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EXPERIMENTAL STUDY OF DEPENDENCIES DURATION OF MANAGEMENT OF HEALTH & SAFETY FROM RESOURCE ENSURING

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ЕКСПЕРИМЕНТАЛЬНЕ ДОСЛІДЖЕННЯ ЗАЛЕЖНОСТІ ТРИВАЛОСТІ ДІЙ З УПРАВЛІННЯ В УМОВАХ НАДЗВИЧАЙНИХ СИТУАЦІЙ

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ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ЗАВИСИМОСТИ ПРОДОЛЖИТЕЛЬНОСТИ ДЕЙСТВИЙ ПО УПРАВЛЕНИЮ В УСЛОВИЯХ ЧРЕЗВЫЧАЙНЫХ СИТУАЦИЙ

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Abstract. *In recent years there has been widespread acknowledgement of the significance of managerial and organisational failures in the causation of accidents. Assess the contribution of safety management in achieving the ultimate goal of creating a safe working environment at the present stage of development of management theory and practice relevant forces and means there is enough challenge. The activities and processes involved in managing safety have come under increasing scrutiny via the development of approaches for safety management and safety culture assessment.*

A lot of human, material and technical resources should be used to eliminate consequences of emergencies. Prevention of emergencies, elumination of their consequences, reduction of losses and damages became a national problem and one of the most important tasks for executive authorities and management at all levels.

The main indicator of effectiveness for tasks solving in case of elimination of emergencies or it's consequences depends on responsivness and time taken for decision making process.

The subject of the research is the decision making process during control in emergency situations.

Keywords: *emergency, safety, danger, control, effectiveness.*

Анотація. *Щорічно на території України та інших держав спостерігаються природні та техногенні катастрофи. Це призводить*

екологічних, суспільних та матеріальних втрат та головне створюють загрозу життю та здоров'ю населення або навіть викликають смерть.

До ліквідації наслідків надзвичайної ситуації необхідно залучати значну кількість людських, матеріальних і технічних ресурсів. Запобігання надзвичайним ситуаціям, ліквідація їх наслідків, максимальне зниження масштабів втрат та збитків перетворилося на загальнодержавну проблему і є одним з найважливіших завдань органів виконавчої влади і управління всіх рівнів.

Тому оперативність реагування у надзвичайних ситуаціях та оперативність при прийнятті рішень у таких випадках, головні показники рівня ефективності виконання задач з ліквідації надзвичайних ситуацій або їх наслідків.

Предметом дослідження є оперативність прийняття рішень при управлінні у надзвичайних ситуаціях.

Метою дослідження є розроблення методу визначення часу оперативності реагування при прийнятті управлінських рішень у разі виникнення надзвичайних ситуацій.

Ключові слова: *надзвичайна ситуація, безпека, небезпека, оперативність, управління, ефективність системи.*

Анотация. *Ежегодно на территории Украины и других государств наблюдаются природные и техногенные катастрофы. Это приводит к экологическим, социальным и материальным потерям и главное создают угрозу жизни и здоровью населения или даже когут вызывать смерть.*

К ликвидации последствий чрезвычайной ситуации необходимо привлекать значительное количество человеческих, материальных и технических ресурсов. Предотвращение чрезвычайных ситуаций, ликвидация их последствий, максимальное снижение масштабов потерь и убытков превратилось в общегосударственную проблему и является одной из важнейших задач органов исполнительной власти и управления всех уровней.

Поэтому оперативность реагирования в чрезвычайных ситуациях и оперативность при принятии решений в таких случаях, главные показатели уровня эффективности выполнения задач по ликвидации чрезвычайных ситуаций или их последствий.

Предметом исследования является оперативность принятия решений при управлении по чрезвычайным ситуациям.

Целью исследования является разработка метода определения времени оперативности реагирования при принятии управленческих решений в случае возникновения чрезвычайных ситуаций.

Ключевые слова: *чрезвычайная ситуация, безопасность, опасность, оперативность, управление, эффективность системы.*

Introduction. In many countries natural and man-made disasters cause damages for about 2-4% GDP of a state according to the UN statistics. Only elimination of consequences after Chernobyl disaster exceeds 2% of the total volume of GDP in Ukraine. Annually in Ukraine there are around 140-150 man-made accidents and disasters at regional and national level. Approximate structure of an emergency

situation is as following: accident emissions high-toxic substances - 4%; fires and explosions - 19.5%; transport accidents - 17.7%; accidents on life-support systems - 17.3%; accidents at radiation facilities - 8.4%; accidents at municipal systems and wastewater treatment plants - 17.3%; emergencies at other facilities - 15.8%. Experts noticed that annual national economic losses from accidents are 140-150 mln. UAH.

Table 1.

Distribution of Emergency Situations in Ukraine

	2011 y.	2012 y.	2013 y.	2014 y.	2015 y.
Total number of disasters	143	212	143	143	Data is not available, due to the lack of data on the annexed territories
– man-made	134	120	75	74	
– natural	77	74	56	59	
– social	10	18	12	10	
killed people, (person)	355	301	253	287	
– children, (person)	39	50	34	39	
injured people (person)	985	861	854	680	
– children, (person)	439	225	192	235	

Results and discussion. Emergency management should be in constant guidance from a governing body and a head of an authorized emergency response services and forces involved in the organization and execution of tasks after disaster or its consequences.

The main objectives of management are: maintaining high level of morale of personnel and constant readiness for actions; planning of actions in advance; continuous data collection and study of the situation in area of an emergency; decisions made and delivered to subordinates on time; organization and continuous interaction ensuring; organized evacuation of a population from an emergency zone; training of capabilities to conduct rescue and other emergency work associated with liquidation of an emergency situation; organization of comprehensive support capabilities; control of activities and tasks execution made by subordinates on time and assurance of necessary assistance if needed.

The basis of management is decision made by a head of emergency response, who takes full responsibility for management of subordinate forces and successful execution of tasks in emergency situations.

Management principles are continuity, strength, flexibility and stability control in emergency situations.

Efficiency of management system could be achieved throw high degree of readiness of its components, sustainable performance and capability to provide centralized and immediate management of forces and means involved for emergency

response.

Organization of rapid response to emergencies is a phased implementation of organizational and managerial activities of planning emergency response, information, transfer of control and power in the highest degree of readiness, immediate management, organization of interaction and comprehensive support to ensure safety of people in an area of emergency.

Management organization carried out in accordance with the specific conditions of a situation, task and decision for application of capabilities during preparation for emergencies based on existing elements of the system of civil protection. There is one feature, which should be mentioned.. Managing organization should ensure an implementation of all claims placed in this particular situation. In other words, organizational management should provide sufficient effectivness of the management system.for those environment conditions.

To assess the contribution of safety management in achieving the ultimate goal, namely the establishment of a safe working environment, you must have methods of experimental research. Using this technique established relationship duration operations safety management of resources. For this method can not only evaluate the effectiveness of the system of safety management in the enterprise, but also to justify complex recommendations for its improvement.

In addition, the development of appropriate methods needed for the following tasks:

- first, identify the compliance management system with modern safety requirements;
- secondly, to determine the impact of the components of safety management on the efficiency of solving the assigned tasks;
- third, prior to the measures to improve safety management, estimating and predicting contribution to improve its functioning.

According to the physical meaning, the duration of the "operation" decreases with increasing number of units of a resource that is designed for its implementation. To solve the problems of planning (distribution) resources to perform complex operations to determine the total (analytical) as a function that displays this dependence, that is:

$$\tau(x). \quad (1)$$

Approximate form τ (x) is linear, that is

$$\tau(x)=-ax+b; \quad (2)$$

Refined form τ (x) is a hyperbola, that is

$$\tau(x) = \left(\frac{c}{x}\right). \quad (3)$$

The interval $(x_{min} \leq x \leq x_{max})$ (4)

We verify the hypothesis of hyperbolic shape dependence τ (x).

Let the known statistical set of pairs of values

$$(\tau_j,x_j),j=1..n \quad (5)$$

Perform the regression analysis concerning a set of statistical law –

$$\tau(x)=(c/x). \quad (6)$$

The coefficient "c" define the method of "least squares".

Adds the sum of squared the difference between the values of (τj, j = 1 .. n) and a set of statistical values of τ (xj) = c / xj for each value of the argument xj:

$$\sum_{j=1}^{n}(\tau_j^2 - 2\tau_j \cdot \frac{c}{x_j} + \frac{c^2}{x_j^2}) \quad (7)$$

We expand the expression (7):

$$sq = \sum_{j=1}^{n}(\tau_j^2 - 2\tau_j \cdot \frac{c}{x_j} + \frac{c^2}{x_j^2}) = \sum_{j=1}^{n}\tau_j^2 - 2c\sum_{j=1}^{n}\left(\frac{\tau_j}{x_j}\right) + c^2\sum_{j=1}^{n}\frac{1}{x_j^2} \quad (8)$$

Define the sum of constants:

$$\sum_{j=1}^{n}\tau_j^2 = S1;\ \sum_{j=1}^{n}\left(\frac{\tau_j}{x_j}\right) = S2;\ \sum_{j=1}^{n}\left(\frac{1}{x_j^2}\right) = S3. \quad (9)$$

Currently

$$sq = S1 - 2c \cdot S2 + c^2 \cdot S3. \quad (10)$$

Extremum The condition of sq by "s" –

$$\frac{d(sq)}{dc} = \emptyset - 2 \cdot S2 + 2c \cdot S3 = \emptyset. \quad (11)$$

Now find the unknown factor "c" of (11) –

$$c^* = \frac{S2}{S3}. \quad (12)$$

Since becoming known analytical form of the function

$$\tau(x) = \frac{c^*}{x} \quad (13)$$

Find the root mean deviation values (τj, j = 1 .. n) of the act (13).
Variance static set (ri, j = 1 .. n) –

$$D(\tau) = \frac{1}{n-1}\sum_{j=1}^{n}(\tau_j - \frac{c^*}{x_j})^2 \quad (14)$$

a sampled standard deviation –

$$\sigma(\tau) = \sqrt{D} \quad (15)$$

A measure of the probability of the hypothesis of hyperbolic dependence (3) is the value of the ratio of standard deviation to the "length" line graph τ (x) in the interval (4) –

$$\alpha = \frac{\sigma(\tau)}{L(\tau)(x)'} \quad (16)$$

$$x_{min} \leq x \leq x_{max},$$

where

$$L = \int_{x_{min}}^{x_{max}} \sqrt{1 + (\frac{d\tau}{dx})^2} \cdot dx. \quad (17)$$

Substituting the

$$\frac{d\tau}{dx} = -\left(\frac{c^*}{x^2}\right)$$

In (17) obsessively formula –

$$L = \int_{x_{min}}^{x_{max}} \sqrt{1 + (-\frac{c^*}{x^2})^2} \cdot dx. \quad (18)$$

The value of the integral calculate a numerical integration methods, such as using "trapeze" ("rectangles").

Determine the length of the "step" argument (*eps*); then the number of steps of integration –

$$m = \frac{(x_{max} - x_{min})}{eps} \quad (18)$$

Then (18) will have the form

$$L = \sum_{i=1}^{m} \left(\sqrt{1 + \left(-\frac{c^*}{x_i^2} \right)^2} \right) \cdot eps, \quad (20)$$

where

$$x_i = x_{i-1} + eps,\ x_{i=0} = x_{min}. \quad (21)$$

If $\alpha \leq 0.05$ (5%), we consider the hypothesis correct.

Conclusions.

Methods of experimental research are as follows:

1. Implemented «n» attempts to perform a complete transaction volume A unit of capacity and resources (1) at different amount of resources. Derived statistical set of experimental data (τj, xj), j = 1 .. n.

2. Implemented statistical regression analysis to test the hypothesis set of hyperbolic dependence τ (x).

3. Is calculated estimate the probability of the hypothesis as the ratio of the JMA and the "length" of the regression line τ (x).

4. If $\alpha \leq 0.05$ (5%), then the hypothesis is accepted.

5. Similarly calculated the probability of the hypothesis of "linear" dependence of τ (x). Done comparative evaluation.

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