оцінювання визначено вагові коефіцієнти основних показників, що впливають на спроможність виконання завдань у зазначених умовах.

Національна гвардія України виконує службово-бойові (бойові) завдання у складі військових нарядів, підрозділів, частин, з'єднань та угруповань військ (сил). Найбільш складні, багатофункціональні, витратні за ресурсами і тривалі за часом завдання виконують угруповання військ (сил) Національної гвардії України у разі виникнення надзвичайних ситуацій техногенного або природного характеру, які призводять до значних втрат серед цивільного населення. Виникнення надзвичайної ситуації внаслідок аварії на гідротехнічних спорудах ставить високі вимоги до ефективності виконання завдань силами Національної гвардії України.

У чинних керівних документах не визначено показники і критерії ефективності виконання завдань силами Національної гвардії України у випадку виникнення надзвичайної ситуації, спричиненої руйнуванням гідротехнічної споруди, і не сформовано системи таких показників та критеріїв за окремими завданнями, функціями й режимами функціонування у таких випадках.

Проблемна ситуація пов'язана з прийняттям обґрунтованого рішення за інтенсивності надходження інформації і значних її обсягів в умовах обмеження часу.

У процесі дослідження сформовано сукупність показників, загальна кількість яких збільшувала час на проведення розрахунків, що негативно позначалося на оперативності прийняття рішення на виконання завдань у зазначених умовах. Тому методом експертного оцінювання було здійснено ранжування і кількість показників скорочено. Це дає можливість підвищити обґрунтованість рішень і скоротити час на прийняття рішень щодо виконання завдань без шкоди для їх якості.

Отримані показники і критерії оцінювання можливостей сил Національної гвардії України, залучених до виконання завдань у разі руйнування гідротехнічних споруд, дають змогу вибрати найбільш прийнятне обґрунтоване рішення. У подальшому вибрані показники застосовуватимуться у методиці обґрунтування залучення сил Національної гвардії України до виконання завдань у разі аварій на гідротехнічних спорудах.

Ключові слова: *показники, критерії, надзвичайний стан, надзвичайна ситуація, експертне оцінювання, критерії ефективності, ефективність виконання службово-бойових завдань, руйнування гідротехнічних споруд, можливості сил Національної гвардії України з ліквідації наслідків надзвичайної ситуації.*

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