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SOME DETERMINATION ISSUES OF ANTHROPOGENIC HAZARDOUS OBJECTS OF ECONOMIC ACTIVITY WHILE PERFORMING MULTIDISCIPLINARY FORENSIC OF FIRE- TECHNICAL AND TECHNICAL ENVIRONMENTAL EXAMINATIONS

The aim of this work is to analyze the sources and factors of danger, their structure and the nature of functioning, which under certain circumstances can initiate or cause the threat of emergency situations, as well as the study of the main stages in determining the compliance with the category of industrial hazard of business objects.

The relevance of the work is since on the territory of Ukraine there is a significant number of objects on which hazardous chemical and biological substances, as well as other hazardous sources and hazard factors, are used in carrying out economic activities in technological processes. Such objects are located mainly in areas with a high concentration of the population, which in turn sharply increases the level of threat to human life and health, worsen the state of the environment and, in the event of accidents or catastrophes, can lead to large material losses.

One of the tasks in conducting complex forensic examinations and expert studies is to establish the belonging of a business entity to a certain category of technological safety. For this, it is necessary to analyze their structure and the nature of their functioning to establish the fact of the presence or absence of sources of danger, which under certain circumstances can initiate or cause a real threat of emergency situations.

In this paper, we consider an algorithm for solving problems of establishing the availability of sources and hazards, determining their ability to initiate an emergency, and further determining the category of industrial hazard to which economic activity belongs.

The classification of emergencies by the nature of origin, the extent of distribution, the size of human losses, and material losses is determined. The state, regional, local, object levels of emergency are considered.

The main stages are given in determining the compliance with the category of industrial hazard of economic activity objects, which will allow systematizing the research process when performing complex fire engineering, engineering environmental examinations.

Keywords: technological hazard, potentially dangerous object, object of increased danger, dangerous substance, threshold mass, source of danger, emergency.

Formulation of Research Problem. Currently, many business entities that use hazardous chemicals, biological substances, as well as other hazardous sources and risk factors are operating and operating in the territory of Ukraine. The amount (mass) of hazardous substances present on the sites may be insignificant, such as when handling reagents or government samples. In other cases, the more common is the storage of hazardous substances with a total mass of more than 1000 tonnes and even more than 10000 tonnes. Often, contrary to current requirements, such facilities are in areas with high concentration of population, which dramatically increases the level of threat to life and health of people, environmental degradation and serious material damage in the event of accidents or catastrophes.

If hazardous substances are rotated (stored, processed, transported) at an object, then, in accordance with the current legislation, an economic entity owned or used by such an object or intends to start construction of such object organizes its identification. During the identification, the business entity must analyze the structure of the business objects and the nature of their operation to determine whether sources of danger that may trigger emergencies in certain circumstances and determine the levels of potential emergencies. After that, submit the results of the identification to identify the potential danger to the local civil protection authority to summarize the results of the identification¹.

Depending on the amount of mass of dangerous substances that rotate on the object, it may refer to a potentially hazardous object (PHO) and a high-risk object (HRO) of the first or second class.

Potentially Hazardous Object – An object that uses, produces, processes, stores, or transports dangerous radioactive, fire, chemical and biological agents, hydraulic and transport structures, vehicles, and other objects that create a real the threat of an emergency.

High risk facility: an entity that uses, manufactures, processes, stores, or transports one or more hazardous substances or categories of substances in an amount equal to or more than the prescribed threshold

¹ Pro obiekty pidvyshchenoi nebezpeky [On high risk objects]: Zakon Ukrainy № 2245–iii vid 18.01.2001. URL : <http://zakon.rada.gov.ua/laws/show/2245–14> (data zvernennia 06.06.2019 [in Ukrainian]).

masses, as well as other objects as such which, according to the law, is a real threat of an anthropogenic and natural emergency¹.

According to the normative legal acts of Ukraine, economic entities owned (used) by which are PHO or HRO, must plan annually for preventive measures to prevent emergencies and to ensure their realization by appropriate financial and material resources. Contingency plans should be developed based on the materials of the ongoing assessment of man-made safety at the facility (s), the possible consequences of environmental impact in the event of emergencies, including working personnel and the public. They should include specific measures to minimize the risks of emergencies to their acceptable performance, prevent technological accidents, utilize them, dispose of harmful substances and wastes or eliminate them, and fulfill other requirements in the field of technogenic safety.

Due to the fact that the implementation of the above measures' economic entities needs to invest significant financial and material resources each year, in the identification process, they often neglect the current requirements and lower the level of danger, which further affects the actual status of the object and increases risk to life and health of humans and other serious consequences.

Thereafter, a contradictory situation arises between the business entity and the local public oversight body in the field of civil protection regarding the attribution (or not attribution) of the respective entity to the PHOs or the HROs, which they can only resolve by court.

That is, the most important task to be solved during carrying out complex fire-technical, engineering and environmental examinations and expert researches is to establish the business entity belonging to a certain category of technogenic safety.

Analysis of recent research and publications. Recent provisions on the problem of emergencies of anthropogenic nature, which lead to grave consequences and methods and methods aimed at minimizing such consequences, were considered by modern scientists and covered the following issues: determination of the risk of emergencies of anthropogenic nature by the criterion of the state of potential non-potential and preliminary investigation of danger with the purpose of isolation of objects of high risk (O. P. Mikhailuk, V. V. Oliynyk, A. A. Mikhailuk), analysis of fire explosion safety of oil and gas, oil and gas, chemical and energy sectors, fires and explosions that reach the scale of catastrophes (O. P. Mikhailuk, V. V. Oliynyk, I. Y. Kris, P. A. Bily), causes of

¹ Pro identyfikatsiiu ta deklaruvannia bezpeky ob'ektiv pidvyshchenoi nebezpeky [On the identification and declaration of safety of high-risk objects]. (NPAOP 0.00–6.21–02), (NPAOP 0.00–6.22–02) : postanova Kabinetu Ministriv Ukrainy № 956 vid 11.09.2002. URL : <http://zakon.rada.gov.ua/laws/show/956-2002-p> (data zvernennia 06.06.2019) [in Ukrainian].

emergence and prevention of emergencies situations (V. V. Zatsarny, O. V. Zatsarna, O. V. Zemlyanskaya, N. A. Prahovnik).

Article Purpose. The purpose of this article is to analyze the sources and factors of danger, their structure and nature of functioning, which in certain circumstances may initiate or cause a threat of emergencies, as well as to study the main stages in determining the conformity of the category of man-made hazard of economic activities.

Main content presentation. Danger is viewed as an objectively existing reality in the relationship between society and technology, human habitation. According to the definition of the Committee on Perception of Risk and informing it of the National Research Council of the USA is a danger «... *an act or phenomenon that causes potential harm to people or objects*» The American researcher Wilhelm Marshall (1934–1996) states that danger is «... a natural or anthropogenic phenomenon, which can cause phenomena or processes that can affect people, cause material damage, destroy the environment, etc.».

Human life is constantly accompanied by potential dangers. Unwanted external influences lead to injuries, diseases, poor health and other undesirable effects. The dangers exist in space and time and are realized in the form of flows of energy, matter and information. They do not operate selectively. As a result, hazards affect the entire material environment.

Identify the dangers in view of the principle of «*everything affects everything*»: the source can be all living and non-living, the danger also threatens all living and non-living.

The science that deals with hazard classification is called taxonomy. Depending on the specific needs, hazard classifications are used by different criteria:

- time of action (impulsive and cumulative);
- localization (related to summer, hydro, atmosphere and space);
- consequences (morbidity, mortality, reduction of life expectancy, destabilization of society);
- scale (global, national, regional, local);
- area of expression (household, sports, production);
- structure (simple and derivatives);
- origin (natural, anthropogenic, social, political, combined).

Most often they refer to the classification of sources of danger by origin. Among the natural sources of danger are natural objects, natural phenomena and natural disasters that threaten human life or health (earthquakes, landslides, volcanoes, storms, hurricanes, fogs, lightnings, asteroids). Anthropogenic sources of danger are related to the use of vehicles, technical equipment, the use of combustible, flammable substances, various types of radiation. Social sources of danger include those caused by low spiritual and cultural levels: vagrancy, prostitution, and alcoholism. The sources of political danger are conflicts at the

international level, political terrorism, wars. Combined sources of danger are divided into the following subgroups:

- natural-anthropogenic (smog, acid rain, deterioration of soil fertility);
- natural and social (drug addiction, epidemics, infectious and sexually transmitted diseases);
- socio-anthropogenic (occupational diseases, occupational injuries)¹. All hazards are to some extent caused by striking (negative) factors. Depending on the consequences of exposure to the human body, the risk factors are divided into dangerous and harmful. *Dangerous factors* are environmental factors that lead to injuries, burns, frostbite, other damage to the body or its organs and even death. Somewhat less harmful to human health. *Adverse factors* are environmental factors that cause impaired well-being, decreased performance, illness, and more. By nature, nature and energy, all factors are divided into the following groups: physical, chemical, biological, psychophysiological. They also distinguish between passive-active factors, which are manifested by the attraction of human energy (sharp fixed objects, uneven or very smooth surfaces, etc.), and passive ones that affect the person indirectly through degradation of the properties of materials (manifested in destruction, explosions, etc.).

Emergencies are classified by nature of origin, extent of distribution, extent of human loss and material loss.

Depending on the origin of the events that may cause emergencies in the territory of Ukraine, emergencies are classified by origin as follows:

- anthropogenic: transport accidents (catastrophes), fires, explosions at explosive objects or their threat, accidents with emissions (threat of release) of dangerous chemical, radioactive, biological substances, sudden destruction of structures and buildings, accidents at engineering power engineering systems., hydrodynamic accidents on dams and so on;
- natural: dangerous geological, meteorological, hydrological, marine and freshwater phenomena, degradation of soils and subsoil, natural fires, changes in the status of the air basin, infectious morbidity of people, farm animals, mass destruction of agricultural plants of pests, pests so on;
- social nature: related to the unlawful acts of a terrorist and anti-constitutional trend: the actual or actual threat of an act of terrorism (armed attack, seizure and detention of important objects, nuclear installations and materials, communications and telecommunications systems, attack or assault on the crew aircraft or ship), abduction (attempt to steal) or destruction of ships, hostage-taking, installation of explosive

¹ Pro zatverdzhennia Klasyfikatsiinykh oznak nadzvychainykh sytuatsii [On Approval of the Classification of Emergency Situations]: nakaz MVS Ukrainy № 658 vid 06.08.2018. URL : <http://zakon.rada.gov.ua/laws/show/z0969-18> (data zvernennia 06.06.2019) [in Ukrainian].

devices in public places, theft or seizure of weapons, detection of ammunition, etc;

– military nature: violation of the normal conditions of life and activity of people in a territory or object on it or in a water object caused using conventional weapons or weapons of mass destruction during which secondary factors of population damage occur.

Depending on the volumes caused by an emergency, the number of casualties and casualties, the volumes of technical and material resources needed to eliminate its consequences, the following levels of emergency situations are determined: state; regional; local; object¹.

The state level includes the NA:

1) that has spread or may extend to the territory of other States;
2) that has spread to the territory of two or more regions of Ukraine, and for its elimination the necessary material and technical resources in volumes exceeding the capabilities of these regions, but not less than 1 percent of the amount of expenditures of the respective local budgets (state emergency in territorial distribution);

3) which resulted in the death of more than 10 persons or the result of which more than 300 persons were injured (victims – persons who were injured by personal injury or ill, resulting in a disability, certified or impaired condition) more than 50 thousand people for a long time (more than 3 days);

4) as a result of which more than 5 persons were killed or more than 100 people were injured, normal living conditions of more than 10 thousand people were violated for a long time (more than 3 days), and losses (estimated in accordance with the procedure established by the law) were caused by an emergency, exceeded 25 thousand minimum wages (at the time of emergency);

5) losses from which exceeded 150 thousand minimum wages;

6) which in other cases provided for by the acts of the legislation, is recognized as a state-level emergency by its features.

The regional level includes the emergency:

1) which has spread to the territory of two or more districts, and for its elimination the necessary material and technical resources in volumes exceeding the capabilities of these areas, but not less than 1 percent of the amount of expenditures of the respective local budgets (regional emergency in territorial distribution);

2) which led to the death of 3 to 5 people or as a result of which 50 to 100 people were injured, or the normal living conditions of 1 thousand to 10 thousand people were violated for a long time (more than 3 days), and the losses exceeded 5 thousand minimum wages;

¹ Pro zatverdzhennia Poriadku klasyfikatsii nadzvychainykh sytuatsii za yikh rivniamy : postanova Kabinetu Ministriv Ukrainy № 368 від 24.03.2004 URL : <http://zakon.rada.gov.ua/laws/show/368-2004-п> (data zvernennia 26.06.2019).

3) losses from which exceeded 15 thousand minimum wages;

The local level includes the following:

1) that went beyond the territories of a potentially dangerous object, threatens the environment, neighboring settlements, engineering structures, and for its elimination the necessary material and technical resources in the amount exceeding their own potential of a potentially dangerous object;

2) as a result of which 1-2 persons were killed or 20 to 50 people were injured, normal living conditions of 100 to 1000 people were violated for a long time (more than 3 days), and the losses exceeded 5 thousand minimum wages payments;

3) losses from which exceeded 2 thousand minimum wages;

The object level includes all emergencies that do not fall within the above definitions.

As noted earlier, all entities that own or use facilities that can use, manufacture, process, store, or transport hazardous substances (PHO), as well as any intended entities start the construction of a PHO, the responsibility is to carry out the identification of the object as a PHO.

The algorithm for carrying out this identification does not apply to:

- potentially hazardous objects that are classified as such due to the presence of radioactive substances on them;

- potentially dangerous mineral exploration, production and development activities, including exploration and development of the seabed, the presence of hazardous substances that are due to natural phenomena and cannot be controlled;

- dangerous substances transported outside the enterprise by road, rail, aviation, river and sea;

- hydraulic structures;

- potentially hazardous objects that are associated with such waste due to the presence of wastes, except those where quantification of hazardous substances in accordance with the regulations is possible.

The identification procedure primarily involves analyzing the structure of business entities and the nature of their operation to determine the fact of the presence or absence of sources of danger, as well as to determine the levels of possible emergencies.

Identification of sources of danger occurs when the information about the technological features of specific industries is investigated with the existing criteria necessary to identify the object as potentially dangerous. The main criterion is the presence in the production of a certain amount of dangerous substances, the excess of which means creating a danger for the normal functioning of enterprises and the environment.

An economic activity is recognized as potentially dangerous, if it contains at least one source of danger capable of triggering a local, regional or emergency state level, or if it falls within the scope of regulatory acts irrespective of the levels of the emergency. An entity that does not qualify for these requirements is not recognized as a PHO. If

according to the results of the conducted research, the object of business activity is recognized as a PHO, then identification must be made to identify it as an HRO.

A potentially hazardous object is a class HRO in the case where the value of the total mass of hazardous materials (HAZMATs) rotating on the object exceeds the threshold mass norm.

If the total mass of HAZMAT does not exceed the norm of the threshold mass of HM then the identification procedure is considered complete and the PHO does not apply to the HRO provided that the distance from it to the boundary of the residential area (residential areas, stadiums, hospitals, schools, etc.) exceeds 500 m for HM groups 1 and 2 and 1000 m for HM groups 3.

If the total mass of the HAZMAT on the HRO does not exceed the value of the threshold mass of the HM in accordance with the standards, but the distance from this object to the places of the gathering area is less than the above, then the calculation of the HAZMAT threshold mass, considering these distances.

If the total mass of HAZMAT on the HRO exceeds the estimated threshold mass, then the object is assigned the appropriate hazard class, and if it does not exceed – the identification procedure is considered complete and the HRO does not apply to the HRO.

Conclusions. In our opinion, to reduce the risk of emergencies at the objects of economic activity, a full and unbiased analysis of their structure and nature of operation is needed to identify potential sources of danger. To achieve this, it is necessary to conduct research to determine the conformity of the anthropogenic hazard category of business entities.

The results of the conducted research will allow the body that appointed the forensic expert to make the appropriate decision on the merits and will be directed to establish the actual state of the object with the purpose of carrying out by the subject of economic activity of all necessary measures for ensuring anthropogenic safety aimed at preventing emergencies.

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**ДЕЯКІ ПИТАННЯ ВИЗНАЧЕННЯ КАТЕГОРІЇ ТЕХНОГЕННОЇ
НЕБЕЗПЕКИ ОБ'ЄКТІВ ГОСПОДАРСЬКОЇ ДІЯЛЬНОСТІ ПРИ
ВИКОНАННІ КОМПЛЕКСНИХ СУДОВИХ ПОЖЕЖНО-ТЕХНІЧНИХ
ТА ІНЖЕНЕРНО-ЕКОЛОГІЧНИХ ЕКСПЕРТИЗ**

Розглянуто основи визначення особливостей виявлення джерел та чинників небезпеки. Визначено класифікацію надзвичайних ситуацій за характером походження, мірою поширення, розміром людських втрат і матеріальних збитків. Розглянуто державні, регіональні, місцеві, об'єктові рівні надзвичайних ситуацій. Наведено класифікацію небезпек за різними критеріями. Розкрито поняття потенційно небезпечних об'єктів та об'єктів з підвищеною небезпекою. Наведено основні етапи при визначенні відповідності категорії техногенної небезпеки об'єктів господарської діяльності, що дозволить систематизувати процес дослідження при виконанні комплексних судових пожежно-технічних та інженерно-екологічних експертиз.

Ключові слова техногенна небезпека, потенційно небезпечний об'єкт, об'єкт підвищеної небезпеки, небезпечна речовина, порогова маса, джерело небезпеки, надзвичайна ситуація.

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