**NATIONAL UNIVERSITY OF LIFE AND ENVIROMENTAL SCIENSES OF UKRAINE**

**Department of General Ecology, Radiobiology and Safety of Life Activity**

# Basics of Civil Protection

## Manual for graduate students in the study program 101 Ecology

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Рекомендовано до видання вченою радою факультету захисту рослин, біотехнологій та екології
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У навчально-методичному посібнику для студентів ОС Магістр за спеціальністю 101 Екологія вперше англійською мовою ґрунтовно викладені теоретичні і практичні аспекти цивільного захисту; у тому числі, значна увага приділена історії становлення та вимогам міжнародного гуманітарного права, організаційним основам цивільного захисту в Україні, моніторингу надзвичайних ситуацій. Навчально-методичний посібник містить також основи надання домедичної допомоги постраждалим від надзвичайних ситуацій.

In this Manual for graduate students in the study program 101 Ecology the theoretical and practical aspects of civil protection are thoroughly outlined for the first time in English; including considerable attention to the history and requirements of international humanitarian law, the organizational foundations of civil protection in Ukraine, and emergency monitoring. The textbook also contains the basics of first aid to victims of emergency situations.

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# INTRODUCTION

The purpose of the civil protection system is to protect the population and its vital resources in the event of disasters, emergencies, or armed conflicts, and to contribute to bringing these events under control and limiting the damage they may cause.

Civil protection encompasses:

- preventive measures to reduce the impact of future emergencies or disasters;

- aid delivered by a government to populations in need following an emergency or a natural disaster.

Modern development of Ukraine in conditions of systemic transformation is characterized as a permanent complex, and sometimes even failures of the extremity.

Global development of human civilization, in addition to the positive achievements, given rise to numerous threats to the vital interests of man and citizen, society and state. Significant among these threats is the danger of technogenic and natural areas. Many of them in varying degrees, inherent to Ukraine. In this regard, a large role in ensuring technogenic and natural security is given a Single state system of civil protection of population and territories.

A significant number of major disasters that have occurred recently in the world and in Ukraine, among which a special place is the Chernobyl (1986), changed the traditional orientation of the civil protection system to meet the challenges of an exclusively wartime to protect the population and territories from emergency situations of peacetime and the transition from sectoral (departmental) to the functional (integrated) the principle of response.

Civil protection is carried out with the aim of implementing state policy aimed at ensuring the safety and protection of population and

territories, material and cultural values, the environment from negative consequences of emergencies in peacetime and during the special period, overcoming of consequences of emergency situations, including consequences of emergencies in territories of foreign States in accordance with international treaties of Ukraine agreed to be binding by the Verkhovna Rada of Ukraine.

The basis of civil protection entrusted the provisions of international humanitarian law and article 3 of the Constitution of Ukraine, which noted that the man, his life, honour and dignity, inviolability and security are defined in Ukraine as the highest social value, and assertion and providing of rights and human freedoms is the main duty of the state.

## LIST OF ABBREVATION

**AP I** - Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts

**AP II** - Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Non-international Armed Conflicts

**IHL** - International humanitarian law

**GC I** - Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field

**GC II** - Geneva Convention for the Amelioration of the Condition of the Wounded, Sick, and Shipwrecked Members of Armed Forces at Sea

**GC III** - Geneva Convention Relative to the Treatment of Prisoners of War

**GC IV** - Geneva Convention Relative to the Protection of Civilians in Time of War

**SESU** - The State Emergency Service of Ukraine

**CCPU** - The Code of civil protection of Ukraine

**PHO**s - potentially hazardous objects

**OMH** - object of major hazard

**NPPs** - nuclear power plants

**HCS** - hazardous chemical substance

**USSCP** - The Unified State System of Civil Protection

**WMD** - Weapons of Mass Destruction

**TNT equivalent** - trinitrotoluol equivalent

**EMP** - electromagnetic impulse

**Rem** - roentgen-equivalent-man

**mSv** - millisievert

**HHC** - highly hazardous chemicals

**CWAs** - chemical warfare agents

**RCAs** - riot control agents

**NBC agents** - nuclear, biological and chemical warfare

**EMS** - Emergency Medical Services

**mTBI** - Mild traumatic brain injury

## SECTION 1

## PRINCIPLES OF INTERNATIONAL HUMANITARIAN LAW. GENEVA CONVENTIONS AND ADDITIONAL PROTOCOLS

International humanitarian law (IHL) is a set of rules which seek, for humanitarian reasons, to limit the effects of armed conflict. It protects persons who are not or are no longer participating in the hostilities and restricts the means and methods of warfare. International humanitarian law is also known as the law of war or the law of armed conflict.

IHL is part of public international law – the body of rules governing relations between States. Public international law is made up primarily of treaties or conventions concluded between States, customary rules (general practice accepted as law), and general principles of law.

Distinction must be made between IHL, which regulates the conduct of parties engaged in an armed conflict (*jus in bello*), and that part of public international law set out in the Charter of the United Nations that regulates whether a State may rightfully resort to armed force against another State (*jus ad bellum*).

The Charter prohibits such use of force, with two exceptions: cases of self-defence against an armed attack, and when the use of armed force is authorized by the United Nations Security Council.

Warfare has always been subject to certain principles and customs. It may be said therefore that IHL has its roots in the rules of ancient civilizations and religions.

Universal codification of IHL began in the nineteenth century, notably through the adoption of the 1864 Geneva Convention for the Amelioration of the Condition of the Wounded in Armies in the Field and the 1868 Declaration of Saint Petersburg, which prohibited the use of certain projectiles in wartime. Since then, States have agreed to and codified a

series of practical rules to keep pace with evolving means and methods of warfare and the related humanitarian consequences.

These rules strike a careful balance between humanitarian concerns and the military requirements of States and non-State parties to armed conflict. They address a broad range of issues, including:

- protection for wounded and sick soldiers;

- treatment of prisoners of war and other persons detained in connection with an armed conflict;

- protection for the civilian population and civilian objects, such as cultural property; and

- restrictions on the use of certain weapons and methods of warfare.

Over time, the number of States adhering to these rules has grown, securing virtually universal acceptance for the core treaties of IHL.

The Geneva Conventions (1949) and their Additional Protocols (1977) **form the core of international humanitarian law**, which regulates the conduct of armed conflict and seeks to limit its effects. They are international treaties that contain the most important rules limiting the barbarity of war.

They protect people who do not take part in the fighting (civilians, medics, aid workers) and those who can no longer fight (wounded, sick and shipwrecked troops, prisoners of war).

The Conventions and their Protocols call for measures to be taken to prevent or put an end to all breaches. They contain stringent rules to deal with what are known as "grave breaches". Those responsible for grave breaches must be sought, tried or extradited, whatever nationality they may hold[1].

[1] The Practical Guide to Humanitarian Law. Geneva Conventions of 1949 and Additional Protocols I and II of 1977. https://guide-humanitarian-law.org/content/article/3/geneva-conventions-of-1949-and-additional-protocols-i-and-ii-of-1977/

*The First Geneva Convention*[2] (Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (GCI)) protects wounded and sick soldiers on land during war. This Convention contains 64 articles.

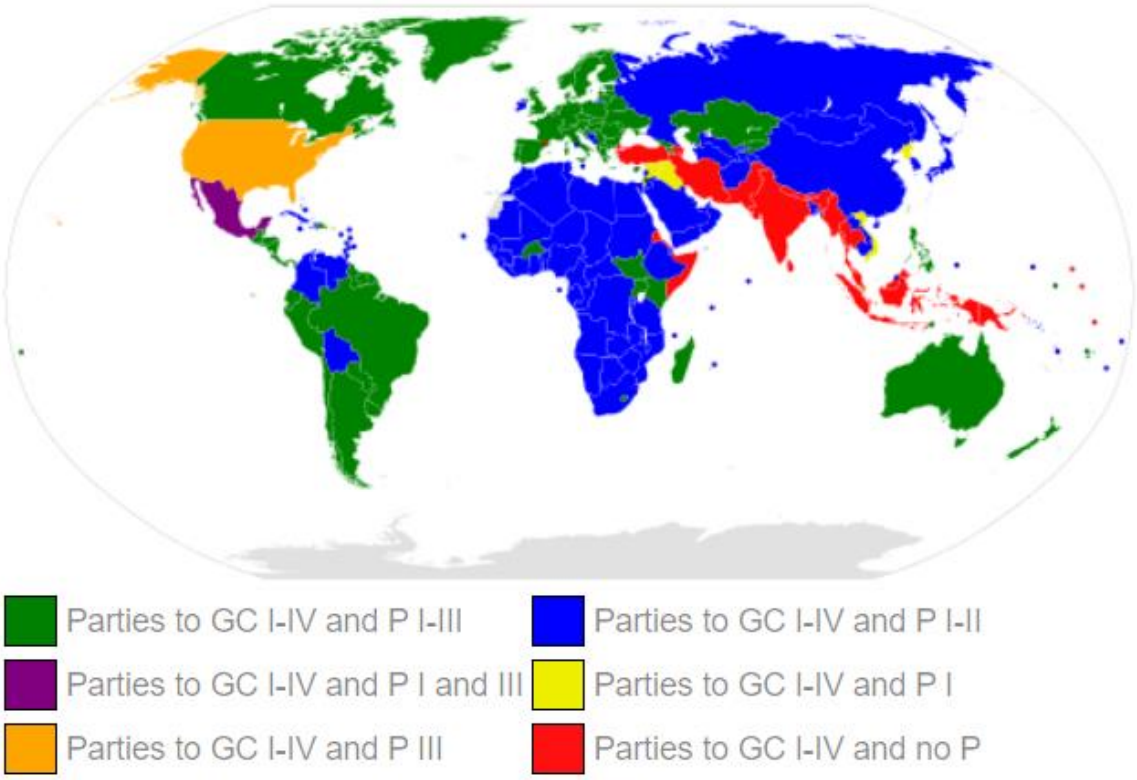


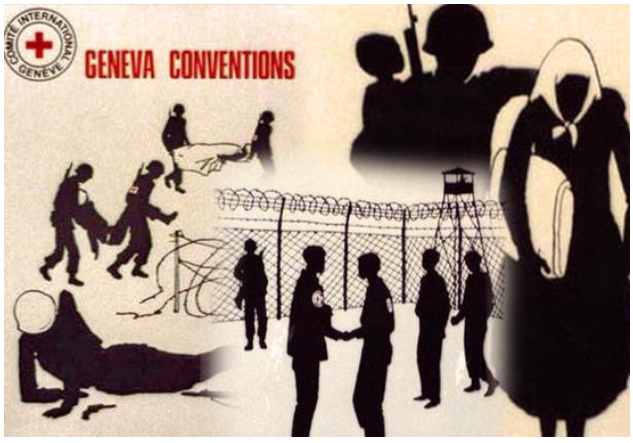

*Fig. 1 − Parties to the Geneva Conventions*[3]

These provide protection for the wounded and sick, but also for medical and religious personnel, medical units and medical transports. The Convention also recognizes the distinctive emblems. It has two annexes containing a draft agreement relating to hospital zones and a model identity card for medical and religious personnel.

[2] The Geneva Conventions of 1949 and their Additional Protocols. https://www.icrc.org/en/document/geneva-conventions-1949-additional-protocols
[3] List of parties to the Geneva Conventions. https://military.wikia.org/wiki/List_of_parties_to_the_Geneva_Conventions

*The Second Geneva Convention* (Geneva Convention for the Amelioration of the Condition of the Wounded, Sick, and Shipwrecked Members of Armed Forces at Sea (GCII)) protects wounded, sick and shipwrecked military personnel at sea during war. It has 63 articles specifically applicable to war at sea. For example, it protects hospital ships. It has one annex containing a model identity card for medical and religious personnel.

*The Third Geneva Convention* (Geneva Convention Relative to the Treatment of Prisoners of War (GCIII)) applies to prisoners of war. The categories of persons entitled to prisoner of war status were broadened in accordance with Conventions I and II. The conditions and places of captivity were more precisely defined, particularly with regard to the labour of prisoners of war, their financial resources, the relief they receive, and the judicial proceedings instituted against them. The Convention establishes the principle that prisoners of war shall be released and repatriated without delay after the cessation of active hostilities. The Convention has five annexes containing various model regulations and identity and other cards.




*The Fourth Geneva Convention* (Geneva Convention Relative to the Protection of Civilians in Time of War (GCIV)) protects civilians, including those in occupied territory. The Geneva Conventions, which were adopted before 1949 were concerned with combatants only, not with civilians. The events of World War II showed the disastrous consequences of the absence of a convention for the protection of civilians in wartime. The Convention adopted in 1949 takes account of the experiences of World War II. It is composed of 159 articles. It contains a short section concerning

the general protection of populations against certain consequences of war, without addressing the conduct of hostilities, as such, which was later examined in the Additional Protocols of 1977. The bulk of the Convention deals with the status and treatment of protected persons, distinguishing between the situation of foreigners on the territory of one of the parties to the conflict and that of civilians in occupied territory. It spells out the obligations of the Occupying Power vis-à-vis the civilian population and contains detailed provisions on humanitarian relief for populations in occupied territory. It also contains a specific regime for the treatment of civilian internees. It has three annexes containing a model agreement on hospital and safety zones, model regulations on humanitarian relief and model cards.

The Geneva Conventions have been ratified by all States and are universally applicable.

In the two decades that followed the adoption of the Geneva Conventions, the world witnessed an increase in the number of non-international armed conflicts and wars of national liberation. In response, two Protocols Additional to the four 1949 Geneva Conventions were adopted in 1977. They strengthen the protection of victims of international (Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (API)) and non-international (Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Non-international Armed Conflicts (APII)) armed conflicts and place limits on the way wars are fought. Protocol II was the first-ever international treaty devoted exclusively to situations of non-international armed conflicts.

In 2005, a third Additional Protocol was adopted creating an additional emblem, the Red Crystal, which has the same international status as the Red Cross and Red Crescent emblems.

*Fig. 2 − Protected emblems under the Geneva Conventions*

Other international treaties prohibit the use of certain weapons and military tactics, and protect certain categories of person and object from the effects of hostilities.

These treaties include[4]:

- the 1925 Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare;

- the 1954 Convention for the Protection of Cultural Property in the Event of Armed Conflict and its two Protocols of 1954 and 1999;

- the 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction;

- the 1976 Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques;

- the 1980 Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (CCW) and its five Protocols of 1980 (I, II and III), 1995 (IV), and 2003 (V);

[4] International Committee of the Red Cross. ADVISORY SERVICE ON INTERNATIONAL HUMANITARIAN LAW. What is international humanitarian law?

- the 1993 Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction;

- the 1997 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (APMBC);

- the 2000 Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict;

- the 2006 International Convention for the Protection of All Persons from Enforced Disappearance;

- the 2008 Convention on Cluster Munitions (CCM).

In addition, the 1998 Statute of the International Criminal Court (ICC) established the Court's jurisdiction in respect of war crimes (Article 8), thus strengthening States' obligation to prevent serious violations of IHL.


Many provisions of the treaties mentioned above are now thought to reflect customary IHL and are, consequently, binding on all States and all parties to a conflict.

IHL applies only to situations of armed conflict. It does not cover internal tensions or disturbances such as isolated acts of violence that do not reach the threshold of an armed conflict. In addition, IHL distinguishes between International and non-international armed conflict.

International armed conflicts are those in which one or more States resort to the use of armed force against another State. Wars of national liberation, under certain conditions, and situations of occupation are regarded as international armed conflicts. International armed conflicts as

mentioned above are governed by the four Geneva Conventions and Additional Protocol I.

Non-international armed conflicts are restricted to the territory of a single State and involve either governmental armed forces fighting one or more non-State armed groups, or such groups fighting each other. The rules applicable to non-international armed conflict have a more limited scope than those governing international armed conflict.

These rules are set out in Article 3 common to the four Geneva Conventions and in AP II. However, customary law expands the protection provided by certain rules of IHL to all types of armed conflict, including non-international conflicts.

IHL applies once the conditions for an armed conflict or occupation are met on the ground – even if a state of conflict is not recognized as such by one of the parties and regardless of whether the occupation encounters armed resistance.

IHL applies equally to all sides, irrespective of who started the fighting and, in the case of international armed conflict, even if one of the belligerent States is not party to the Geneva Conventions or Additional Protocol I.

The distinction between international and non-international conflict is not always clear-cut.

In recent years, conflicts have arisen that contain elements of both. A case-by-case approach is therefore recommended to determine which normative framework is applicable.

As a general rule, IHL prohibits means and methods of warfare that cause superfluous injury or unnecessary suffering.

Specific treaties have therefore banned or restricted the use of many weapons, including exploding bullets, chemical and biological weapons, blinding laser weapons, anti-personnel mines, cluster munitions, and incendiary weapons.

Pillage, starvation and perfidy are some of the methods of warfare specifically prohibited under IHL.

IHL also regulates the general conduct of hostilities on the basis of *three core principles*: distinction, proportionality, and precaution.

The principle of distinction requires that the parties to an armed conflict distinguish at all times between civilians and civilian objects on the one hand, and combatants and military objectives on the other, and that attacks may only be directed against combatants and military objectives. The purpose of this is to protect individual civilians, civilian property, and the civilian population as a whole. Under this principle, indiscriminate attacks are prohibited.

The principle of proportionality, a corollary to the principle of distinction, dictates that incidental loss of civilian life and property or injury to civilians must not be excessive in relation to the concrete and direct military advantage anticipated.

In order to implement the restrictions and prohibitions on targeting, the principle of precaution requires all parties to an armed conflict to take specific precautions such as, when conducting an attack, to verify that targets are military objectives or to give the civilian population an effective warning before the attack. It can also entail restrictions on the timing and location of an attack.

In addition, Articles 35(3) and 55 of AP I prohibit methods and means of warfare that cause widespread, long-term and severe damage to the natural environment.

The rules on the conduct of hostilities also grant specific protection to certain objects, including cultural property and places of worship (the 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict; AP I), objects indispensable to the survival of the civilian population (AP I), and “works and installations containing dangerous forces” (AP I, Article 56; AP II, Article 15). Such works and installations, as

well as cultural property and civil defence personnel and facilities, can be identified by specific symbols.

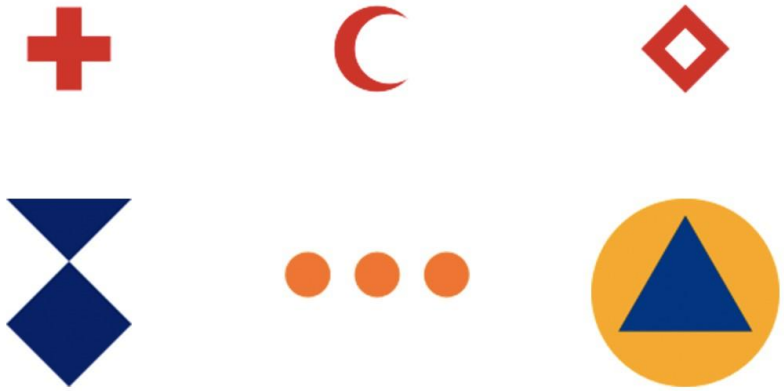


*Fig. 3 − Internationally recognized protective emblems*[5]

Implementation of IHL is primarily the responsibility of States. They must respect and ensure respect for these rules in all circumstances.

States must adopt legislation and regulations aimed at ensuring full compliance with IHL. States must also adopt laws protecting the red cross, red crescent, red crystal and other symbols.

Other domestic implementation measures should also be taken: developing educational programmes for the armed forces and the general public; recruiting and/or training qualified, specialist personnel; producing identity cards and other documents for protected persons, etc.

[5] https://www.iai.it/en/pubblicazioni/e-emblems-protective-emblems-and-legal-challenges-cyber-warfare

In this context **civil defence** is defined in international humanitarian law according to the tasks carried out rather than the organizations that carry out those tasks[6].

Thus, AP I (Art. 61) provides a list of "humanitarian tasks" to be performed for the following purposes:

- to protect the civilian population against the dangers arising from hostilities or other disasters;
- to help it to recover from the immediate effects of such events;
- to provide the conditions necessary for its survival.

The list is limited to the 15 following tasks:

- warning;
- evacuation;
- management of shelters;
- management of blackout measures;
- rescue;
- medical services – including first aid – and religious assistance;
- fire-fighting;
- detection and marking of danger areas;
- decontamination and similar protective measures;
- provision of emergency accommodation and supplies;
- emergency assistance in the restoration and maintenance of order in distressed areas;
- emergency repair of indispensable public utilities;
- emergency disposal of the dead;
- assistance in the preservation of objects essential for survival;
- complementary activities needed to carry out any of the tasks mentioned above.

[6] International Committee of the Red Cross. ADVISORY SERVICE ON INTERNATIONAL HUMANITARIAN LAW. Civil Defence in International Humanitarian Law. https://www.icrc.org/en/document/civil-defence-international-humanitarian-law

The provisions of AP I cover **the civil defence organizations set up by the State**, their personnel and any civilians called upon by the State to carry out civil defence tasks under its control.

International humanitarian law establishes specific provisions for the protection of civil defense personnel, as well as for the installations, equipment, and supplies they use. Because of the close links between civil defense services and military authorities (which help organize them), the personnel and organizations involved in such activities are protected by international humanitarian law, when they are assigned exclusively to the performance of the tasks listed earlier.

Civil defence aims to mitigate the loss, damage and suffering inflicted on civilians as a result of the dramatic development of the means and methods of warfare. It is an essential component of the protection of civilians against military operations provided by international humanitarian law.

## SECTION 2
## INSTITUTIONAL AND ORGANIZATIONAL FRAMEWORK OF CIVIL PROTECTION IN UKRAINE

Since the Declaration of the Independence, the formation of the national system of protection of population and territories from emergency situations were assigned to Civil protection headquarters being the central executive authority subordinated to the Cabinet of Ministers of Ukraine.

Civil protection of Ukraine has become an important element of national security. Importantly, the Prime - Minister of Ukraine had been assigned to be the head of Civil Protection of Ukraine, as well as the heads of executive bodies had been assigned to become heads of Civil Protection in the regions. In order to improve the governance in the field of civil protection, the Ministry of Ukraine on Emergencies and Affairs of Population's Protection from Consequences of Chernobyl Catastrophe had been established in 1996.

The adoption of the Code of Civil Defense of Ukraine (October 2, 2012) was extremely important, as it is the only systematic legislative act on civil protection. Consequently, the issue and the implementation of Decrees of the President of Ukraine, acts of the Cabinet of Ministers of Ukraine, which determined tasks and functions, mechanisms of formation and realization of state policy in this area have become very important, including the reassignment of the State department of fire security from the Ministry of Internal Affairs in 2003 to the Fire Extinguishing and Emergency Response. Both governmental body and its subordinate authorities, institutions and units

that contributed to the unification of forces and means had been reassigned.

On December 24, 2012 the Ministry of Emergencies of Ukraine and the State Inspectorate of technological security of Ukraine had been reorganized into the State Emergency Service of Ukraine (hereinafter - SESU), which was coordinated by the Cabinet of Ministers of Ukraine through the Minister of Defense of Ukraine (since April 25, 2014 it is coordinated by the Cabinet of Ministers of Ukraine through the Minister of Interior of Ukraine).

Now the State Emergency Service of Ukraine (SESU) is a central body of executive power with activities directed and coordinated by the Cabinet of Ministers through the Minister of internal affairs. It implements state policies in the domain of civil protection, protection of population and territories from emergencies, prevention of emergencies, rectification of emergency consequences, rescue work, fire extinguishing, fire and technogenic safety, accident rescue service activities and hydrometeorologic activities.

The principal tasks of SESU are:

1) implementing state policies in the domain of civil protection, protection of population and territories from emergencies, prevention of emergencies, rectification of emergency consequences, rescue work, fire extinguishing, fire and technogenic safety, accident rescue service activities and hydrometeorologic activities;

2) providing state supervision (control) over observing and satisfying legal requirements in the domain of civil protection, fire and technogenic safety, accident rescue service activities;

3) introducing proposals on state policymaking in the aforesaid spheres for consideration by the Minister of internal affairs;

4) implementation, within its powers envisaged by the law, of state policies in volunteer activities.

The Code of civil protection of Ukraine (2012) governs the relations connected with protection of the population, the territories, the surrounding environment and property against emergency situations, response to them, functioning of single state system of civil protection and determines powers of public authorities, Council of Ministers of the Autonomous Republic of Crimea, local government bodies, the rights and obligations of citizens of Ukraine, foreigners and stateless persons, the companies, organizations and the organizations irrespective of pattern of ownership.

The legal basis of civil protection is the Constitution of Ukraine, Code of civil protection of Ukraine, other laws of Ukraine, and also acts of the President of Ukraine and the Cabinet of Ministers of Ukraine.

**Civil protection** is the function of the state directed to protection of the population, the territories, the surrounding environment and property against emergency situations by prevention of such situations, liquidations of their effects and assistance by the victim in peace time and during the special period.

Civil protection is performed on such basic principles:

1) guaranteeing and ensuring constitutional rights of citizens with the state on protection of life, health and property;

2) integrated approach to the solution of tasks of civil protection;

3) priority of the tasks directed to rescue of life and preserving health of citizens;

4) greatest possible, economically reasonable reduction of risk of emergence of emergency situations;

5) centralization of management, one-man management, subordination, authorized discipline of Operational rescue service of civil protection, rescue services;

6) publicity, transparency, free receipt and distribution of public information on condition of civil protection, except the restrictions established by the law;

7) voluntariness - in case of involvement of citizens to implementation of the actions of civil protection connected with risk for their life and health;

8) responsibility of officials of public authorities and local government bodies for observance of requirements of the legislation concerning civil protection;

9) justified risk and responsibility of heads of forces of civil protection for safety during rescue and other urgent works.

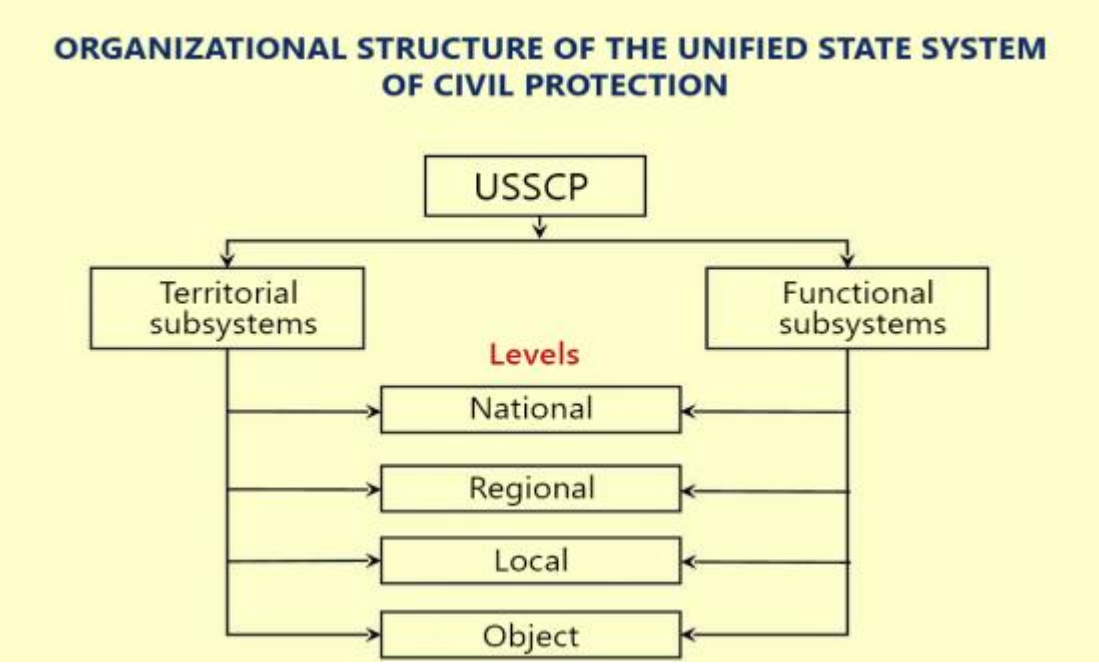



*Fig. 4 − Organizational structure of the Unified State System of Civil Protection*[7]

[7] Report “Civil Protection Code of Ukraine: structure, content, peculiarities of certain norms and provisions” – Oleksandr Mykolayovych Yevdin, Director, All-Ukrainian Research and Development Institute for Civil Protection of Civilians and Territories Against Industrial and Natural Disasters https://ppt-online.org/61833

According to the Regulation on the Unified State System of Civil Protection, the existing civil protection system consists of permanent functional and territorial subsystems and their branches.

Functional subsystems of the unified state system of civil protection (“functional subsystems”) are created by central executive authorities in the relevant areas of social life for the purpose of protecting civilians and localities against disasters during peacetime and a special period, and ensuring preparedness of forces and means subordinated to them for actions aimed to prevent and respond to disasters.

Territorial subsystems of the unified state system of civil protection (“territorial subsystems”) are created in the Autonomous Republic of Crimea, blasts, and the cities of Kyiv and Sevastopol for the purpose of protecting civilians and localities in the relevant region against disasters during peacetime and a special period.


*Fig. 5 − Map of Ukraine with boundaries of administrative units (oblasts)*

The Unified State System of Civil Protection is ensuring realization of state policy in the field of civil protection is performed by single state system of civil protection which consists of functional and territorial subsystems and their links.

The Unified State System of Civil Protection depending on scales and features of emergency situation which is predicted or arose, **functions in the modes**:

1) daily functioning;

2) the increased readiness;

3) emergency situation;

4) emergency state.

The regulations on single state system of civil protection determine the list of actions which are performed in the corresponding mode, tasks and order of interaction of subjects of ensuring civil protection during functioning of the specified system in the corresponding mode.

Forces of civil protection are the rescue units, specialized services and other forming of civil protection intended for carrying out rescue and other urgent works on liquidation of emergency situations. They include:

- Operational rescue service of civil protection - special not military consolidation of rescue and other forming, governing bodies of such forming of system of the central executive body which provides forming and implements state policy in the field of civil protection;

- Rescue services - set organizationally the joint governing bodies, forces and means intended for carrying out rescue and other urgent works;

- Formations of civil defense. They are formed to carry out large amounts of work to eliminate the consequences of emergencies, military

(combat) actions or terrorist acts, as well as for restoration work, which requires the involvement of a large number of people and equipment;

- Specialized rescue services - the professional rescue service which has the trained rescuers and appropriate means of civil protection and is intended for carrying out rescue and other urgent works with extra risk for life and health, in particular for suppression of gas fountains, carrying out diving and mine-rescue works;


- Fire and rescue units (brigades);

- Voluntary formations of civil protection are formed during the threat or occurrence of emergencies to carry out ancillary work to prevent or eliminate the consequences of such situations.

The cooperation procedure between forces of civil protection with other subjects providing civilian protection, which are involved in the response to emergency, based on the plans of cooperation. Leaders at all levels in the response to the emergency should take all possible measures to maintain continuous cooperation with subordinates and interacting government bodies and civil defense forces, to immediately resume cooperation in case of loss.

In case of significant unpredicted plans, changes in the situation and necessity in new tasks the order of cooperation is specified by managers interacting government bodies, civil defense forces or is determined again.

Article № 28 of the Code of Civil Protection of Ukraine stipulates that Armed Forces of Ukraine may be involved in the case of emergencies, as well as other military units and law enforcement agencies for special purposes, formed under the laws of Ukraine. Engagement rules of Armed forces of Ukraine, other military formations and law enforcement of special purpose, established according to the laws of Ukraine for emergencies

determined in accordance with the Constitution of Ukraine and laws of Ukraine "On legal regime of emergency situation", "On the Armed Forces of Ukraine" and other laws.

Participation in rectification of the emergency consequences of natural and industrial disasters is one of the most important activities of the Armed Forces of Ukraine in peacetime.

**Emergency situation** is situation in the separate territory or the


subject of managing on it or water object which is characterized by violation of normal conditions of life activity of the population caused by catastrophic crash, accident, the fire, natural disaster, epidemic, epizooty, epiphytoty, use of weapons of destruction or other dangerous event which brought (can bring) to emergence of threat of life or health of the population, large number of dead and injured, drawing considerable loss of property, and also to impossibility of accommodation of the population in such territory or object, implementation on it economic activity.

Emergency situations in Ukraine are classified by nature of origin, extent of distribution, the amount of human losses and loss of property.

Depending on nature of origin of events which can cause emergence of emergency situations in the territory of Ukraine such types of emergency situations are determined:

1) technogenic nature;

2) natural nature;

3) social;

4) military.

Depending on amounts of the effects caused by emergency situation, amounts of the technical and material resources necessary for their liquidation, such levels of emergency situations are determined:

1) state;

2) regional;

3) local;

4) object.

Classification signs of emergency situations are determined by the central executive body which provides forming and implements state policy in the field of civil protection.

The Code of civil protection of Ukraine (CCPU) regards **monitoring** as a part of the disaster prevention system featuring government regulation of civil protection-related activity of business entities. This stance is quite reasonable, because monitoring serves as the basis for planning of disaster prevention actions.

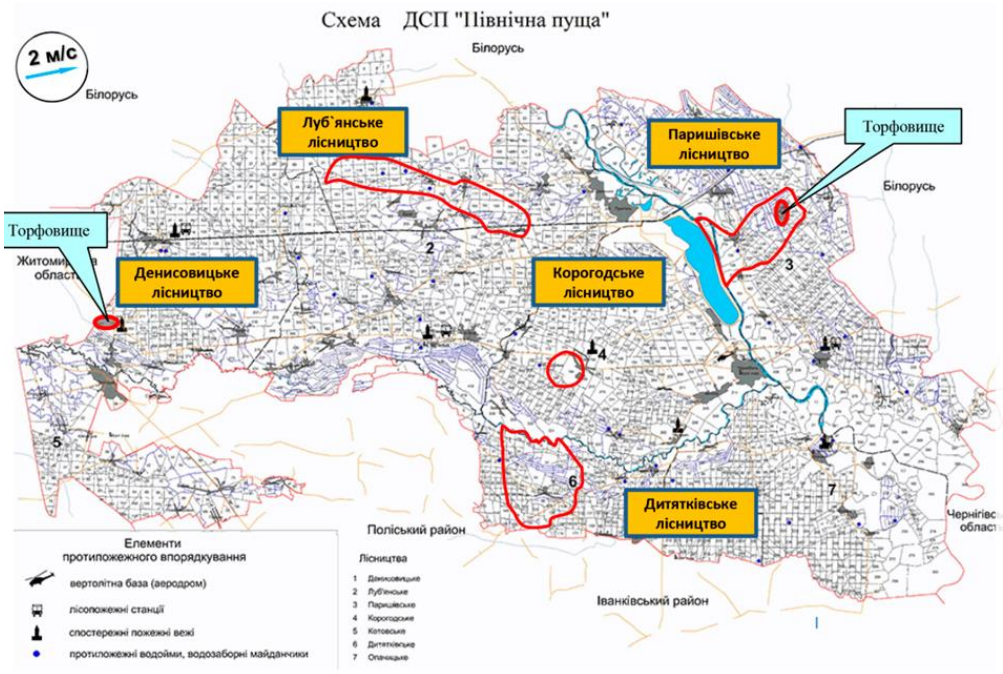



*Fig.6 − Example of monitoring forest fires in the exclusion zone (April 19, 2020)*

At the same time, it would have been inappropriate to limit the scope of using monitoring data only by the prevention sphere.

According to Article 43 of the CCPU, disaster monitoring is a system of continuous observations, laboratory and other controls performed to assess the state of protection of civilians and territories and the hazardous processes which can result in the potential or actual occurrence of disasters, and also, timely identification of tendencies toward their change.

According to the same Article, a separate disaster monitoring and forecasting system must be created and launched for the purpose of monitoring and forecasting disasters in Ukraine. Finally, the CCPU states that the procedure of this system's functioning and the list of institutions and organizations responsible for disaster monitoring, observation, laboratory control and forecasting shall be determined by the Cabinet of Ministers of Ukraine.

Currently, the disaster monitoring process is not regulated by a separate legislative ac[8]t. In fact, disaster monitoring consists of two large systems:

- environmental monitoring, regulated by the Regulation on the State Environmental Monitoring System[9], and

- monitoring of potentially hazardous objects, regulated by the Regulation on Monitoring of Potentially Hazardous Objects[10].

Presently, the environmental monitoring system is not fully functional as a single system. Only certain elements of the monitoring system are operational, such as monitoring of the ambient air and surface water. But at the same time, here is no monitoring of underground water, mine water

[8] On the state of Ukrainian legal framework regulating civil protection in the context of priorities of the Sendai Framework for Disaster Risk Reduction. ANALYTICAL REPORT. https://r2p.org.ua/wp-content/uploads/2021/02/report-on-civil-protection_3p-consortium-eng-1.pdf

[9] On the approval of the Regulation on the State Environmental Monitoring System. Resolution 391 of the Cabinet of Ministers of Ukraine of 30 March 1998.

[10] On the approval of the Regulation on Monitoring of Potentially Hazardous Objects. Order 425 of the Ministry of Ukraine for Emergencies and Civil Protection against the Chornobyl Disaster Consequences of 06.11.2003.

or groundwater; data concerning the state of subsoil is not being gathered on a regular basis. No uniform methodology of gathering this data is available, and there is no authority responsible for gathering, analyzing and publishing this data. Therefore, an integrated system ensuring the availability of comprehensive data concerning the state of the natural environment is presently nonexistent.

As for the monitoring of potentially hazardous objects (PHOs), it shall be performed, according to Ukrainian law, by USSCP entities according to the level of their subordination, and also, at object level, by persons responsible for civil protection.

The monitoring functions are divided among the authorized bodies for emergencies, the State Department of Documentation Insurance Fund (DIF Department) and its subordinated institutions and legal entities which own (use) PHOs. According to the Regulation, the purposes of PHO monitoring are to improve the knowledge of potential hazard coming from monitored objects and improve information services provided to users of the PHO Register.

The existing PHO regulatory framework is presently being reformed. According to information provided by a representative of the Industrial Safety Division, Disaster Prevention Department of the State Emergency Service of Ukraine, active lawmaking work is currently underway for the purpose of harmonizing Ukrainian legislation with EU standards, in particular, on the transition from the concept of potentially hazardous object (PHO) to the concept of object of major hazard (OMH) for the purpose of implementing the relevant European standards, in particular, Directive 2012/18/EU[11].

[11] On the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC. Directive 2012/18/EU of the European Parliament and of the Council of 04 July 2012

A number of draft legislative acts are currently being developed for this purpose, aimed to introduce the term “object of major hazard” into Ukrainian legislative framework.

During 2018-2019 the official website of the State Emergency Service of Ukraine published drafts of two documents: a draft Procedure of Operating a Disaster Monitoring and Forecasting System, and a draft Regulation on Interaction of Entities Responsible for Disaster Monitoring, Observation, Laboratory Control and Forecasting.

It has been said the regulatory basis of the civil protection system in Ukraine is comprised of two key documents in this area: the Civil Protection Code of Ukraine (CPCU) adopted in 2012, and the Regulation on the Unified State System of Civil Protection14 approved in 2014. These documents comprise and govern the structure of the civil protection system in Ukraine. A number of sectoral regulatory acts governing operation of the civil protection system in Ukraine were developed and adopted on their basis.

In the conditions of implementing decentralization reform, a significant portion of authority, including civil protection-related, must be transferred to the smallest administrative subdivision: amalgamated community (AC)[12].

Considering decentralization reform, attention should be given to developing regulatory acts at local level, providing greater methodological assistance to ACs, improving connection and dialogue among national, regional and local levels, in particular, when creating and developing structural units and formations at AC level.

It is worth noting that the civil protection system existing in Ukraine today needs to be changed. These changes must concern not only legal regulation of certain aspects of the national policy on civil protection – the

[12] On Voluntary Amalgamation of Territorial Communities. Law of Ukraine No 57 of 5 February 2015. The Official Journal of Ukraine of 13.03.2015 — 2015, No 18, page 21

approaches to this policy must be fundamentally changed. To build a modern, European civil protection system, not only public bodies and services but also businesses and the public at large must be engaged in these changes.

The involvement in processes, understanding of how the system works, continuous development, training and awareness – these are the fundamental principles of a sophisticated, resilient system which the civil protection system must become.

Today, there is an opportunity to borrow from the best international practices and management principles in this sphere, gathered and laid down in the Sendai Framework, and obtain the desired result – a modern civil protection system conformant with international standards and today's challenges[13].

[13] On the state of Ukrainian legal framework regulating civil protection in the context of priorities of the Sendai Framework for Disaster Risk Reduction. ANALYTICAL REPORT. https://r2p.org.ua/wp-content/uploads/2021/02/report-on-civil-protection_3p-consortium-eng-1.pdf

## SECTION 3
## EMERGENCY MONITORING

Contrary to popular belief that technical civilization has reduced the risk associated with human exposure to adverse natural processes and phenomena, the analysis of the modern world shows that it remains vulnerable to emergencies that destabilize social and economic systems.

An emergency situation is the result of a set of exceptional circumstances that have developed in the relevant area as a result of an emergency of man-made, natural, anthropogenic and military nature, as well as under the influence of possible emergencies.

Thus, an emergency is the result of an emergency and possible emergency.

Emergencies in their development go through *five conditional phases*[14]:

First: the accumulation of deviations from the normal state or process. In other words, this is the stage of emergence of the emergency, which can last days, months, sometimes years and decades.

Second: initiating an emergency (accident or natural disaster).

Third, the process of an emergency that affects people, objects, and the environment. Practically this phase is a consequence and development of the second.

Fourth: the action of secondary affecting factors under the influence of possible emergencies.

Fifth: emergency response. The fifth phase can begin in time before the end of the third phase and combine with the fourth.

One of the important properties of an emergency is surprise and suddenness. But this is only a form of their realization, manifestation. In

[14] Основи цивільного захисту: Навч. посібник / В.О. Васійчук, В.Є Гончарук, С.І. Качан, С.М. Мохняк.- Львів:Видавництво Національного університету "Львівська політехніка", 2010.- 417 с.

essence, they arise as a natural result of the action of many factors that form a causal chain of events that lead to extreme situations.

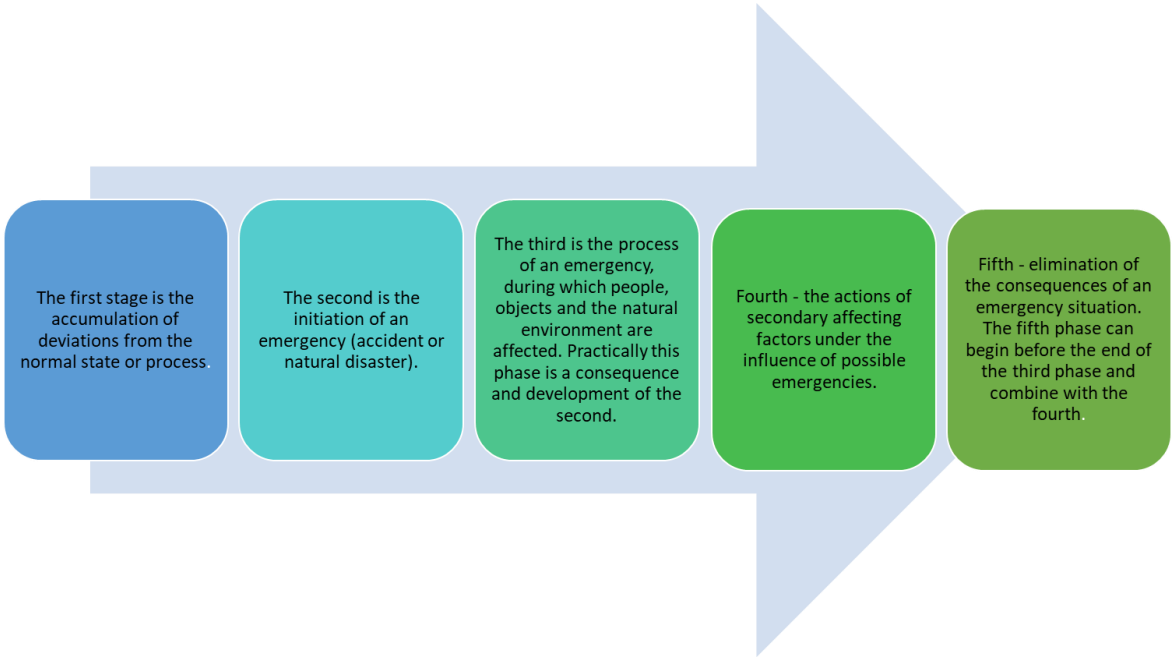



*Fig. 7 − Five conditional stage phases of emergency situation*

The emergency cannot be perceived as a one-moment act - a catastrophe, but must be considered in dynamics as a process in which some events are a consequence of others. It follows that society should not adhere to a passive waiting strategy, concentrate forces and resources solely on protecting the population directly in extreme situations and eliminating their consequences. **Every effort should be made to reduce the risk of emergencies**.

Emergencies are classified according to the nature of the origin, the degree of spread, the amount of human loss and material damage.

***The level of the emergency situation*** (Table 1) is determined in accordance with the Procedure for Classification of Emergencies by Their Levels, approved by the Resolution of the Cabinet of Ministers of Ukraine of March 24, 2004 № 368, as: state; regional; local; object.

*Table 1. Criteria for determining the level of emergency* [15]

| Level of emergency | Died, persons | Injured, persons | Violated living conditions of the population for more than 3 days, persons |
|---|---|---|---|
| *State* | 10 | 300 | 50 thousand |
| Taking into account losses | 5 | **100** | 10 thousand |
| Territorial distribution | The emergency has spread or may spread to the territory of other states<br>The emergency has spread to the territory of the two regions, and to eliminate it requires resources in excess of the capacity of these regions, but not less than 1% of their budgets | | |
| *Regional* | 5 | **100** | 10 thousand |
| Taking into account losses | 3—5 | 50—100 | 1—10 thousand |
| Territorial distribution | The emergency has spread to the territory of the two regions, and to eliminate it requires resources in excess of the capacity of these regions, but not less than 1% of their budgets | | |
| *Local* | 2 | 50 | 1 thousand |
| Taking into account losses | 1—2 | 20—50 | 100—1 thousand |
| Territorial distribution | The emergency has spread to the territory, threatens the environment, settlements, buildings, and to eliminate it requires resources in excess of the capacity of this object | | |
| *Object* | Emergency criteria do not reach these indicators | | |

The final decision on the level of emergency is made by the SESU in agreement, if necessary, with the interested central authorities, as well as taking into account the expert opinion (if provided) of the regional

[15] https://zakon.rada.gov.ua/laws/show/368-2004-%D0%BF#Text

commission on thermal power and emergency (commission on technogenic and environmental safety and emergencies).

***Depending on the nature of the origin*** of events that may cause emergencies in Ukraine, the following types of emergencies are identified:

1) of a technogenic nature;

2) of a natural nature;

3) social;

4) military.

The National Classifier DK 019: 2010 "Classifier of Emergencies" classifies 167 emergencies, of which: man-made - 78; of natural character - 62; social nature - 26; military nature - 1.

Emergency of natural nature - violation of normal living conditions and activities of people in a particular area or object on it or on a water body, associated with a dangerous geophysical, geological, meteorological or hydrological phenomenon, soil or subsoil degradation, fire in natural ecological systems, changes in the state of the air basin, infectious diseases and poisoning of people, infectious diseases of domestic animals, mass death of wild animals, damage to agricultural plants by diseases and pests, etc.

Emergency situation of man-caused nature - violation of normal living conditions and activities of people in a particular area or facility on it or on a water body due to a traffic accident (catastrophe), fire, explosion, accident with the release (threat of release) of dangerous chemical, radioactive and biologically hazardous substances, sudden destruction of buildings; accidents in power systems, life support systems, telecommunications systems, sewage treatment plants, oil and gas industrial systems, hydrodynamic accidents, etc.

Social emergency - violation of normal living conditions and activities of people in a particular territory or facility on it or on a water body, caused by illegal acts of terrorism and unconstitutional orientation, or associated

with the disappearance (theft) of weapons and dangerous substances, accidents with people, etc.

A military emergency is a violation of the normal living conditions and activities of people in a particular area or facility on it or on a body of water, caused by the use of conventional weapons or weapons of mass destruction, during which there are secondary factors affecting the population. separate normative documents. This classifier of military emergencies is not given in detail, but only indicated at the highest level of detail with the code 40,000.

***Natural threats*** can be caused by geological, hydrometeorological, medical and biological factors and fires in natural ecosystems.

• *Geological threats* (geophysical and geological emergencies). The most dangerous for the life of the population and objects of the economy are flooding of lands and settlements, landslides, abrasion, karst processes and earthquakes.

• *Threats of hydrometeorological nature* (meteorological, hydrological marine and hydrological emergencies of surface waters). The causes of emergencies in Ukraine are such phenomena as downpours, squalls or tornadoes, mudslides, floods, intense ice drift and more.

• *Threats of medical and biological nature* (medical and biological emergencies). The greatest dangers are infectious diseases of the population, mass poisoning of people, infectious diseases of farm animals, the mass spread of pests of agricultural plants.

Analysis of the causes of medical and biological emergencies shows that they are quite traditional. These are, first of all, violation of production technology, terms of storage and sale of food products, non-compliance with sanitary-hygienic and sanitary-epidemiological norms, non-compliance of drinking water quality with regulatory requirements, low level of sanitary-educational work, reflecting negative modern ecological and socio-economic state of society.

• *Threats of fires in natural ecosystems* (emergencies related to fires in natural ecosystems). Forest lands in Ukraine cover an area of over 10.7 million hectares. On average, according to the SESU, 3,500 forest fires are recorded annually on an area of more than 5,000 hectares of forest.

***Threats of man-made emergencies*** can be caused by hazard factors: radiation, chemical, fire and explosion, hydrodynamic, transport, life support facilities, cross-border threats.

Radiation hazard is one of the most dangerous man-made factors that negatively affect the living conditions of the population and the environment. In Ukraine, the objects of nuclear and radiation danger are:

• 4 operating NPPs (nuclear power plants) (Zaporizhzhya, South-Ukrainian, Khmelnytsky and Rivne with reactors such as WWER-440 and WWER-1000);

• spent nuclear fuel storage facilities;


*Fig. 8 − NPPs of Ukraine*

• 2 research reactors;

• uranium ore mining and processing enterprises;

• Shelter and waste in the 30-kilometer zone of the Chernobyl NPP;

• 8 enterprises dealing with radioactive waste;

• enterprises that use sources of ionizing radiation and radiation-hazardous technologies.

The main factors of chemical danger in Ukraine include the operation of more than 1.4 thousand facilities, which store or use in production more than 350 thousand tons of hazardous chemical substance (HCS), including: about 9 thousand tons of chlorine, 213 thousand tons ammonia and more than 130 thousand tons of other HCS.

The biggest polluters among 30 enterprises are the Kaluga concern "Oriana"; Lysychansk soda plant; Severodonetsk VO "Nitrogen"; Kremenchug and Nadvirna refineries, Prydnipryansky Chemical Plant.

There are more than 1.5 thousand explosive and fire-hazardous objects in Ukraine, on which about 13 million tons of solid and liquid explosive and fire-hazardous substances are concentrated. They include an extensive network of oil, gas, ammonia pipelines, chemical, oil and gas refining, coke and metallurgical enterprises, conventional gas stations and more.

The real threat is posed by about 1.4 million tons of conventional types of ammunition stored in the arsenals, bases and warehouses of the Armed Forces stationed throughout Ukraine (Fig. 9).

The main factors of hydrodynamic danger are hydraulic structures, which create and concentrate a certain amount of water: dams, dams, sluices. More than 800 reservoirs have been created in Ukraine. They are environmentally dangerous due to the volume of water, which in the event of a break in the dams can cause flooding of lands, settlements, economic damage, death of people and farm animals.

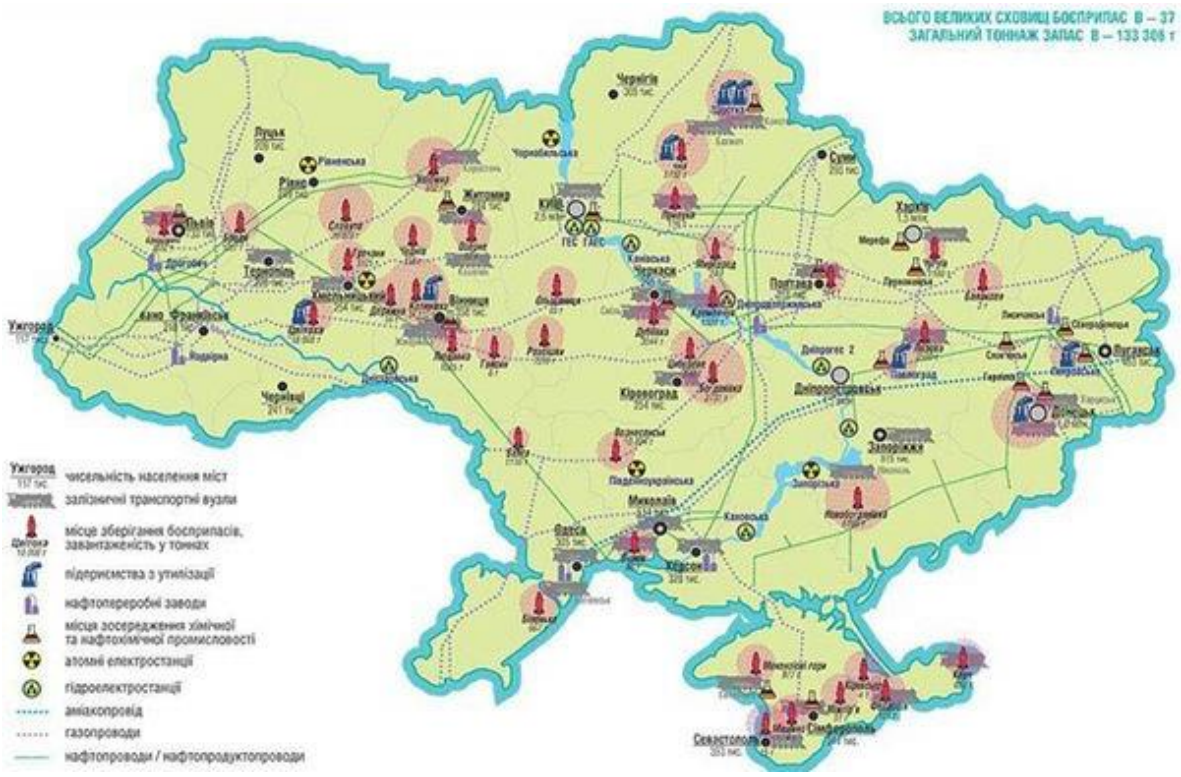



*Fig. 9 − Large ammunition depots in Ukraine*

In the transport sector of Ukraine there are: 6 railways, 32 airports, 20 state sea trade ports, 10 river ports, 97 air and about 150 shipping companies of various forms of ownership, about 700 state enterprises, institutions and organizations, more than 58 thousand business entities which carry out motor transportations.

***Social threats***. Illegal acts of terrorism and unconstitutional orientation, which can lead to a socio-political emergency in Ukraine are:

• armed attacks, seizures and forcible detention of nuclear power plants or other important facilities;

• attempt on the lives of heads of state and people's deputies of Ukraine;

• attack, attempt on the life of crew members of an aircraft or sea (river) vessel, abduction, destruction of such vessels; hostage-taking from among crew members or passengers; installation of an explosive device in crowded places, on objects, in the residential sector, on transport;

• disappearance or theft of weapons and HP from PHO (potentially hazardous object), OMH (object of major hazard) and during transportation;

• detection of obsolete ammunition, accidents at arsenals, ammunition depots and other military facilities;

• related to accidents with people, etc.

***Threats of a military nature*** are related to the consequences of the use of modern means of destruction in wartime on the territory of the state. These include nuclear, chemical, bacteriological and new weapons, such as:

• beam weapon (directed-energy weapon) - the action is based on the use of sharp rays of electromagnetic energy or a concentrated beam of elementary particles, accelerated to high speeds.

• radio frequency weapons - the action is based on the use of electromagnetic radiation of ultra-high or ultra-low frequencies. Impressive effect - damage, violation of vital functions, organs and systems of man, such as the brain, heart, circulatory system, central nervous system.

• radiological weapons (radioactive material weapon) - the action is based on the use of radiological warfare agents, as well as waste generated during the operation of nuclear reactors.

• geophysical weapons - action based on the use of destructive forces of inanimate nature by their artificial initiation: such as hurricanes, artificial earthquakes, landslides, avalanches, landslides, mudslides, artificial magnetic storms, droughts and more.

• nano weapons - the use of nanotechnology in the design of military equipment, nanorobots.

Analysis of hazards and threats of man-made and natural nature, the occurrence of emergencies shows that over the past 10 years, trends to increase or decrease are not observed (Table 2).

*Table 2. The state of man-made and natural security in Ukraine (number of emergencies that took place in Ukraine in 2009 - 2018)*

| **Years** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
|---|---|---|---|---|---|---|---|---|---|---|
| All emergencies* | 264 | 254 | 221 | 212 | 144 | 143 | 148 | 149 | 166 | 128 |
| Including: | | | | | | | | | | |
| technogenic nature | 133 | 135 | 134 | 120 | 76 | 74 | 63 | 56 | 50 | 48 |
| natural nature | 117 | 108 | 77 | 74 | 56 | 69 | 77 | 89 | 107 | 77 |
| social | 14 | 11 | 10 | 18 | 12 | 10 | 8 | 4 | 9 | 3 |
| Including: | | | | | | | | | | |
| state level | 2 | 3 | 4 | 1 | 1 | 5 | 2 | 1 | 2 | 2 |
| regional level | 29 | 16 | 3 | 13 | 12 | 9 | 9 | 9 | 8 | 6 |
| local level | 109 | 107 | 89 | 83 | 58 | 59 | 62 | 64 | 70 | 64 |
| object level | 124 | 126 | 125 | 115 | 73 | 70 | 75 | 65 | 86 | 56 |
| Died, persons | 356 | 361 | 355 | 301 | 253 | 387 | 343 | 183 | 172 | 168 |
| Injured, persons | 1516 | 753 | 986 | 861 | 864 | 680 | 962 | 1856 | 892 | 839 |
| Material losses, UAH million | 594,0 | 984,7 | 102,8 | 249,8 | 396,3 | 198,9 | 532,7 | 266,3 | 896,8 | 516,4 |
| * Number of emergencies without taking into account the territorial distribution of emergencies (some emergencies were territorially spread to several regions of Ukraine) | | | | | | | | | | |

However, given the preservation of the level of consequences of emergencies, it should be noted that the level of risks of natural and man-made emergencies and the risks of losses from them remain virtually unchanged and quite high for most regions of Ukraine.

The risks of losses remained particularly acute in 2010 and 2017, due to the occurrence and spread of complex natural disasters.

Each region of Ukraine has its own levels of technogenic-natural-social threat (risks), which must be taken into account to adequately respond to natural, man-made and social emergencies. For example, in 2019, the largest number of emergencies was registered in Odesa oblast (11 emergencies), Donetsk and Poltava oblasts (10 emergencies each), and the smallest number was registered in Cherkasy (1 emergency) and Khmelnytsky (2 emergencies) oblasts (Fig. 10).

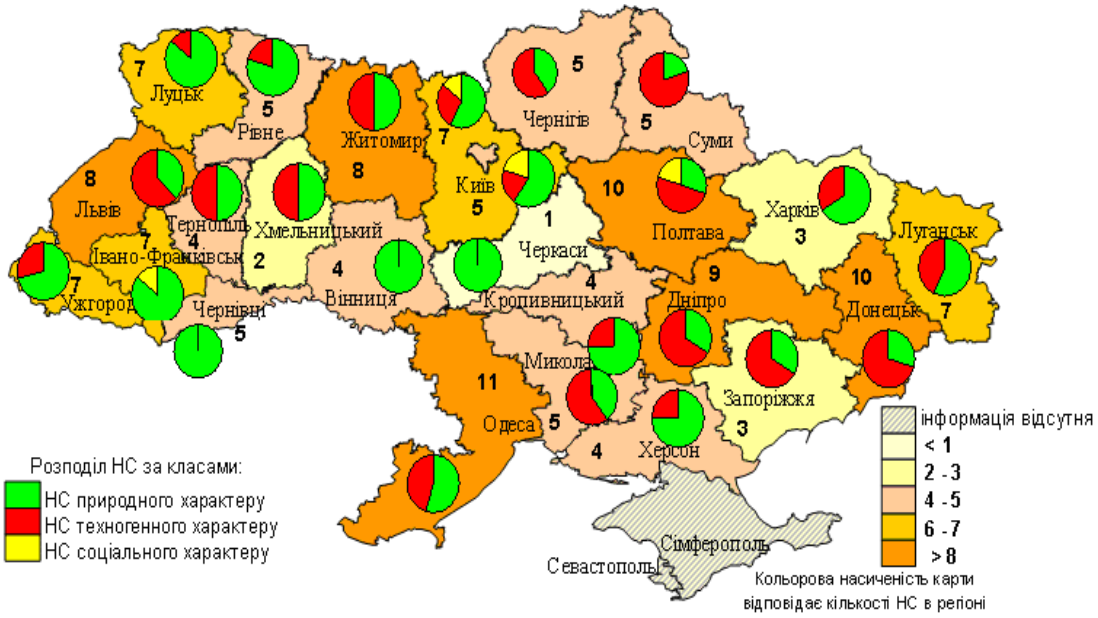



*Fig. 10 − Dynamics of emergencies and their consequences*[16]

The highest number of deaths in emergencies was registered in Odesa region (46 people, the vast majority of whom (36 people) died as a result of emergencies related to fires). Most of the victims of the emergency were registered in Kyiv (495 people, all due to medical and biological emergencies related to human measles, salmonellosis and acute intestinal infections).

State-level emergencies have been registered:

- in June 2019 - related to the threat of termination of technological equipment of the main pipeline transport facilities of the gas transmission system of Ukraine due to the lack of sufficient volumes of natural gas for the technological needs of JSC "Ukrtransgaz";

- in December 2019 - related to a fire in a 6-storey building of the Odessa College of Economics, Law and Hotel and Restaurant Business (Odessa, Troitskaya Street, 25), which killed 16 people (including 1 child)

[16] https://www.dsns.gov.ua/ua/Dovidka-za-kvartal/103179.html

and 30 people (including 16 children) were injured, and 40 people were rescued and evacuated by SES units.

In order to ensure the implementation of measures to prevent emergencies in Ukraine, ongoing monitoring and forecasting of emergencies.

As mentioned in Section 2, emergency monitoring is a system of continuous observation, laboratory and other control to assess the state of protection of the population and territories and dangerous processes that may lead to the threat or occurrence of emergencies, as well as timely detection of trends.

Observations, laboratory and other controls include the collection, processing and transmission of information on the state of the environment, contamination of food, food raw materials, fodder, water with radioactive and chemical substances, infection with infectious diseases and other hazardous biological agents.

The Cabinet of Ministers of Ukraine shall determine the procedure for functioning of the emergency monitoring and forecasting system, emergency monitoring and forecasting, the list of institutions and organizations belonging to the subjects of monitoring, surveillance, laboratory control and emergency forecasting.

Today, the system of monitoring and forecasting of emergencies is based on the use of existing organizational structures of the subjects of monitoring, surveillance, laboratory control and forecasting of emergencies.

## SECTION 4
## FORECASTING OF THE SITUATION AND PLANNING OF PROTECTION MEASURES IN THE CENTERS OF MASS DAMAGE

According to the scale and nature of damage, modern weapons are divided into weapons of mass destruction and conventional.

Weapons of Mass Destruction (WMD) are weapons designed to inflict mass losses or destruction over a large area. Weapons of mass destruction include nuclear, chemical and biological.

Depending on the type of use of the weapon there is a corresponding center of defeat. The initial effects of WMD striking factors can lead to explosions, fires, flooding of the area and the spread of highly toxic substances. At the same time secondary centers of defeat are formed.

The largest, most dangerous for the population may be the focus of nuclear damage that occurs with the use of nuclear weapons.

**Nuclear weapons** are the weapons whose striking effect is based on the use of intranuclear energy released as a result of explosive fission reactions or the synthesis of chemical elements.

The power of an explosion of nuclear munitions is usually expressed in TNT equivalent (trinitrotoluol equivalent), i.e., the amount of ordinary explosive, during the explosion of which is released as much energy as it is released during the explosion of these nuclear munitions. TNT equivalent is measured in tons (kilotons, megatons).

According to the power of the explosion, nuclear ammunition will be divided into 5 ranges (or calibers):

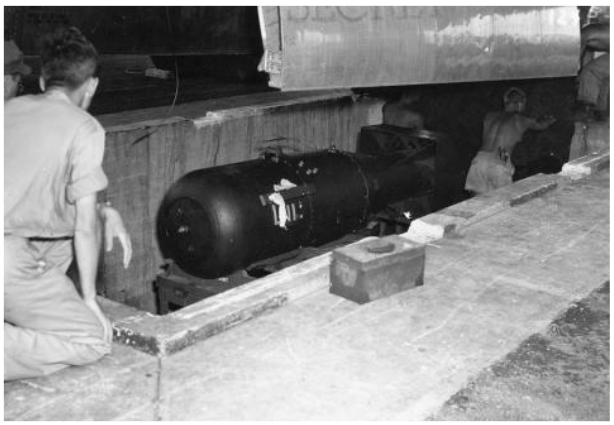
• too small (less than 1 kt);

• small (1 - 10 kt);

• medium (10 - 100 kt);

• large (100 - 1000 kt, or 1 Mt);

• extra large (over 1 Mt).



“Little Boy” - atomic bomb dropped on the city of Hiroshima (1945). Explosive force: 15,000 tons of TNT equivalent

Depending on the tasks to be solved with the help of nuclear weapons, the type of objects affected and their location, the nature of further actions of troops and other conditions, nuclear explosions can occur at different altitudes in the air, on the ground (water) or under water (underground).

Accordingly, nuclear explosions are divided into: high-altitude, air, ground, surface, underground and underwater. The point on the surface of the earth (water) at which the explosion occurred is called the epicenter of the explosion.

*Airborne nuclear weapons* - the height of the explosion (H) above the ground up to 10 km - is used to destroy personnel, equipment, buildings.

*Altitude nuclear explosion* - the height of the explosion above the earth's surface over 10 km - is used to destroy in flight air and space targets. The type of high-altitude explosion is space (H> 80 km) and stratospheric (10 <H <80 km).

*A ground (surface) explosion* is an explosion in which a glowing area touches the surface of the earth (water). It is used to destroy heavily protected fortifications or to create heavy radioactive contamination of the area.

*An underground nuclear explosion* is an explosion during which the environment surrounding the explosion zone is soil (H <0). *An underwater nuclear explosion* is an explosion in which the environment surrounding the explosion zone is water (H <0).

The center of nuclear damage is the area within which the impact of the impact of a nuclear explosion, as well as secondary factors of damage (for example, fragments of structures of buildings and structures, fires, toxic products of incomplete combustion, etc.) occurred mass destruction of people, farm animals and plants, destruction and destruction of buildings, structures and property.

The size of the hotbed of nuclear proliferation depends on the power and type of nuclear explosion, the terrain, meteorological conditions and the nature of the building. Thus, settlements with compact buildings can receive significant damage throughout the territory, if the center of the explosion coincides with the center of the village.

The nuclear effects are (Fig. 11):

- ✓ blast wave,
- ✓ light radiation,
- ✓ initial nuclear radiation,
- ✓ radioactive contamination of ground,
- ✓ electromagnetic impulse (EMP).

Studies show that about 50% of the energy of a nuclear explosion is spent on the formation of a shock wave, 35% on light radiation, 5-10% on penetrating radiation and electromagnetic pulse, and 5-10% on radioactive contamination.

***A blast wave*** is a region of strong compression of a medium that propagates radially from the center of a nuclear explosion at supersonic speeds. The blast wave affects people due to direct action and indirect action. At direct action of an air blast wave the reason of defeat is excess

pressure. Excessive pressure a person feels as a sharp push or blow. At the same time people can receive injuries of various degrees:

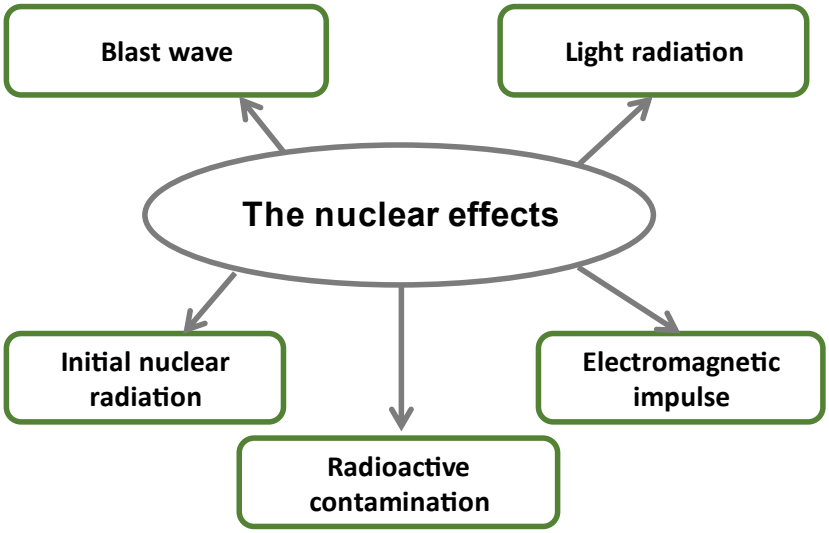



*Fig. 11 − Effects from a nuclear explosion*

- minor injuries occurs at blast overpressure of 20 - 40 kPa (slight contusion, temporary hearing loss, bruises, dislocations).

- moderate injuries - occurs at blast overpressure of 40 - 60 kPa (brain injuries with loss of consciousness, hearing damage, bleeding from the nose and ears, fractures and dislocations of the extremities).

- severe and very severe injuries - at a blast overpressure of 60 - 100 kPa. and more than 100 kPa (brain injuries with prolonged loss of consciousness, damage to internal organs, severe damage to the extremities, etc.).

The main measure of escape from the striking effects of the air shock wave is the shelter of people in protective structures.

***Light radiation*** is a stream of electromagnetic radiation that includes the ultraviolet, visible and infrared regions of the spectrum. The source of light radiation is the area of a glowing nuclear explosion, which consists of hot gases from the substance of nuclear munitions, air and soil (brilliant fireball).

The main parameter of light radiation is a flash pulse. Depending on the size of the flash pulse, there are 4 degrees of gravity of a flash burn:

- first degree burn occurs when the flash pulse is 100 - 200 kJ/$m^2$ - it causes redness of the skin, tumors.

- second degree burn occurs at a flash pulse of 200 - 400 kJ/$m^2$ - the formation of bubbles is observed.

- third-degree burn - at a flash pulse of 400 - 600 kJ/$m^2$ - necrosis of deep layers of skin.

- fourth-degree burn - at a flash pulse of 600 and more kJ/$m^2$ - charring.

A reliable protection against the light radiation of a nuclear explosion is any opaque obstacle to the propagation of light rays.

***Initial nuclear radiation*** is a stream of gamma rays and neutrons that are emitted from the zone of the fission chain reaction. Under the influence of gamma rays and neutrons, processes occur that cause ionization of the environment.

The degree of ionization of the medium characterizes the doses of these radiations. The dose of gamma radiation is measured in X-rays, and the dose of neutrons - in roentgen-equivalent-man (Rem).

When passing through any medium, the penetrating radiation transmits to it part of its energy. The medium, absorbing energy, receives a dose of radiation. Depending on the size of the absorbed dose of radiation due to external $\gamma$- radiation, a person can get radiation sickness.

Depending on the received dose of radiation there are four degrees of radiation sickness.

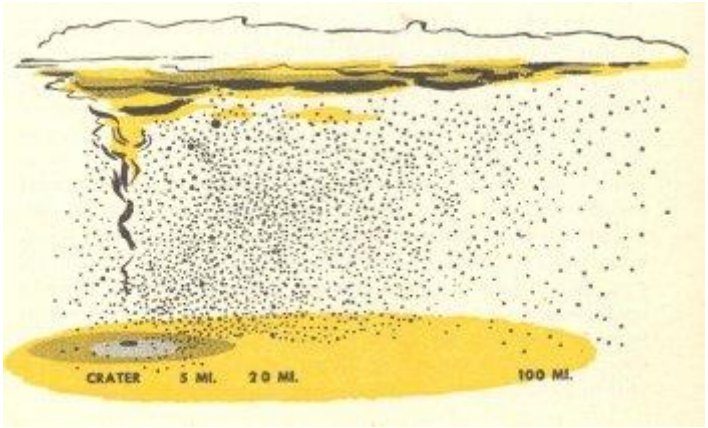
- radiation sickness of the first (mild) degree occurs at a total absorbed dose of 100 - 200 roentgen. The incubation period lasts two to three weeks, after which there is a general weakness, periodic fever, heaviness in the head, nausea. The number of white blood cells in the blood decreases.

- radiation sickness of the second degree - at a dose of 200 - 400 roentgen. The latent period is about a week. Symptoms are more pronounced: more malaise, headache, fever.

- the third degree of the disease occurs at 400 - 600 roentgen. The incubation period is several hours. Severe (severe) general condition, unconsciousness, hemorrhage into the skin and mucous membranes.

- radiation sickness of the fourth degree occurs at a dose of more than 600 roentgen. The person has a very serious condition. If treatment is not carried out within two weeks, then death occurs.

The most reliable protection against penetrating radiation will be engineering structures and armored vehicles.




***Radioactive contamination*** of ground, surface layer of the atmosphere, airspace, water and other objects occurs due to the fallout of radioactive substances from the cloud of a nuclear explosion or in accidents at radioactive-hazardous enterprises.

Radioactive fragments of fission of radioactive elements (during the fission chain reaction more than 80 isotopes of 35 chemical elements are formed) and the remnants of the nuclear charge evaporate under the

action of high temperatures and pass in plasma to the cloud of a nuclear explosion.

During ground, underground and low air explosions, a significant mass of soil (several thousand tons) also enters this cloud. Radioactive isotopes condense on colder soil particles, forming radioactive dust that makes up a radioactive cloud. It rises at a considerable speed to a height that depends on the power of the explosion. The cloud reaches its maximum height in about ten minutes.

After the cessation of the rise, the cloud moves in the wind, forming a so-called cloud trail, and radioactive substances begin to fall out of it. There is a radioactive contamination.

The importance of radioactive contamination is due to the fact that high levels of radiation can be observed not only in the area of the explosion, but also at considerable distances from it. External radiation can cause radiation sickness. Depending on the received dose of radiation, there are four degrees of radiation sickness (as well as when receiving a dose of initial nuclear radiation).

The degree of human damage depends not only on the size of the dose, but also on the time during which it is received. Doses of radiation received in a short period of time cause more severe damage than those that have the same size, but received over a long period of time.

To prevent human radiation sickness, permissible radiation doses are set for wartime and peacetime (in the event of an accident at a nuclear power plant with the release of radioactive substances)[17].

The document that provides radiation protection - "Radiation Safety Standards" (NRBU-97) - sets the permissible level of radiation exposure to humans equal to 1 mSv/year, and for nuclear industry workers - 20 mSv/year.

[17] Державні гігієнічні нормативи "Норми радіаційної безпеки України (НРБУ-97)".

During a nuclear explosion, powerful electromagnetic fields are formed, which due to their short-term existence are called ***electromagnetic impulse (EMP)***.

The striking effect of EMP is due to the occurrence of electrical voltages and currents in the wires and cables of overhead and underground communication lines, alarms, power lines, in the antennas of radio stations.

Simultaneously with the EMI, radio waves appear, which propagate long distances from the center of the explosion. These waves are perceived by radio equipment as interference.

The focus of nuclear damage is also characterized *by destruction and a difficult fire situation*.

According to the nature of the destruction of industrial and residential buildings, structures, the size of the excess pressure in the front of the blast wave, the center of nuclear damage is conventionally divided into areas of complete, heavy, moderated and light damage.

At the boundary of *the area of complete damage* (Fig. 12) excess pressure of 50 kPa, when approaching the center of the cell, it becomes much higher.

This area is characterized by: mass irreversible losses among the vulnerable population; complete destruction of buildings and structures; destruction and damage of utility and energy and technological networks, as well as part of the central storage facilities; formation of continuous blockages in settlements.

The area of the zone is from 10 to 15% of the total area of the nuclear hotbed. People who find themselves openly within the zone of complete destruction are 100% likely to suffer defeats that will lead to their failure.

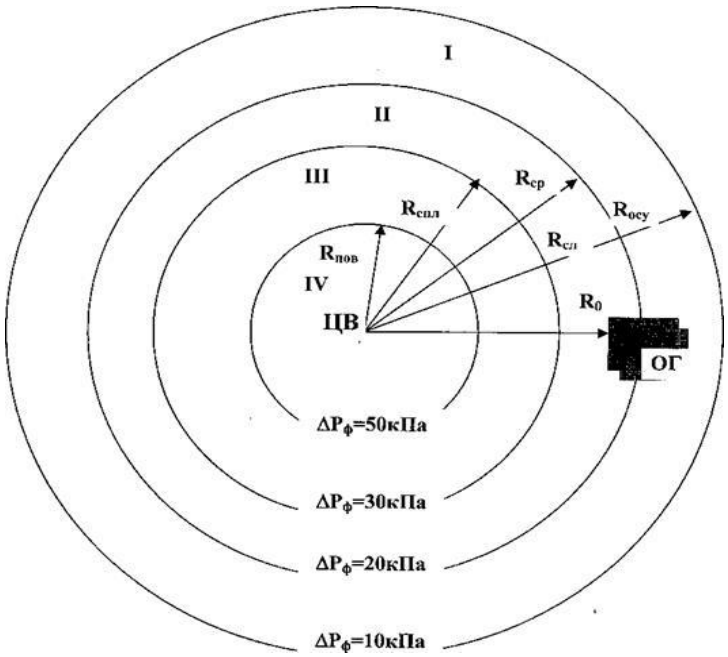
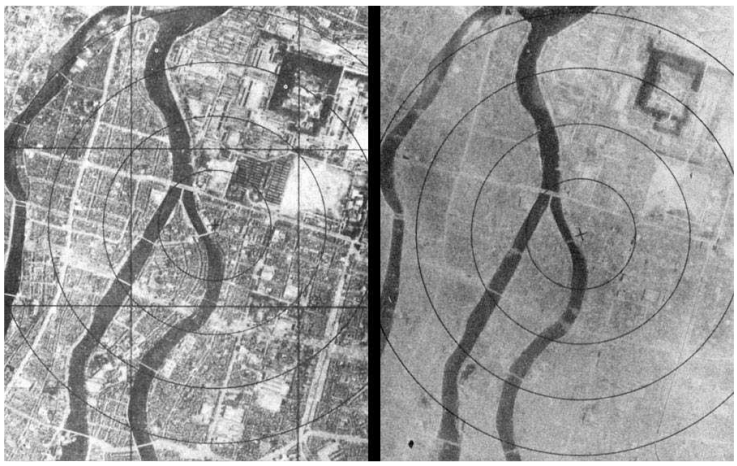



*Fig. 12 − Areas of complete (IV), heavy (III), moderated (II) and light (I) damage*



These aerial photographs show ground zero before and after the atomic bombing of Hiroshima

*Area of heavy damage* - excess pressure within the zone varies from 50 to 30 kPa, characterized by massive irreversible losses among the vulnerable population (up to 90%). Complete and severe destruction of buildings and structures, damage to utilities and technological networks; formation of local and continuous blockages in settlements. Fallout shelters and most radiation proof shelters are preserved. The area of this zone is 10% of the total area of the hotbed.

*The area of moderated damage* is the pressure in the front of the shock wave from 30 to 20 kPa. Losses among the vulnerable population - up to 20%; medium and severe destruction of buildings and structures; formation of local and partial blockages, continuous fires; storage of utility and energy and technological networks, storage facilities and most PRUs. The area of the zone is 15% of the nuclear hotbed area.

*Area of light damage* - pressure from 20 to 10 kPa. The outer boundary of the zone of light damage is the outer boundary of the nuclear hotbed area. There are weak and medium-sized destruction of buildings and structures, the area - 60%. Defeat people - only in separate cases.

The boundary of the nuclear hotbed area on the plains is conditionally limited by a circle - conditional line, where the excess pressure in the front of the shock wave is 10 kPa.

**Chemical weapons and their damage effects**. The spread of highly hazardous chemicals (HHC) in the environment forms a zone of chemical contamination and a focus of chemical damage.

A zone of chemical contamination is the area in which there is an impressive concentration of HHC. A center of chemical damage is an area where massive damage to people, farm animals and plants has occurred as a result of a chemical accident.

The zone of chemical contamination and the center of chemical damage are characterized by: 1) size, as well as 2) type of HHC, 3) concentration, 4) density of contamination and 5) resistance. There may be one or more centers of chemical damage in the area of chemical contamination.

***Chemical weapons*** are toxic substances and their means of use - aircraft bombs, artillery shells, pouring devices, rockets and more.

Chemical warfare agents (CWAs) are defined as “any toxic chemical or its precursor that can cause death, injury, temporary incapacitation or sensory irritation through its chemical action.”[18] (Table 3).

*Table 3. Chemical warfare agents*

| Title of chemical warfare agents | Cipher |
|---|---|
| Toxic chemical agent | |
| VX | VX |
| Sarin | GB |
| Soman | GD |
| Yperite | HD |
| Lewisite | L |
| Hydrocyanic acid | AC |
| Cyanogen chloride | CK |
| Phosgene | CG |
| BZ | BZ |
| CS | CS |
| CR | CR |
| Adamsite | DM |
| Chloropicrin | PS |
| Toxins[19] | |
| XR (botulinum) | XR |
| PG (staphylococcal) | PG |
| Phytotoxicants [20] | |
| Orange composition | “ORANGE” |
| White composition | “WHITE” |
| Blue composition | “BLUE” |

[18] CW Agent Group. (n.d.) Brief description of chemical weapons, chemical weapon as defined by the CWC. Organization for the Prohibition of Chemical Weapons. Retrieved July 25, 2017, from www.opcw.org/about-chemical-weapons/what-is-a-chemical-weapon/.

[19] Toxins are chemicals of extreme biological activity and exceptional selectivity of plant, animal or microbial origin, which can affect the human body if used.

[20] Phytotoxicants - chemical compounds that, when used in a certain (significant) amount can cause vegetation death.

Historians cite one of the earliest dedicated, targeted uses of CWAs in warfare as World War I. The French military used tear gas and acetone-based compounds for crowd control; chlorine gas was placed in capsules and released at the Battle of Ypres in 1915, and was used as an alternative weapon after the German military exhausted materials for explosive weapons and began to investigate and use CWAs.

Later, other agents such as phosgene and cyanide were considered for military use, because these chemicals had more toxic pulmonary effects.

Nerve agents developed in the 1930s and 1940s were stockpiled during the Cold War. More recently, nerve agents have been used in the Iran-Iraq War in the 1980s, the Japanese terrorist attacks by the Aum Shinrikyo cult in 1995 and attacks in Syria in 2017.


The creation of the Chemical Weapons Ban in 1997 (officially the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction) by the Organization for the Prohibition of Chemical Weapons (OPCW) stifled the development, use and stockpiling of these materials for military use across 148 nations.

CWAs include five primary categories: nerve agents, asphyxiants, blistering agents, toxic industrial chemicals and blood agents.

***Nerve agents*** include two primary categories of chemical agents: G-agents and V-agents. Developed first, G-agents are sarin, cyclosarin, tabun and soman. V-agents include: VE, VG, VM, VR and VX.

Nerve agents have a chemical structure similar to organophosphates which allows them to covalently bind acetylcholinesterase to deactivate the enzyme.

*Table 4. – An overview of chemical warfare agents*

| CWA type | Chemical agents | Method of exposure | Clinical symptoms |
|---|---|---|---|
| Nerve agents | G-agents (sarin, cyclosarin, tabun, soman) | Inhalation | SLUDGE, miotic pupils, bradycardia, bronchospasm, bronchorrea, muscle spasms/fasciculations, weakness, flaccid paralysis, tachycardia, seizures, respiratory failure |
| | V-agents (VE, VG, VM, VR, VX) | | |
| Blistering agents | Nitrogen mustard & sulfur mustard (mustard gas) | Inhalation | Acute: Skin, eye and lung damage (pulmonary edema and pulmonary hemmorhage), erythematous rash, skin blistering |
| | | | Chronic: Lung damage (chronic obstructive pulmonary disease, asthma, bronchiolitis obliterans), neutropenia, pancytopenia |
| Asphyxiants | Carbon monoxide, chlorine, phosgene, hydrogen sulfide gases | Inhalation | Upper airway distress, skin and eye irritation, fatal pulmonary edema and acute respiratory distress syndrome |
| Blood agents | Cyanide | Skin absorption, inhalation and ingestion | Severe distress, tachycardia, cyanosis, hypotension, severe metabolic acidosis, seizures, cardiac arrest |
| Hydrofluoric acid | — | Skin absorption, inhalation and ingestion | Severe pain in exposed area, gastrointestinal distress, vomiting, cardiac arrhythmias, hypocalcemia, hyperkalemia |

The primary mechanism of action for nerve agents is blockage of acetylcholinesterase at the neuromuscular junction of muscarinic and nicotinic receptors. Acetylcholinesterase is the primary degrading enzyme of acetylcholine.

The result of nerve agent blockade is increased acetylcholine availability at the neuromuscular junction. Nerve agents may also have effects at glutamate receptors and direct neurotoxic effects.

The emergency service tend to victims of the Aum Shinrikyo ***sarin attack*** on Tokyo's subway in 1995

Clinical symptoms of nerve agent poisoning are a direct result of muscarinic and nicotinic nerve stimulation. Muscarinic nerve stimulation leads to the clinical symptoms commonly known as SLUDGE:

- Salivation;
- Lacrimation;
- Urination;
- Diarrhea;
- Gastrointestinal distress; and
- Emesis.

Miotic pupils are also common.

Most importantly, nerve agents cause the more life-threatening clinical symptoms: bradycardia, bronchospasm and bronchorrhea.

Nicotinic nerve stimulation leads to the clinical symptoms of muscle spasms/fasciculations, weakness, flaccid paralysis and tachycardia. Seizures are common in patients who have been exposed to nerve agents.

There's high mortality associated with nerve gas exposure, which primarily occurs from respiratory failure secondary to bronchospasm and bronchorrhea, or from status epilepticus.

Nerve agents also demonstrate clinical latency periods. Latency depends on the route of exposure. Inhalational exposures generally have near immediate symptom onset. However, cutaneous exposure may have a latency period of minutes/hours until symptoms manifest.

The pharmacology of nerve agents is key to understanding treatment options. Nerve agents phosphoylate acetylcholinesterase to inactivate the enzyme. The acetylcholinesterase-nerve agent complex will undergo a process called aging, in which the nerve agent permanently binds to the enzyme, rendering acetylcholinesterase completely inactivated. The time to aging depends on the nerve agent: Soman has one of the fastest aging times of 1 - 2 minutes, while VX's aging time is 30 hours.

***Blistering Agents***

Nitrogen mustard and sulfur mustard, more commonly known as mustard gas, were developed and used as chemical weapons during World War I. Today, nitrogen mustard derived compounds are used as chemotherapy for leukemia and lymphoma.

John Singer Sargent's 'Gassed' depicts the aftermath of a ***mustard gas attack*** on British troops

Mustard gas is an alkylating agent that crosslinks DNA and blocks cellular replication. Although not technically a gas agent, exposure occurs via inhalation when the liquid evaporates or is aerosolized.

Although mustard gas is generally not a fatal chemical agent, it causes both acute and chronic medical injury to those exposed to it.

In the acute phase, mustard gas exposure results in skin, eye and lung damage.

Depending on the exposure dose, patients may have only an erythematous rash (low dose) or large, painful blisters that may become necrotic (high dose).

Additionally, there’s also latency in appearance of skin blistering that can delay decontamination and medical care. Skin blistering can result in long-term skin hypopigmentation, permanent scarring and increases the risk of infection.

Patients should be treated at a dedicated burn center for wound care and fluid management. Additionally, there’s some evidence that using povidone iodine solution can decrease damage to non-blistering areas if applied immediately after exposure.

Initial symptoms of eye injury secondary to mustard gas exposure including pain, photophobia, scleral injection and lacrimation.

Corneal ulceration can result if significant high-dose exposure occurs.

For eye injury and exposure, supportive care, including initial eye decontamination with water, darkened glasses for photophobia management and avoiding eye bandaging are all recommended.

Lung damage from mustard gas exposure also results in both acute and chronic lung injury; however, long-term, lung-associated sequelae of mustard gas exposure are severe and debilitating. In the acute phase, lung injury from mustard gas includes pulmonary edema and pulmonary hemorrhage.

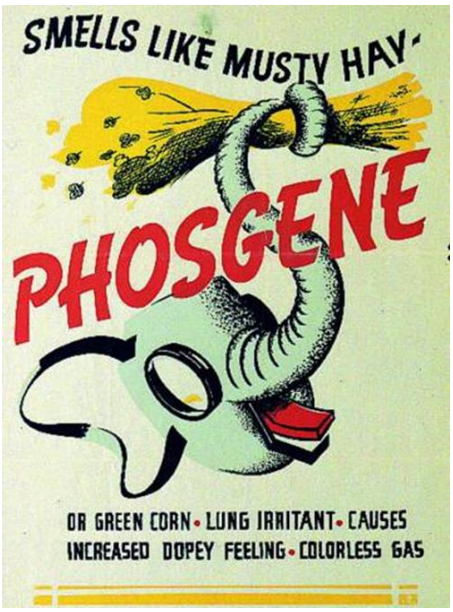
Late sequelae include chronic obstructive pulmonary disease (COPD), asthma and bronchiolitis obliterans (BOOP), which are caused by the fibrotic changes that occur.

Some patients with mustard gas exposure will suffer from neutropenia or pancytopenia. Similar to pulmonary symptoms, there's often a latent period of 4 - 24 hours before presentation of this lab abnormality. Patients may require treatment with colony-stimulating factor for management and recovery of white blood cell counts.

***Asphyxiants***. Common chemical asphyxiants include carbon monoxide, chlorine, phosgene and hydrogen sulfide gases. As described above, chlorine and phosgene gases were one of the earliest CWAs used by Germany in World War I. Both of these gases exert their toxic effects on the respiratory system.

Chlorine is an asphyxiant gas used in various industries including polyurethane and polychloroethene (PVC) production, chemical solvent production and water sterilization. Its toxic effects are primarily localized to the upper airways and occur immediately after exposure. Chlorine gas can also cause skin and eye irritation.

In addition to decontamination, some studies have trialed the use of nebulized sodium bicarbonate; results suggested improved lung function based on lab studies but overall no improved survival.




Phosgene is also an asphyxiant gas used in the pesticide and plastics industries. Phosgene has direct toxic effects on the lungs and exposure results in fatal pulmonary edema and acute respiratory distress syndrome (ARDS).

***Blood Agents***. Emergency providers often encounter cyanide exposure when caring for patients in house fires, but it's also a CWA. Cyanide, or hydrogen cyanide, is a weak acid that blocks cytochrome C oxidase and shuts down mitochondrial respiration. Exposure to cyanide can occur via ingestion, skin absorption and inhalation.

Zyklon B (the trade name of a cyanide-based pesticide) was used to kill millions in concentration camps during the Holocaust

Patients with cyanide poisoning present in severe distress with tachycardia, cyanosis and hypotension. The most notable and life-threatening lab abnormality is severe metabolic acidosis. Seizures are common and cardiac arrest may occur.

There's currently no rapid cyanide blood test to detect exposure; thus, diagnosis is based on context, clinical symptoms and clinical suspicion.

***Hydrofluoric Acid***. Not commonly used as a weapon, hydrofluoric acid is an industrial chemical used in electronics, glass etching and other

chemical industries. However, unprotected exposure to hydrofluoric acid can pose severe health risks.

Hydrofluoric acid is a weak acid easily absorbed by the skin that binds and depletes calcium and magnesium stores. Calcium-fluoride and magnesium-fluoride complexes deposit in the soft tissues.

Clinical symptoms of local hydrofluoric acid poisoning include severe pain in the exposed area. Patients with systemic toxicity usually have gastrointestinal distress, vomiting and cardiac arrhythmias.

Systemic toxicity usually occurs with large body surface area exposures, inhalation and ingestion exposures.

Cardiac arrhythmias may result from hypocalcemia and hyperkalemia, a lab abnormality associated with hydrofluoric acid exposure.

Chemical warfare agents also can be divided into such categories as: nerve agents (sarin, tabun, cyclosarin, soman, VX), blister agents (sulfur mustard, nitrogen mustard, lewisite), choking agents (chlorine, phosgene, diphosgene and chloropicrin), blood agents (arsine, cyanogen chloride and hydrogen cyanide) and riot control agents.

Riot control agents (or RCAs) are chemical agents that are dispersed via liquids or aerosols and that inflict temporary incapacitation of the eyes, mouth, throat, skin and lungs.

Common symptoms of exposure to RCAs include the production of tears, excessive coughing, constriction of the airway and irritation of the skin, eyes, nose or mouth.

While RCAs can be legitimately possessed for the purposes of domestic law enforcement, they are classed as chemical weapons if they are used as methods of warfare.

RCAs are divided into three categories - lachrymators (which cause eye irritation), sternutators (which cause irritation of the respiratory tract)

and emetics (which cause nausea and vomiting). Common examples of RCAs include tear gas (CS) and pepper spray (OC).

*Depending on the duration of storage of the properties to infect unprotected manpower* when infecting troops and areas of CWAs are divided into two groups:

- Persistent agents, the striking ability of which persists for several hours and days (VX, mustard, soman);

- Non-persistent agents, the striking ability of which persists for several tens of minutes after their combat use (hydrocyanic acid, phosgene).

Persistent agents, once on the ground, food, building materials, penetrate to different depths. For example, mustard penetrates into dense soil to a depth of 3 cm, wood - 1.5 cm, brick - up to 3 cm, bread - up to 0.5 cm. In the gaseous state, agents penetrate through cracks into residential premises, polluting the air, people, and various objects. Upon entering the reservoir, some agents (sarin, soman, hydrocyanic acid, mustard gas) dissolve in water, thus contaminating the entire reservoir. In some reservoirs, V-gases can be stored for up to 3 years.

***The center of biological damage. Bacteriological / biological weapons.*** As a result of hazardous biological agents entering the environment (accident, accidental introduction of a pathogen or application of biological WMD) and spread of pathogenic microbes, toxins, dangerous pests, biological contamination zones and foci of biological damage may be formed.

*Biological contamination zone* - a territory or water area within which dangerous biological substances, biological means of human destruction or dangerous microorganisms that endanger human life and health, farm animals, plant existence, as well as the environment are spread or introduced.

Pathogens of infectious diseases can spread, increasing the area of infection, humans, insects, especially bloodsuckers, animals, rodents, birds. People, farm animals and birds, wild animals and birds, air, terrain, water bodies, wells, drinking water tanks, fodder, agricultural crops, crop stocks, food, machinery, livestock, pastures and housing can be infected. The zone of infection is characterized by the type of biological agents, size, location relative to facilities, time of formation, degree of danger and change over time.

*The center of biological damage* is the area within which the spread of biological agents has created a mass destruction of people, farm animals and plants. It can be formed both in the area of biological infection and as a result of the spread of infectious diseases outside the area of infection.

The sizes of the centers of biological defeat and zones of biological infection depend on a kind of pathogens, meteorological and climatic conditions, speed of detection and timeliness of carrying out preventive measures, disinfection and treatment.

In order to prevent the spread of human diseases, a *set of treatment and prevention measures is carried out in the center of biological damage*. Quarantine or observation is established.

***Quarantine*** - administrative and health measures used to prevent the spread of particularly dangerous infectious diseases.

According to International health regulations (2005)[21] “quarantine” means the restriction of activities and/or separation from others of suspect

[21] https://www.who.int/ihr/IHR_2005_en.pdf

persons who are not ill or of suspect baggage, containers, conveyances or goods in such a manner as to prevent the possible spread of infection or contamination.

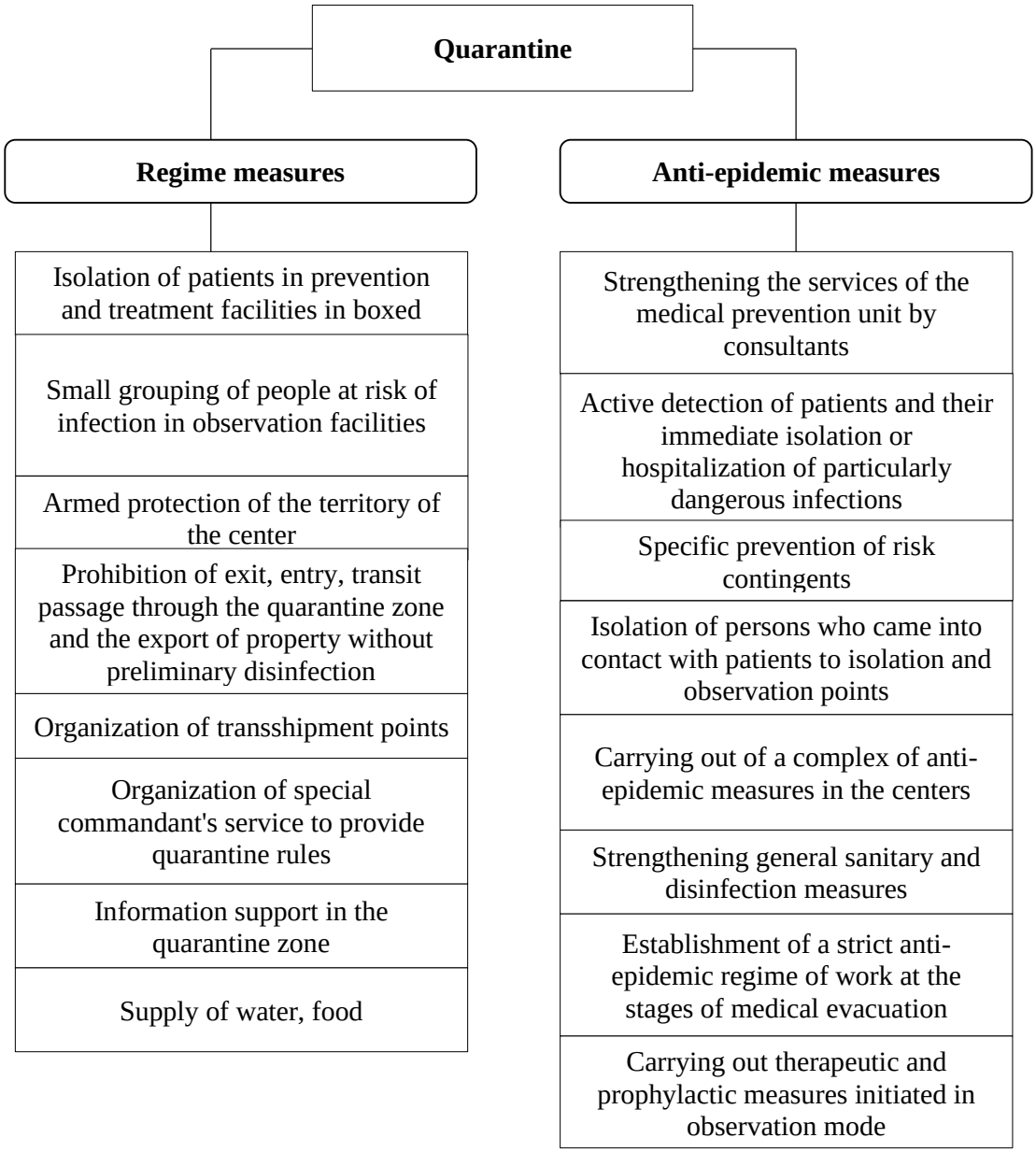



*Fig. 13 − Quarantine as a system of anti-epidemic measures aimed at complete isolation of the source of infection and elimination of infectious diseases in it*[22]

[22] Методичні матеріали до практичного заняття з дисципліни «Екстрена і невідкладна медична допомога», Вінницький Національний медичний університет ім. М.І. ПИРОГОВА, Кафедра медицини катастроф та військової медицини. Вінниця, 2017.

In general, quarantine is a system of strict anti-epidemic measures to isolate the entire lesion and eliminate infectious diseases (Fig. 13). Quarantine ends after the isolation of the last potential patient and the end of disinfection.

***Observation*** - regime-restrictive measures, which, together with the strengthening of medical and veterinary surveillance and anti-epidemic, treatment-and-prophylactic and veterinary-sanitary measures, limit the movement and movement of people or farm animals in all adjacent to the quarantine zone administrative-territorial entities observations.

Observation is introduced in areas with an unfavorable or emergency sanitary-epidemic condition, that is, the appearance of group non-contagious diseases or isolated cases of contagious infections.

Observation and quarantine are canceled after the end of the maximum incubation period of this infectious disease from the moment of isolation of the last patient, final disinfection and sanitization of service personnel and the population.

The most effective method for the distribution of biological agents is the spraying of liquid and dry formulations of microbes in the air to form the so-called cloud of biological aerosol. Such a cloud, moving under the influence of the wind, can infect vast territories, forming centers of bacteriological infection. On the territory of the outbreak, the locality, reservoirs, plants, structures, equipment, people, animals are infected.

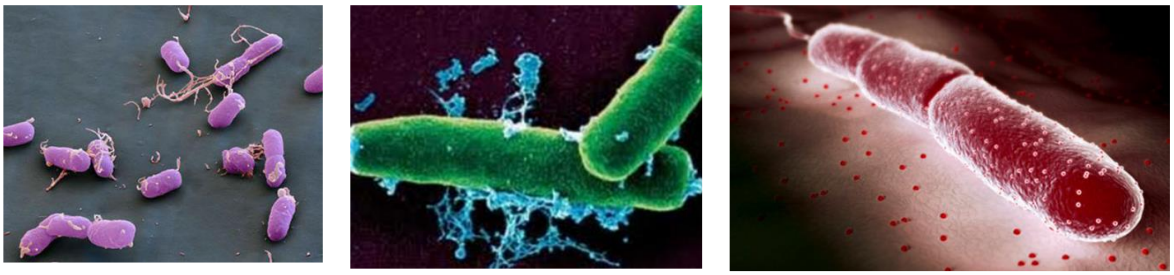
Disease-causing agents, once deposited on the soil or vegetation, retain their viability for a long time. Rising together with dust, they can create so-called secondary bacterial clouds, which can cause contamination of people and animals long after the use of biological weapons.

The diversionary way of using biological agents is the deliberate concealed contamination of closed spaces (volumes) of air and water, as well as products (forage) used directly, without pre-cleaning (treatment).

Another fairly effective way to use biological weapons is to spread infected carrying agents (insects, ticks, rodents). The transmission of the pathogen through carriers is called *the transmission route of infection*.

Examples of biological weapons agents are:

- *bacterial pathogens:* anthrax, plague, tularemia, brucellosis, cholera;

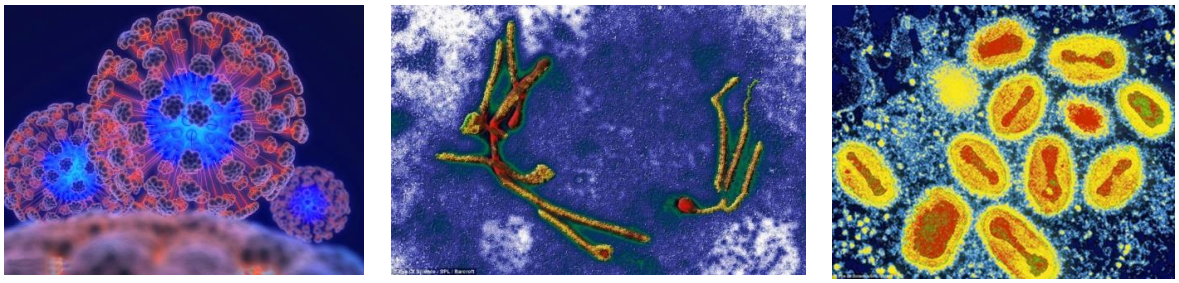


a) b) c)

*Fig. 14 − Bacterial pathogens: a) plague (bubonic); b) anthrax; c) cholera*

- *toxins (poisons):* botulinum exotoxin, ricin, staphylococcal enterotoxin; microbial toxins largely determine the course of an infectious disease, and during some diseases play a major role (botulism, diphtheria, tetanus);

- *viruses:* smallpox, hemorrhagic fevers, naturally focal encephalitis, foot and mouth disease, spongiform encephalopathy;

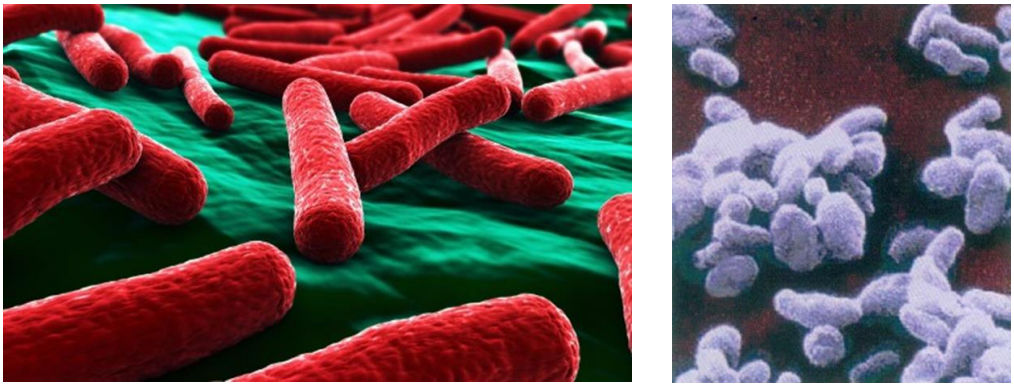


a) b) c)

*Fig. 15 − Viruses: a) HIV; b) Ebola; c) smallpox*

- *rickettsia:* typhus, Rocky Mountain spotted fever, Q fever pneumonia;

- *fungi:* can cause both superficial mycoses (scab, ringworm) and deep mycoses (actinomycosis, coccidioidomycosis, histoplasmosis, nocardiosis).



a) b)

*Fig. 16 − Rickettsia that causes: a) epidemic typhus; b) Q fever*

Major biological warfare remedies include:

- Specific vaccines, serums, antibiotics, sulfonamides, and other drugs;

- personal protective equipment;

- observation and quarantine to prevent the spread of infectious diseases in the center;

- decontamination of personnel;

- disinfection of contaminated objects.

## SECTION 5
## PROTECTION OF POPULATION AND TERRITORIES FROM EMERGENCY SITUATIONS

Ensuring the protection of the population and territories in the event of a threat and emergencies is one of the most important tasks of the state.

The level of national security cannot be sufficient if on a national scale the task of protecting the population, economic facilities, national patrimony from emergencies of a man-made, natural or other nature is not solved.

The principles of protection derive from the basic provisions of the Geneva Convention for the Protection of Victims of War and its Additional Protocols, the possible nature of hostilities, and the real capacity of the state to establish the material basis for protection.


They are:

- the principle of the unconditional primacy of security, according to which the concept of progress gives way to the concept of security;

- the principle of non-zero (acceptable) risk, which is to try to achieve a level of risk in enterprises that could be considered acceptable.

- the principle of payment for risk. The amount of payment depends on the potential danger of man-made objects and is proportional to the amount of possible damage. These funds are used to set up pre-safety and pay increases in unsafe industries (e.g., coal mines), and certain risk payments should incentivize safety measures;

- the principle of voluntariness, according to which no one has the right to put a person at risk without his consent;

- the principle of everyone's inalienable right to a healthy environment. This right must be guaranteed and protected by law. This principle implies the obligation of natural and legal persons to ensure this right and to conduct their activities in a way that does not harm the environment;

- the principle of legal security implies that all aspects of the system of protection of the population and territories are regulated by relevant laws and other normative legal acts;

- the principle of freedom of information for human security is to take into account public opinion when solving issues of construction of hazardous enterprises;

- the principle of rational safety provides for the maximum economically feasible reduction of the probability of emergencies and mitigation of their consequences;

- the principle of preventive safety - the maximum possible value of the probability of emergencies;

- The principle of necessary sufficiency and maximum possible use of available forces and means determines the scope of measures to protect the population and territories in the event of a threat of emergency situations.

*The main purpose of protective measures* is to avoid or minimize the impact on the population.

In order to effectively implement the tasks of civil defense, reduce material losses and avoid damage to objects, material and cultural values and the environment in the event of an emergency, the central and local executive authorities, local self-government bodies, their subordinate forces and means, enterprises, institutions and organizations regardless of their form of ownership, as well as voluntary rescue formations shall carry out:

- warning and informing the subjects of civil protection;

- sheltering of the population in civil defense structures and evacuation activities;

- engineering protection of territories, radiation and chemical protection;

- medical, biological and psychological caretaker, safety of sanitary and epidemic welfare of the population;

- training of the population to act in emergency situations.

**Warning and informing about the threat or occurrence of emergency situations**. One of the main activities to protect the population from emergencies is its timely notification of the danger, the situation that resulted from its implementation, as well as information about the order and rules of conduct in emergency situations.

***Warning***, according to the Code of civil protection of Ukraine (CCPU), is the communication of signals and messages of civil protection authorities about the threat and occurrence of emergencies, accidents, disasters, epidemics, fires, etc. to the central and local executive authorities, enterprises, institutions, organizations and the population.

***Informing*** the population in the field of civil protection - communication by civil protection authorities through the media, television and radio networks of information about emergencies, predicted or arisen

with the definition of their classification, distribution boundaries and consequences, on ways and methods of protection against them as well as on its activities on civil protection issues, including taking into

account the specifics of notification of persons with physical, mental, intellectual and sensory disabilities.

Warning of the threat or occurrence of emergency situations is organized taking into account the structure of public administration in Ukraine, the maximum predictable nature and degree of emergency situations.

Warning systems by level are divided into:

- the national automated system for centralized warning,
- territorial automated centralized warning systems,
- local automated centralized warning systems;
- special warning systems;
- local public warning systems;
- to the object public warning systems.

*Fig. 16 − Building automated warning and information systems in the Zakarpattya region on the experience of the European Union: “Pavian” siren and control panel*

Dissemination of signals, messages about the threat or emergence of emergency situations to the population, as well as informing is carried out:

- through the National Public Television and Radio Company of Ukraine, state and public television and radio companies, municipal, public and other television and radio organizations, regardless of their form of ownership, using their television networks and broadcasting networks (accompanied by sign language and/or subtitling if it is voice and audio commentary if it is visual);

- through telecommunications operators using public telecommunications networks (telephone communication, text messages);

- through Internet resources (websites, social networks).

To attract attention before delivering information to the population about the threat or occurrence of an emergency situation, a warning signal "Attention All!!!" is transmitted, namely: intermittent sounding of electric horns, frequent honking of vehicles, in particular in the recording by radio networks and through street loudspeakers.

**Engineering protection of territories, radiation and chemical protection**. ***Engineering protection measures*** to prevent man-made and natural emergencies are carried out in the design and operation of structures and other economic facilities, the consequences of which may have a harmful effect on the safety of the population and the environment.

Engineering protection measures shall provide for:

- accounting for possible manifestations of dangerous and catastrophic phenomena in the development of master plans for the development of settlements;

- rational placement of object of major hazard (OMH);

- development and implementation of measures for accident-free operation of the OMH;

- development and implementation of regional and local emergency prevention and response plans;

- organization of construction of landslide, flood, mudflow, avalanche and other special purpose engineering structures.

***Radiation and chemical protection of population and territories*** includes:


1) identification and assessment of the radiation and chemical situation;

2) organization and conducting dosimetric and chemical control;

3) development and implementation of standard radiation protection modes;

4) the use of collective protective equipment;

5) use of personal protective equipment, radiation and chemical reconnaissance devices, dosimetric and chemical monitoring by rescue services, formations and specialized civil protection services involved in emergency rescue and other urgent work, firefighting in affected areas of radiation and chemical hazardous facilities and the population living in areas of hazardous contamination;

6) Iodine prophylaxis of rescuers involved in the response to a radiation accident, personnel of radiation hazardous facilities and the population living in areas of possible contamination with radioactive iodine isotopes in order to prevent thyroid irradiation;

7) providing the public with the opportunity to purchase personal protective equipment and dosimetric and chemical monitoring devices for personal use;

8) sanitary treatment of the population and special treatment of clothing, property and vehicles;

9) development of general criteria, methods and methods of monitoring to assess the radioactive and chemical situation;

10) other radiation and chemical protection measures, depending on the situation.

Assessment of the radiation situation is carried out to determine the impact of radioactive contamination on the population according to direct measurement of the radiation dose rate (radiation reconnaissance) and the calculation method (prediction of radioactive contamination).

The data of radiation reconnaissance determine the specific modes of radiation protection of personnel, the beginning and duration of shifts in the contaminated area, the required number of changes to perform their tasks in conditions of radioactive contamination, the need for decontamination of weapons, equipment and food.

Radiation protection regime - the procedure for the population and the use of means and methods of protection in the radioactive contamination zone in order to possibly reduce the impact of ionizing radiation on people.

It provides for the sequence and duration of use of protective structures, protective properties of industrial and residential premises, limitation of stay of people in the open area.

a) b) c)

*Fig. 17 − Types of respiratory protective equipment: a) filter gas mask; b) self-contained breathing apparatus; c) respirator*

In the event of a nuclear explosion, 8 standard modes of radiation protection are in place:

- № 1-3 - for people who do not work;

- № 4-7 - for workers and employees of facilities that continue production activities in conditions of radiation contamination (work indoors);

- № 8 - for personnel of formations that carry out rescue operations in the contaminated area.

Assessment of the chemical situation involves determining:

• scale of chemical pollution;

• degree of danger of chemical pollution;

• duration of chemical pollution.

The main indicator characterizing the degree of danger of chemical pollution is the predicted number of casualties in the zone of chemical pollution.

The number of casualties among the production personnel of the facility where the accident occurred, and the population living near this facility, is determined in accordance with the number and time of people in the zone of chemical pollution, their protection from the effects of HCSs.

Special treatment, as one of the measures of radiation and chemical protection, includes:

- decontamination - measures to clean a person from radioactive substances, decontamination or elimination of HCSs.

- partial decontamination is carried out by the person himself/herself as self-help and mutual aid with the use of equipment and improvised means.

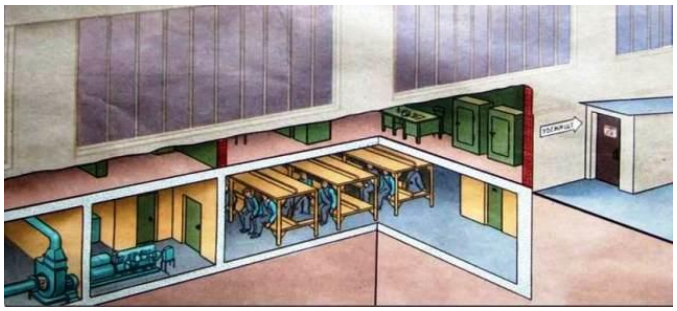
- complete decontamination of the population and affected people consists of washing the whole body with soap and water and a complete change of underwear.

**Shelter in protective structures and evacuation measures** is a set of measures for the advance construction of protective structures and maintaining them in readiness for use, as well as the adaptation of existing facilities for the protection of the population.

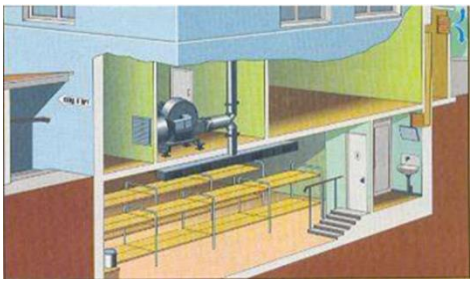
***Sheltering*** the population in protective structures is a reliable way to protect against nuclear, chemical, bacteriological, conventional weapons, in case of accidents and some natural disasters (hurricanes, snow drifts).

The fund of protective structures is the main means of collective protection of the population.

According to Article 32 of the CCPU, protective constructions of civil protection include:



• *shelter* - a hermetic structure for the protection of people, in which conditions are created for a certain time, excluding the impact on them of dangerous factors arising from an emergency situation, military (combat) actions and terrorist acts;



• *radiation shelter* - a non-hermetic structure for the protection of people, which creates conditions that exclude the impact on them of ionizing radiation in the event of radioactive contamination of the area;

• *quickly constructed protective constructions* - protective constructions, which are built from special structures in a short period of time to protect people from the effects of means of destruction in a special period.

To protect people from some of the hazards of emergencies in peacetime, and the action of means of destruction in a special period is also used:

- double-purpose structure - an above-ground or underground facility that can be used for its primary functional purpose and for the protection of the public;

- the simplest shelter - a fortification structure, semi-basement or basement premises, reduces the combined defeat of people from the dangerous consequences of emergencies, as well as from the effects of means of destruction in a special period.


a) b)

*Fig. 18 − a) double-purpose structures; b) the simplest shelter*

Under conditions of insufficient provision of protective structures in populated areas where high risk facilities are located, as well as during the period, the main way to protect the population is to evacuate and place them in areas that are safe for habitation.

***Evacuation*** is the organized withdrawal or removal of the population from an emergency area or an area of possible destruction, if there is a threat to life or health, as well as material and cultural values, if there is a threat of damage or destruction. In the event of threats caused by an emergency situation, animals, material and cultural values, documents and archival materials are also subject to evacuation.

Depending on the characteristics of emergency, the following types of evacuation are established:

- mandatory;
- total or partial;
- temporary or non-return.

*Mandatory evacuation* of the population is carried out in case of threat:

• accidents involving the release of radioactive and hazardous chemicals;

• catastrophic flooding;

• mass forest and peat fires, earthquakes, landslides, other geological and hydrogeological phenomena and processes;

• armed conflicts (from areas of possible hostilities to safe areas, which are determined by the Ministry of Defense of Ukraine for a special period).

*Fig. 19 − Mandatory evacuation of the population of Pripyat and the 30-kilometer zone around the Chernobyl nuclear power plant (1986). In total, more than 115,000 people were evacuated*

*Total evacuation* in case of threat of occurrence or occurrence of emergencies of man-caused and natural nature is carried out for all categories of the population from the zones:

• possible radioactive and chemical contamination;

• catastrophic flooding of the area with a four-hour run of the breakthrough wave during the destruction of hydraulic structures.

*Partial evacuation* is carried out to remove categories of the population who, due to their age or state of health, are not able to take measures to save their lives or health in the event of an emergency, as well as persons who take care of such persons in accordance with the law.

**Medical, biological and psychological protection, ensuring sanitary and epidemic well-being of the population**.

***Medical protection*** of victims in an emergency is a complex of organizational, therapeutic, preventive, sanitary and anti-epidemic and evacuation activities aimed at the elimination of medical and sanitary consequences of emergencies.

Medical assistance to the population, one of the tasks of medical protection, is provided by the State Service of Disaster Medicine.

In the territories affected by the consequences of the emergency, a sharp deterioration of the sanitary-epidemic situation is possible, which causes the need for sanitary and anti-epidemic measures to ensure the ***sanitary and epidemic well-being of the affected population***.

Responsibility for sanitary measures lies with the executive authorities, local governments, bodies, institutions and establishments of the State Sanitary and Epidemiological Service, health care institutions, enterprises, institutions and organizations regardless of ownership, as well as citizens.

To organize and carry out sanitary measures, a sanitary and epidemiological reconnaissance should be organized and carried out in the first hours after an emergency, based on the results of which an *epidemic situation can be defined as*:

• prosperous epidemic situation - infectious diseases are not registered or their isolated cases are registered, there are no favorable conditions for the spread of these diseases;

• unstable epidemic situation - the level of human disease for infectious diseases does not exceed the long-term average, but there are favorable conditions for the spread of these diseases;

• unfavorable epidemic situation - the level of human disease for infectious diseases exceeds the long-term average, outbreaks of infectious diseases are registered.

The result of the assessment of the sanitary-epidemic situation is the sanitary and epidemiological forecast, on which the decision-making on sanitary and anti-epidemic protection of the affected population is based.

Under the medical and sanitary consequences of an emergency is understood a set of conditions and factors that determine the scope, nature and direction of the organization of medical care for victims.

When mass casualties occur at one moment in the population with insufficient medical forces and means, it is impossible to provide help in time to all the victims. The doctrine of disaster medicine - medical triage, which is based on the need to provide Emergency Medical Services (EMS) in the shortest possible time to the greatest possible number of victims, have a chance of survival.

Triage systems are methods for systematic prioritizing of patients' treatment according to how urgent they need care. The triage result should influence the order and priority of emergency treatment, the order and priority of emergency transport, or the transport destination for the patient.

Modern approaches to triage assessment of acutely ill or injured patients are usually based on trace and trigger tools for vital signs, and

include a systematic questionnaire for each chief complaint and generally physiological findings.

Medical triage is carried out both at the pre-hospital stage (starting from the moment of rendering first medical aid to victims in the emergency area), outside the emergency area (during evacuation) and at the hospital stage (when victims are admitted to a hospital for receiving full medical aid and treatment to the end result).

In the emergency zone, as a rule, the simplest elements of medical sorting are performed. However, as additional medical staff (ambulance crews, etc.) arrive, the sorting becomes more specific and deeper.

There is a well-known, proposed by M.I. Pirogov, distribution of victims into four sorting groups (categories), as it shown in table 5.

*Table 5. Criteria for determining the sorting categories of victims*

| Triage Color | Priority | Acuity | Need for Treatment | Comments |
|---|---|---|---|---|
| RED | **1** | Emergent | Immediate | Threat to life, limb or organ |
| YELLOW | **2** | Urgent | Delayed | Significant injury or illness but can tolerate a delay in care |
| GREEN | **3** | Minimal | Minor | Can safely wait for treatment |
| BLACK | **0+** | Dead<br><br>Expectant | None<br><br>Comfort Care | Dead: Don't move<br><br>Expectants: Consider transport and care AFTER initial "Reds" are cleared, if resources exist and it does not delay care for Yellows |

The first stage of medical triage is organized at the scene of the emergency, but at a safe distance from the action of its destructive factors.

During the first stage of medical triage, the following basic scope of medical care is defined:

- adults are checked for breathing and, if necessary, airway patency is restored;

- determine the capillary pulse;

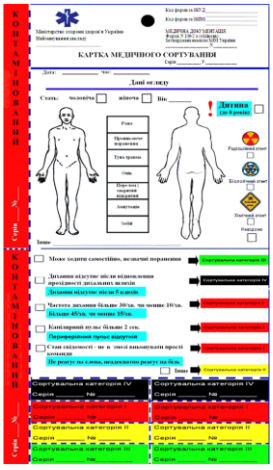
- determine the state of consciousness;

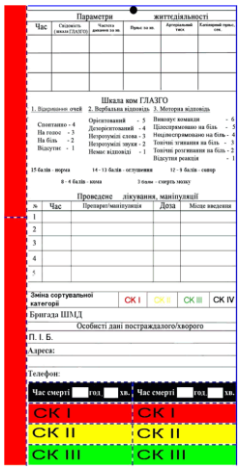
- in children under 8 years of age, to restore airway patency in the absence of breathing, 5 artificial breaths are performed.

The duration of the first stage of the medical triage is no more than 60 seconds.

*Table 6. Criteria used to determine the triage categories of victims*

| **Sorting category (corresponding color)** | **Consciousness (according to the Glasgow Com Scale)[23]** | **Breathing (respiratory rate)** | **Blood circulation** |
|---|---|---|---|
| I (red) | 10 points or less | Less than 10 or more than 30 per 1 min. | Capillary pulse for more than 2 seconds. No peripheral pulse |
| II (yellow) | 14 - 11 points | Not less than 8 and not more than 30 per 1 min. | Capillary pulse is less than 2 seconds. Peripheral arterial pulse present |
| III (green) | Consciousness without disturbance | Breathing without disturbance | Circulation without disturbance |
| IV (dark purple/ black) | No consciousness | No consciousness | No consciousness |
| | | No breathing | No pulse in the main arteries |




It is important to note that a medical triage card is filled out and will accompany the casualty all the way to the medical facility where he will be evacuated. The medical triage card is filled out by the medical personnel who perform the triage (usually nurses as instructed by the doctor).

[23] The Glasgow Coma Scale (GCS) is the most common scoring system used to describe the level of consciousness in a person following a traumatic brain injury. Basically, it is used to help gauge the severity of an acute brain injury.

With the adoption in 2012 of the Law of Ukraine "On Emergency Medical Care," there was a separation of types of medical care, taking into account the categories of persons who directly provide it to victims, namely:

- *pre-medical care* - urgent actions and organizational activities aimed at saving and preserving the life of a person in an emergency condition and minimizing the consequences of such a condition on health, carried out at the accident scene by persons who do not have medical training, but by their official duties must have basic skills to save and preserve the life of a person who is in an emergency, and in accordance with the law must carry out such actions and activities;

- *emergency medical assistance* - medical assistance, which consists in the implementation by EMS system employees in accordance with this Law of urgent organizational, diagnostic and therapeutic measures aimed at saving and preserving the life of a person in an emergency condition and minimizing the consequences of such a condition on health.

According to Article 12 of this law, pre-medical care for persons in an emergency condition must be provided by rescue workers, firefighters, police officers, pharmacists, train conductors, flight attendants and other persons who, in connection with their official duties, must have appropriate skills.

**Biological protection of the population, animals and plants** includes:

1) timely identification of factors and organization of biological contamination, its localization and elimination;

2) forecasting the scale and consequences of biological contamination, development and implementation of timely anti-epidemic, prophylactic, anti-epizootic, anti-epiphytotic and therapeutic measures;

3) conducting emergency nonspecific and specific prevention of biological contamination of the population;

4) timely use of personal and collective protective equipment;

5) introduction of restrictive anti-epidemic measures, observation and quarantine;

6) implementation of disinfection measures in the nidus of infection, disinfection of economic entities, animals and sanitary treatment of the population;

7) emergency medical care for those affected by biological pathogenic agents;

8) other biological defense measures, depending on the situation.

Biological protection of the population is the protection against biological means of destruction, including the timely identification of factors of biological contamination, depending on their type and degree of defeat, a set of administrative and economic, restrictive and special anti-epidemic and medical measures.

In order to ensure a reliable level of biological protection of the population, timely indication and identification of dangerous biological agents in Ukraine there is a system of indication of biological pathogenic agents[24] .

Means of protection in the focus of bacteriological (biological) damage are divided into nonspecific and specific.

The means of *nonspecific protection* include:

[24] Міністерство охорони здоров'я, Академія медичних наук. Наказ "Про удосконалення функціонування системи індикації біологічних патогенних агентів" від 21.03.2003 N 127/27

1. Individual means of protection that protects respiratory tract, skin and mucous membranes.

2. Collective protection means. The means of collective protection of a non-specific nature are a variety of shelters.

*Specific protection* is the use of drugs emergency and specific prophylaxis (vaccines, immune serums, bacteriophages, antibiotics). In all cases of bacteriological (biological) contamination, when the type of the pathogen has not yet been identified, one of the first priority activities is the prophylactic treatment of the population from particularly dangerous infectious diseases. For this purpose, broad-spectrum antibiotics and other drugs that provide preventive and therapeutic effects are used.

**Psychological protection** is one of the main measures for implementing the objectives of the civil protection system to prevent or reduce the degree of negative psychological impact on the population and the timely provision of effective psychological care.

In accordance with Article 38 of the Code of civil protection of Ukraine, psychological protection measures are aimed at reducing and neutralizing negative mental states and reactions among the population in the event of a threat and emergencies and include:

1) planning activities related to psychological defense;

2) timely application of licensed and approved in Ukraine informational, psychoprophylactic and psycho-corrective methods of influence on the personality;

3) to identify factors contributing to socio-psychological tension by means of psychological methods;

4) the use of modern psychological technologies to neutralize the negative impact of emergency factors on the population;

5) implementation of other psychological protection measures, depending on the situation.

The main principles of rendering aid to victims who have suffered psychological trauma as a result of the impact of an emergency are:

• urgency;

• proximity to the scene of events;

• expectations that normal condition will be restored;

• unity and simplicity of psychological action.

*Urgency* means that help to the victim should be rendered as soon as possible: the more time has passed from the moment of trauma, the higher probability of occurrence of deeper and prolonged disorders, including post-traumatic stress disorder.

*Proximity* consists in providing care in a familiar environment and social setting, as well as in minimizing the negative effects of "hospitalization".

*Expectations that normal condition will be restored*: a person who has suffered a stressful situation should not be treated as a patient, but as a healthy person. It is necessary to maintain confidence in the speedy return of normalcy.

*The unity of medical-psychological influence* means that either its source can be one person or the procedure of psychological aid must be unified.

*Simplicity of medical-psychological intervention* - you need to take the victim away from the source of trauma, provide food, rest, a safe environment, and an opportunity to be listened to.

**Training of the population to act in emergencies** is carried out:

1) at the place of work - the working population;

2) at the place of education - pre-school children, pupils and students;

3) at the place of residence - non-working population.

In accordance with the "Procedure for training the population to act in emergencies", approved by the Cabinet of Ministers of Ukraine on June 26, 2013 № 444, training of the population consists of:

- training conducted directly at enterprises, institutions and organizations;

- training outside enterprises, institutions and organizations of management and specialists in civil protection and fire safety;

- practical training during special object training and training in the field of civil protection;

- training while receiving the appropriate level of education in the educational institutions of the education system;

- independent study of information on actions in emergency situations.

## SECTION 6.

## MEDICAL ASPECTS OF DISASTERS AND EMERGENCY FIRST-AID PROVISION[25]

**Effects of emergencies and disasters on health:**

*Earthquakes*. The buildings' destruction in earthquakes may cause many deaths (over 10% of the population) and injure large numbers of people. The toll depends mostly on three factors:

- the buildings' typology;
- the time of day at which the earthquake occurs, and
- the population density.

Haiti the 7.2 magnitude earthquake leaves over 300 dead, hundreds injured or missing (August, 2021)

Little information is available about the kinds of injuries (or injury epidemiology) resulting from earthquakes, but regardless of the number of casualties, the broad pattern of injury is likely to be a mass of injured with minor cuts and bruises, a smaller group suffering from simple fractures, and a minority with serious multiple fractures or internal injuries requiring surgery and other intensive treatment.

Patients may appear in two waves, the first consisting of casualties from the immediate area around the medical facility, and the second of referrals as humanitarian operations in more distant areas become organised.

[25] Source: https://www.coe.int/t/dg4/majorhazards/ressources/pub/handbookfiles/3a.pdf

*Destructive winds*. Unless they are complicated by secondary emergencies and/or disasters such as the floods or sea surges often associated with them, destructive winds cause relatively few deaths and injuries.

Effective warning before such windstorms will limit morbidity and mortality, and most injuries will be relatively minor.

*Flash floods and tidal waves.* Flash floods and tidal waves may cause many deaths but leave relatively few severely injured in their wake. Deaths result mainly from drowning and are most common among the weakest members of the population.

*Floods*. Slow-onset flooding causes limited immediate morbidity and mortality. A slight increase in deaths from venomous snake bites has been reported, but not fully substantiated.

Traumatic injuries caused by flooding are few and require only limited medical attention.

Fires rage in several states as heat wave broils US West (August, 2021)

*Fires*. Every year about 100 severe burn disasters occur, each with more than 20 deaths at the scene. These are classified as severe fires and explosions due to airplane accidents, mine explosions, industrial and factory explosions, traffic accidents (bus, tanker truck, train), hotel and discotheque fires, fires collateral to natural disasters (earthquakes, volcano eruptions), etc.

The heat aggression can be associated with a toxic threat such as inhalation of combustion products or caustic gases, with a mechanical

aggression such explosion and collapse and with radiation and contamination threat.

*Road accidents*. In many serious accidents, the effectiveness of relief depends upon the behaviour of the first witnesses in the minutes immediately following the disaster.

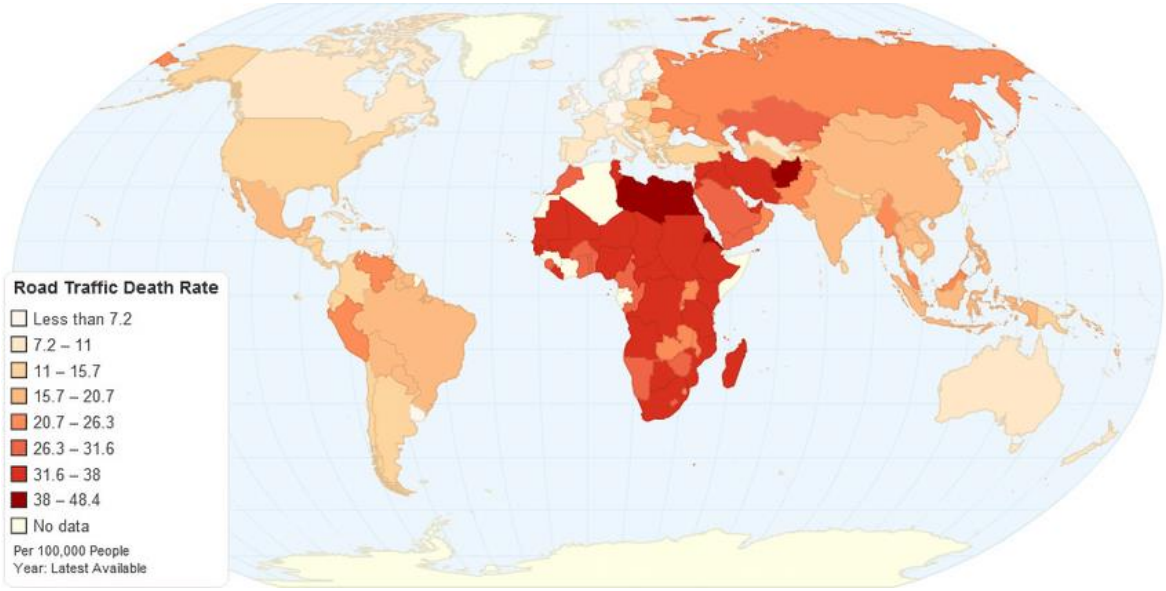



*Fig. 20 − World statistics of road traffic deaths*

The fate of the casualties and the action taken by relief personnel will depend to a large extent on:

- the speed with which the warning has been given;
- whether the warning is addressed to the appropriate headquarters;
- the accuracy of the information provided;
- victim-preservation measures taken;
- the initial steps taken.

Unless the accident is of catastrophic proportions, it is possible to be either witness or victim.

In the past, sudden-impact disasters were believed to cause not only widespread death, but also massive social disruption and outbreaks of

epidemic disease and famine, leaving survivors entirely dependent on outside relief.

Systematic observation of the effects of natural disasters health has led to different conclusions, both about their effects on human health and about the most effective ways of providing humanitarian assistance.

Though all disasters are unique in the way they affect areas with different levels of vulnerability and with distinct social, health and economic conditions, there are still similarities between different emergencies and disasters. If recognized, these common factors can be used to optimize the management of health humanitarian assistance and use of resources. The following key issues should be noted:

• There is a relationship between the type of disaster and its effects on health. This is particularly true of the immediate impact in causing injuries. For example, earthquakes cause many injuries requiring medical care, while floods and tidal waves cause relatively few.

• Some effects are a potential, rather than an inevitable threat to health. For example, population movement and other environmental changes may lead to increased risk of disease transmission, although epidemics do not generally result from natural disasters.

• The actual and potential health risks after a disaster do not all occur at the same time. Instead, they tend to arise at different times and to vary in importance within a disaster-affected area. Thus, casualties occur mainly at the time and place of impact and require immediate medical care, while the risks of increased disease transmission take longer to develop and are greatest where there is overcrowding and standards of sanitation have declined.

• Disaster-created needs for food, shelter and primary health care are usually not total. Even displaced people often salvage some of the basic necessities of life. Furthermore, people generally recover quickly

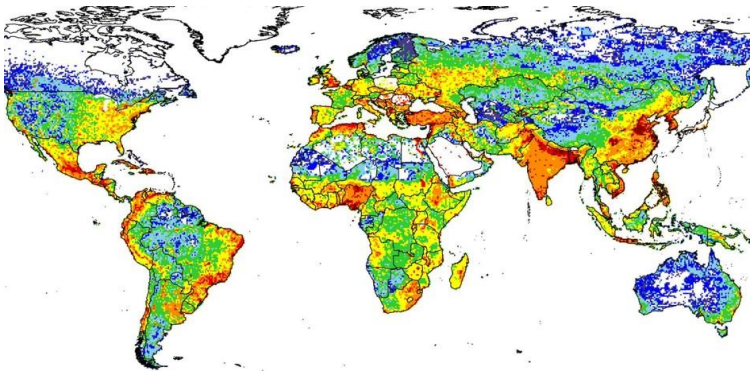
from their immediate shock and spontaneously engage in search and rescue, transport of the injured and other private relief activities.

• Effective management of health humanitarian aid depends on anticipating and identifying problems as they arise, and delivering specific materials at the precise times and points where they are needed. The logistical ability to transport maximum numbers of supplies and personnel to disaster areas is less essential.

**Common health problems:**

***Social reactions.*** After a major natural emergency or disaster, human behaviour only rarely reaches generalized panic or stunned waiting. Spontaneous yet highly organized individual action increases as survivors rapidly recover from their initial shock and set about purposefully to achieve clear personal ends. Earthquake survivors often begin search and rescue activities minutes after an impact and within hours may have organized themselves into groups to transport the injured to medical posts.

Additional resources should, therefore, be directed towards meeting the needs that survivors themselves cannot meet on their own.



The First Global Model of Waterborne Fecal Contamination

***Diseases***. The most frequently observed increases in disease incidence are caused by faecal contamination of water and food; hence such diseases are mainly enteric.

The risk of epidemics is proportional to population density and displacement. These factors increase the pressure on water and food supplies and the risk of contamination (as in refugee camps), the disruption of pre-existing sanitation services such as piped water and

sewage, and the failure to maintain or restore normal public health programmes in the immediate post-disaster period.

***Population displacements***. When large, spontaneous or organised population movements occur, an urgent need to provide humanitarian assistance is created. People may move to urban areas where public services cannot cope, and the result may be an increase in morbidity and mortality.

***Climatic exposure***. The health hazards of exposure to the elements are not great, even after major emergencies or disasters in temperate climates. As long as the population is dry, reasonably well clothed, and able to find windbreaks, death from exposure does not appear to be a major risk. The need to provide emergency shelter therefore varies greatly with local conditions.

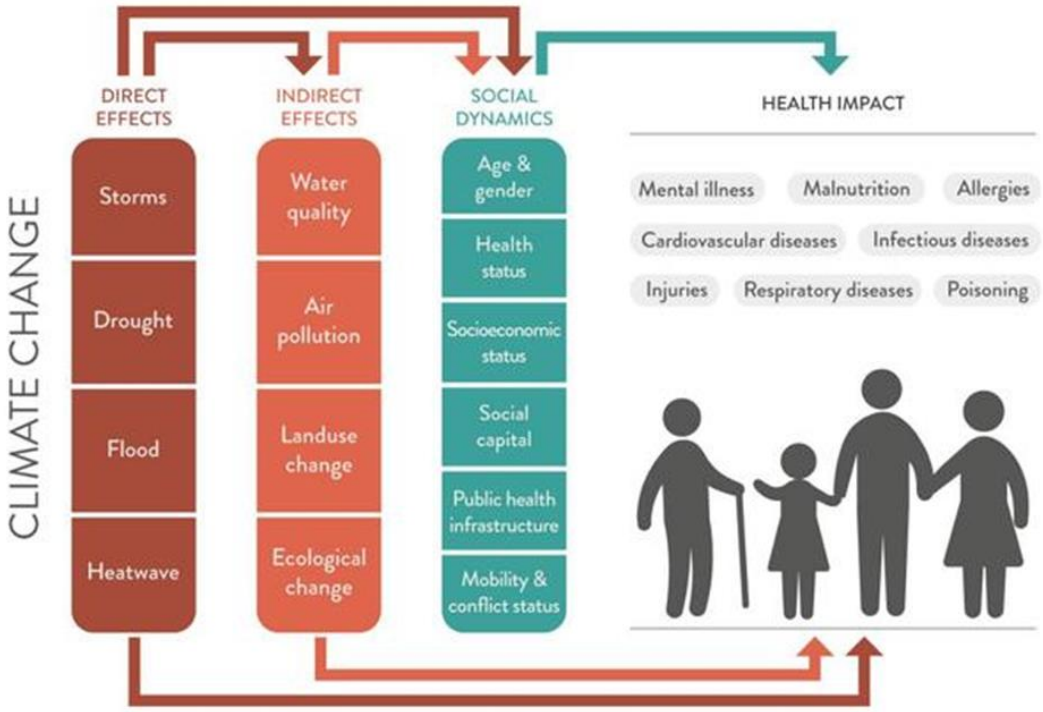



*Fig. 21 − Climate change, together with other natural and human-made health stressors, influences human health and diseases*

It may be necessary to provide shelter for reasons other than protection against the elements.

***Food and nutrition***. Food shortages in the immediate aftermath may arise in two ways. Food stock destruction within the disaster area may reduce the absolute amount of food available, or disruption of distribution systems may curtail access to food.

***Mental health***. Anxiety, neuroses and depression are not major, acute public health problems immediately following disasters, and family and neighbours in rural or traditional societies can deal with them temporarily. Wherever possible, efforts should be made to preserve the family and community social structures. The indiscriminate use of sedatives and tranquillisers during the emergency relief phase is strongly discouraged.

**First aid for injuries[26].**

Burns:

- Burns should be cooled with cold water as soon as possible for a minimum of ten minutes.
- As clean water is available in many areas of the world, clean tap water should be used.
- Ice and ice water should NOT be applied to burn wounds.
- After cooling, it is recommended that burn wounds should be dressed with a sterile dressing dependent on the local burn treatment policies.
- In cases of minor burns that will not be seen by a medical health professional, honey or aloe vera may be applied to the wound.
- NO remedies should be applied before a medical practitioner has reviewed the wounds.

[26] https://www.ifrc.org/Global/Publications/Health/First-Aid-2016-Guidelines_EN.pdf

- Care must be taken when cooling large burns or burns in infants and small children so as not to induce hypothermia.
- A first aid provider should NOT burst the blister(s).

The main educational message is to cool the burn. If cold water is not available, other locally available methods of cooling should be applied only if they will not insulate the burn. Further research is needed on the application of locally available cooling substances and dressings. For substantial burns medical advice should be sought.

Bleeding:

- First aid providers must control external bleeding by applying direct pressure.
- The use of pressure points and elevation is NOT recommended.
- When direct pressure fails to control life-threatening external limb bleeding or is not possible (e.g. multiple injuries, inaccessible wounds, multiple casualties), tourniquets could be considered in special circumstances (such as disaster, war-like conditions, remote locations or in instances where specially trained first aid providers are providing care).
- Localized cold therapy with or without pressure may be beneficial in haemostasis for closed bleeding in extremities. Caution is advised when applying this recommendation to children due to a potential for hypothermia.
- The out-of-hospital application of a topical haemostatic agent to control lifethreatening bleeding not controlled by standard techniques and in situations where standard techniques could not be applied could be considered with appropriate training.

Concussion. Head injuries can range from being severe and cause loss of consciousness and airway control to brief loss of consciousness. In other cases a person suffering from a head injury can remain conscious. Head injuries without loss of consciousness are common in adults and

children. Due to the complexity of symptoms and signs, first aid providers can find it difficult to identify a concussion.

*Table 7. Signs and symptoms of a concussion*

| Physical | Cognitive | Affective | Sleep |
|---|---|---|---|
| Headache | Difficulty thinking | Irritability | Drowsiness |
| Nausea or vomiting | Foggy | Sadness | Sleeping more/less |
| Balance | Difficulty concentrating | Anxiety | Difficulty sleeping |
| Dizziness | Decreased processing | Heightened emotions | |
| Double or blurry vision | Difficulty remembering | Nervousness | |
| Sensitivity to light or noise | Difficulty recalling events | | |
| Tinnitus | Feeling sluggish | | |
| Fatigue | | | |
| Not feel right | | | |
| Loss of consciousness | | | |

- Any casualty who is suspected to have sustained trauma (forceful bump, blow, or jolt to the head or body that results in rapid movement of the head and brain), along with any of the signals listed in table above must be presumed to have sustained mTBI or concussion.
- Any person having sustained mTBI or concussion must be removed from activity (for instance sport or other recreational activities) and referred to a qualified healthcare professional, experienced in evaluating and managing concussion.
- If the person has altered mental status including being unconscious, change in airway or breathing, seizure, change in vision, neuralgic deficits anywhere in the body or bleeding out of the nose, ear or mouth, EMS must be activated.

Extremity injuries. While not always life-threatening extremity injuries have the potential for loss of the limb. In addition, extremity fractures are often painful and there may be associated bleeding. Such bleeding can be internal at the fracture site, or external in the case of open fractures; if large bones are involved, such as the femur, the associated bleeding can

be life-threatening. Depending on the position of the extremity and the nature of the injury, there may also be challenges for moving the injured person. The goals of first aid of extremity fractures are to preserve the extremity, to limit pain and bleeding and to seek further medical assistance.

- A first aid provider could cool a sprained joint and soft-tissue injury.
- First aid providers should assume that any injury to an extremity could include a potential bone fracture and manually stabilize the extremity injury in the position found.
- There is insufficient information to make recommendations for straightening an angulated fracture. For remote situations, wilderness environments or special circumstances with a cool and pale extremity this may be considered by a trained first aid provider.
- Ice or cooling should NOT be applied for more than 20 minutes.
- First aid providers should assess for haemorrhage in all fractures and treat for shock in fracture involving long bones, especially femur, due to possibility of significant internal haemorrhage.
- Based on training and circumstance, providers may need to move an injured limb or person. In such situations, providers should protect the injured person. This includes splinting in a way that limits pain, reduces the chance for further injury, and facilitates safe and prompt transport.

Wounds and abrasions. One of the most common injuries seen by first aid providers, especially in a family environment, is wounds and abrasions. First aid providers can often care for these at home, without needing emergency treatment.

- Superficial wounds and abrasions should be irrigated with clean water, preferably tap water because of the benefit of pressure.

- First aid providers may apply antibiotic ointment to skin abrasions and wounds to promote faster healing with less risk of infection.
- First aid providers may apply an occlusive dressing to wounds and abrasions with or without antibiotic ointment.
- The use of triple antibiotic ointment may be preferable to double- or single-agent antibiotic ointment or cream.
- If antibiotic is not used, antiseptic could be used.
- There is some evidence that traditional approaches, including applying honey, are beneficial and may be used on wounds by first aid providers.
- People with wounds that develop redness, warmth or become painful or with wounds where the person develops fever should seek assessment from a healthcare provider.

Injuries due to chemical exposure. In industry and at home chemical substances might cause burns and first aid providers should be able to provide the required care as well as protect themselves. Evidence exists for treatment in the form of irrigation, but also emergency services should be contacted urgently.

- In the event of chemical exposure, emergency services or poison control centre should be contacted as soon as possible.
- The eye may be irrigated using copious amounts of clean water, preferably using an eyewash bottle, eyewash station or shower.
- First aid providers may use continuous, large volumes of clean water for irrigation of chemical injuries where chemical exposure has occurred to other parts of the body.

Shock and optimal position for shock. Shock is a general term used to describe a lack of blood reaching the major organs and tissues, thus depriving them of oxygen. Here the most common types of shock – hypovolemic, cardiogenic, distributive (most commonly due to sepsis or anaphylaxis) and obstructive are addressed. The causes are broad and

include blood loss, injury, heart infarction, anaphylaxis, obstruction of major blood vessels and toxins. People experiencing shock may complain of feeling weak, fatigue, dizziness, and/or may have altered (excited, depressed or unresponsive) mental status. First aid providers may also observe cool, clammy, pale or ashen skin, rapid heart rate and respiration.

Where specific causes of shock are identified in the initial assessment, the first aid provider should focus on managing those causes (especially stopping the bleeding) and supporting circulation. There are many presentations of shock where first aid will be insufficient to managing the cause, and higher level of care is likely to be required. To support circulation, positioning of the patient can be an important task for first aid provider.

- For a person experiencing or threatened by shock, body temperature should be maintained by preventing heat loss.
- First aid providers should place the person in shock in the supine (lying on back) position.
- First aid providers should position the person who is unresponsive and breathing normally on his or her side while ensuring that his or her airway is open (recovery position).
- First aid providers may raise the non-injured person’s legs 30 degrees to 60 degrees (PLR) if it makes him or her feel better; this may improve the vital signs for a few minutes.
- First aid providers should activate EMS if the person seems to be threatened by shock or shows signs and symptom of shock.
- For people in shock caused by known heart infarction, different positioning (like supine position with slight elevation of the upper body) should be considered.
- If the person is having breathing difficulties and will not tolerate being supine, first aid providers may help the person to get in a position

being most tolerable or comfortable for him or her (usually semi-sitting or sitting position leaning forward).

Fainting. Fainting is described as a transient loss of consciousness, caused by a fall in the blood supply to the whole brain, where consciousness is rapidly regained.

- If the person is breathing normally but remains unresponsive, maintain a patent airway by considering head tilt – chin lift, or recovery position.
- If there is abnormal or no breathing, resuscitation should be started immediately.
- An unresponsive person should be rapidly assessed for breathing/signs of circulation and perfusion (if trained to do this assessment).
- If the person is face down and unresponsive (prone position), the first aider should turn his or her face up (supine position) to check breathing.
- The first aid provider should activate EMS for a person who loses consciousness as causes can vary from not serious to being life-threatening.
- First aid providers should consider that any person who loses consciousness might have low blood sugar, stroke, seizure or other serious conditions.

Frostbite. Frostbite occurs infrequently but can have severe consequences. Local damage is caused to skin and other tissues due to extreme cold. Body parts furthest from the heart and those with large exposed areas are most likely to get frostbites. As the ambient temperature approaches 0ºC (32ºF), blood vessels on the surface of the skin start to constrict. The same response may also result from exposure to high winds. This vessel constriction helps to preserve core body temperature. In extreme cold, or when the body is exposed to cold

temperatures for long periods, this protective strategy can reduce blood flow in some areas of the body to dangerously low levels. Evidence shows the benefits of rewarming, but also the dangers of refreezing.

- People experiencing severe bleeding or major trauma should be kept warm.
- When providing first aid to a person experiencing frostbite, rewarming of frozen body parts should be done only if there is no risk of refreezing.
- Rewarming should be achieved by immersing the affected part in water between 37ºC (i.e., body temperature) and 40ºC (98.6ºF and 104ºF) for 20 to 30 minutes.
- For severe frostbite, rewarming should be accomplished within 24 hours.
- Chemical warmers should NOT be placed directly on frostbitten tissue since these can reach temperatures that result in burns and exceed the targeted temperatures.
- After rewarming, efforts can be made to protect frostbitten parts from refreezing and to quickly transport the person for further care.
- Affected body parts may be dressed with sterile gauze or gauze placed between digits until the person concerned can reach medical care.
- The use of non-steroidal anti-inflammatory drugs for treatment of frostbite as part of first aid is NOT recommended based on potential side effects of these drugs (e.g., allergies, gastric ulcer bleeding).

**De-escalating techniques for violent behaviour**.

Panic attack. A panic attack is a distinct episode of anxiety during which a person develops fear and apprehension and the anxiety reaches its peak within ten to 15 minutes.

During the panic attack, the person can have multiple somatic symptoms such as palpitation, shortness of breath with hyperventilation, chest discomfort, profuse sweating, dizziness and light-headedness and nausea, with fear of dying, fear of losing control and fear of fainting. An accident or a traumatic event can precipitate a panic attack.

- Be aware that the presentation of chest discomfort and shortness of breath can be caused by physical problems such as a heart attack or asthma; if in doubt, send the person to a hospital for management.
- Speak to the person in a calm and unhurried manner. Speak slowly with clear, short sentences.
- Ask the person if he or she knows whether their symptoms are being caused by a panic attack.
- Encourage the person to breathe in through the nose and out through the mouth slowly.
- Reassure the person that his or her anxiety and somatic discomfort will decrease gradually and that the condition is not life-threatening.
- Explain to the person that the somatic symptoms are caused by anxiety and that they will disappear after he or she calms down. However, if he or she misinterprets that the somatic symptoms are originating from severe physical problems, his or her anxiety will increase, which will further increase the intensity of the somatic symptoms resulting in a vicious cycle (see Fig. 22 below).

Extreme stress and post-traumatic stress disorder. Major events outside the range of everyday experience involving the experience of

serious threat, real or imagined, accompanied by feelings of powerlessness, horror or terror may result in extreme or traumatic stress.

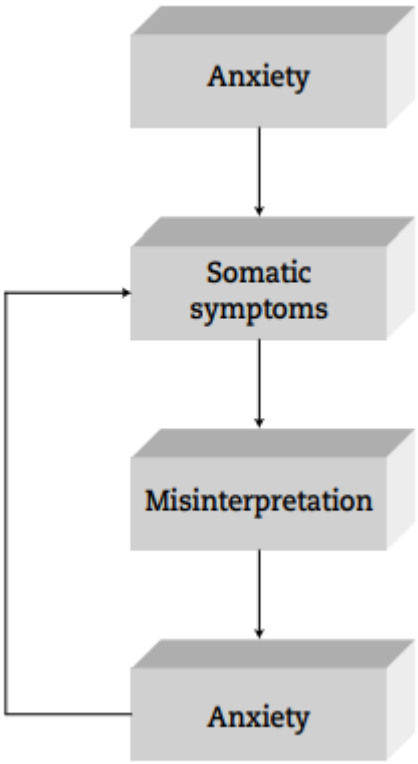



*Fig. 22 − The vicious cycle in panic attack*[27]

Common reactions to extreme stress can include anxiety and fear; constant vigilance and accompanying startled responses; poor concentration and memory; intrusive imagery and sensory intrusions; sleep disturbances including nightmares; feelings of guilt, sadness and anger; emotional numbness and diminished interest as well as both mental and behavioural avoidance. These reactions may be accompanied by physical symptoms such as muscular tensions and trembling or shaking; aches and pains; nausea, vomiting or diarrhoea, disturbance of the menstrual cycle or loss of interest in sex.

[27] IFRC. International first aid and ressuscitation guidelines, 2011

It is important to be aware that these reactions and symptoms are a normal response to an abnormal event. This message should be conveyed to affected people as the reactions may be interpreted as signs of ill health or mental disturbance. Usually, people are resilient and these reactions fade gradually and eventually disappear. Resilience can be promoted by providing different forms of psychosocial support, including psychological first aid.

However, for some people these reactions may be particularly powerful or persist over a longer period of time or worsen. In these cases it is important to intervene as this may lead to serious mental health problems that require professional help.

- First aid providers are NOT expected to make a diagnosis of post-traumatic stress disorder. However, in case of particularly powerful or persistent stress reactions or symptoms, first aid providers should seek help from healthcare professionals, including a clinical psychologist or psychiatrist.

Suicidal ideation.

First aid providers can use the following approaches for a person with suicidal ideation:

- Talk in a calm and unhurried way.
- Express empathy.
- Be aware of your own safety and the safety of other people in the area (a person with suicidal ideation may have items such as sharp objects intended to harm himself or herself).
- Encourage the person to talk about his or her suicide thoughts and plans, and the problems that lead to suicide as a way of coping,

including ambivalence between the will to live and the will to die, if still present.

- Listen in a non-judgmental way.
- Ask about the person’s social support and resources.
- Encourage the person to seek professional help.
- Ensure that the suicidal person is not left alone; ask the person’s relatives or friends to accompany him or her to the hospital, other medical facility or notify EMS.
- If the person appears emotional and cannot be calmed down, summon for help (e.g., call the crisis team, ambulance, or police).

## QUESTIONS FOR REVISION AND SELF-CHECK

### Section 1.

1. Give a definition of International humanitarian law (IHL).

2. Is IHL a part of public international law?

3. What agreements form the core of international humanitarian law?

4. In general, what kinds of people the Geneva Conventions and their Additional Protocols protect?

5. Briefly state the subject of the Fourth Geneva Convention.

6. Why did the need arise to adopt two Protocols Additional to the Geneva Conventions?

7. When was the third Additional Protocol approved? What did this protocol establish?

8. Name some international treaties that prohibit the use of certain weapons and military tactics.

9. What are the international armed conflicts? How does they differ from non-international armed conflicts?

10. IHL regulates the general conduct of hostilities on the basis of three core principles: distinction, proportionality, and … (fill in omitted word).

11. Is civil defence defined in international humanitarian law according to the tasks carried out rather than the organizations that carry out those tasks?

### Section 2.

1. When was the Code of Civil Defence of Ukraine adopted?

2. What is a central body of executive power in Ukraine in the field of civil protection?

3. Give the definition of civil protection according to the Code of civil protection of Ukraine.

4. What are the two subsystems of the existing civil protection system in Ukraine?

5. How many modes of functioning of the Unified State System of Civil Protection are there?

6. What are rescue services? What are they for?

7. What is emergency situation?

8. What are the types of emergency situations determined depending on nature of origin of events which can cause occurrence of emergency situations?

9. What are the levels of emergency situations determined depending on amounts of the effects caused by emergency situation?

10. What is disaster monitoring done for? What are its expected results?

**Section 3.**

1. How many conditional phases emergencies in their development go through? How does the development of an emergency situation begin?

2. What should be the main efforts with regard to an emergency situation?

3. Give some examples of emergencies of natural nature.

4. Do illegal acts of terrorism belong to military emergencies?

5. What threats of hydrometeorological nature do you know?

6. What are the causes of medical and biological emergencies?

7. List the objects of nuclear and radiation danger in Ukraine.

8. What are the main factors of hydrodynamic danger?

9. Among modern means of destruction are nuclear, …, bacteriological and new weapons (fill in omitted word).

10. What does an analysis of the occurrence of emergencies in Ukraine over the past 10 years show?

11. What do observations, laboratory and other controls when conducting emergency monitoring include?

**Section 4.**

1. Which of the centers of mass destruction is the most dangerous in its consequences?

2. The power of an explosion of nuclear munitions is usually expressed in … (fill in omitted words).

3. What are the nuclear effects?

4. What injuries can a person receive as a result of a blast wave?

5. As a result of the effects of what hazardous factor of a nuclear explosion can a person receive burns?

6. As a result of the effects of what factors of a nuclear explosion can a person fall ill with radiation sickness?

7. Name the zones into which the center of nuclear damage is divided by the nature of the destruction.

8. What is the permissible peacetime radiation dose to the population under normal conditions in 1 year?

9. What parameters characterize the center of chemical damage?

10. When were chemical weapons first used?

11. Name the five primary categories of CWAs.

12. Observation is one of the main therapeutic and prophylactic measures in a nidus of biological infestation, isn't it?

13. Give some examples of diseases that are caused by bacterial pathogens.

14. Give some examples of diseases that are caused by viruses.

**Section 5.**

1. What is the main purpose of protective measures?

2. Do the principles of protection derive from the basic provisions of the Geneva Convention for the Protection of Victims of War and its Additional Protocols?

3. What measures are included in the system of protective measures of the population and territories against emergencies?

4. The public alert signal "Attention to all" is a warning signal to attract attention, isn't it?

5. Are social networks one of the ways to convey signals, messages about the threat of emergencies or emergencies to the population?

6. What is the purpose of the assessment of the radiation situation?

7. How many radiation protection modes do you know?

8. Name the types of special treatment as one of the measures of radiation and chemical protection.

9. Which structures belong to the civil protection structures?

10. Give examples of dual-use buildings that can be used to protect people from the effects of emergencies.

11. What is an evacuation? What types of evacuations can you name?

12. Medical care for the population, which is one of the tasks of medical protection, is provided by the service … (fill in omitted words).

13. What is the essence of medical triage?

14. What are the criteria for determining the sorting categories of victims?

15. The main measures in the center of biological damage are quarantine and… (fill in omitted word).

16. State the basic principles of assistance to victims who have suffered psychological trauma as a result of an emergency.

**Section 6.**

1. What are the effects of such emergencies as earthquake on health?

2. What can heat aggression be associated with?

3. On what factors will the fate of victims of road accidents largely depend?

4. The most frequently observed increases in disease incidence are caused by … contamination of water and food (fill in omitted word).

5. Should ice and ice water be applied to burn wounds?

6. How should first aid providers control external bleeding?

7. Name a few signs and symptoms of a concussion

8. What is one of the most common injuries that first aid providers have to deal with, especially in the family environment?

9. How would you describe fainting?

10. What symptoms can be observed during a panic attack?

# GLOSSARY

**Accident** - dangerous event of technogenic nature which entailed defeat injuring of the population or creates in the separate territory or the territory of the subject of managing threat of life or to health of the population and leads to destruction of buildings, constructions, the equipment and vehicles, violation of production or transport process or causes above-standard, emergency emissions of pollutants and other adverse effect on the surrounding environment.

**Belligerent**. The term belligerent was used until the end of World War II to refer to: the States taking part in a war or the individuals authorized to use armed force. This term no longer has a precise legal definition. Instead, the term party to the conflict is used since 1977 to define both State and non-state actors participating in an armed conflict. However, the term belligerent continued to be used until 1977 to refer to individual insurgents who, in a civil war, actually controlled part of the territory of a State.

**Biological hazard** - A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mold) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying disease-causing agents such as parasites, bacteria, or viruses (e.g. malaria).

**Catastrophic crash** - accident big in terms of the scope of or other event which leads to serious consequences.

**Civil defense**. The 1949 Geneva Conventions and their 1977 Additional Protocols define civil defense as “the performance of some or all of the undermentioned humanitarian tasks intended to protect the civilian population against the dangers, and to help it to recover from the immediate effects, of hostilities or disasters and also to provide the conditions necessary for its survival.

**Climatological hazard** - A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability.

**Cluster munition** is a form of air-dropped or ground-launched explosive weapon that releases or ejects smaller submunitions. Commonly, this is a cluster bomb that ejects explosive bomblets that are designed to kill personnel and destroy vehicles.

**Dangerous factor** - the component of the dangerous phenomenon (the fire, explosion, emission, threat of emission of dangerous chemical, radioactive and biologically dangerous substances) or process which is characterized by physical, chemical, biological or other effect (influence) exceeding of normative indicators and creates threat of life and/or to health of the person.

**Dangerous event** - event, including catastrophic crash, accident, the fire, natural disaster, epidemic, epizooty, epiphytoty which on the effects poses threat of life or to health of the population or leads to drawing loss of property.

**Disasters**. A disaster is an unexpected event. The responses to disasters—which may be natural (climatic, seismic, or other natural causes) or human (accidental or voluntary)—must therefore employ exceptional measures.

**Disaster risk** is considered to be a function of hazard, exposure and vulnerability. Disaster risk is normally expressed as the probability of loss of life, injury or destroyed or damaged capital stock in a given period of time.

**Earthquake** - Sudden movement of a block of the Earth's crust along a geological fault and associated ground shaking.

**Emergency situation** - situation in the separate territory or the subject of managing on it or water object which is characterized by violation of normal conditions of life activity of the population caused by

catastrophic crash, accident, the fire, natural disaster, epidemic, epizooty, epiphytoty, use of weapons of destruction or other dangerous event which brought (can bring) to emergence of threat of life or health of the population, large number of dead and injured, drawing considerable loss of property, and also to impossibility of accommodation of the population in such territory or object, implementation on it economic activity.

**Epidemic** - mass spread of infectious disease among the population of the corresponding territory for short period.

**Epiphytoty** - wide circulation in the territory of one or several administrative and territorial units of infectious disease of plants which considerably exceeds the regular illness rate this disease in the corresponding territory.

**Epizooty** - wide circulation of infectious disease of animals for short period which considerably exceeds the regular illness rate this disease in the corresponding territory.

**Evacuation** - organized removal or export from zone of emergency situation or zone of possible defeat of the population if there is threat of his life or to health, and also material and cultural values if there is threat of their damage or destruction.

**Fire** - uncontrollable process of destruction or damage by fire of property during which there are factors dangerous to beings and the surrounding environment.

**Fire safety** - lack of unacceptable risk of origin and development of the fires and the related possibility of harming living beings, material values and the environment.

**Fire protection** - type of activity which consists in prevention of emergence of the fires and protection of life and health of the population, material values, the surrounding environment from influence of dangerous factors of the fire.

**First aid** is the first and immediate assistance given to any person suffering from either a minor or serious illness or injury, with care provided to preserve life, prevent the condition from worsening, or to promote recovery.

**Hazard** - A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socionatural in origin. Natural hazards are predominantly associated with natural processes and phenomena. Anthropogenic hazards, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation. Several hazards are socionatural, in that they are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change.

**Hazardous event** is the manifestation of a hazard in a particular place during a particular period of time. Severe hazardous events can lead to a disaster as a result of the combination of hazard occurrence and other risk factors.

**Injured with emergency situation of technogenic or natural nature** (victims) - persons to whose health harm as a result of emergency situation is done.

**International humanitarian law** (IHL) is a set of rules which seek, for humanitarian reasons, to limit the effects of armed conflict. It protects persons who are not or are no longer participating in the hostilities and restricts the means and methods of warfare.

**Medico-psychological recovery** - complex of the treatment-and-prophylactic, rehabilitation and improving actions directed to recovery of psychophysiological functions, optimum working capacity, social activity of

rescuers of rescue services (forming), persons involved in accomplishment of the wrecking in case of emergency situation and also injured with such emergency situation, first of all minors.

**Mitigation of consequences of emergency situation** - carrying out complex of actions which includes rescue and other urgent works which are carried out in case of emergency situation are directed to cancellation of dangerous factors, rescue of life and preserving human health, and also to localization of zone of emergency situation.

**Natural disaster** - the natural phenomenon which uses the force from big destructive does considerable harm to the territory on which occurs, breaks normal life activity of the population, causes loss of property.

**Noncombatants** - all persons who are not or no longer taking part in hostilities.

**Object of the increased danger** - object which with compliance with the law is considered such, on which there is real threat of emergence of accident and/or emergency situation of technogenic or natural nature.

**Occupied territory** - a territory is considered “occupied” when it is actually placed under the authority of the hostile army.

**Prevention** of emergence of emergency situations - complex of the legal, social and economic, political, organizational and technical, sanitary and hygienic and other actions directed to regulation of technogenic and natural safety, evaluating risk levels, advance response to threat of emergence of emergency situation on the basis of data of monitoring, examination, researches and forecasts of rather possible current of events for the purpose of non-admission of their development into emergency situation or mitigation of its possible effects.

**Recovery work** - complex of the works connected with recovery of buildings, constructions, the companies, organizations and organizations

irrespective of pattern of ownership which were destroyed or damaged as a result of emergency situation, and the corresponding territories.

**Rescue and other urgent works** - the works sent to search, rescue and protection of the population, avoidance of destructions and loss of property, localization of zone of influence of dangerous factors, liquidation of factors which make impossible carrying out such works or threaten life of rescuers.

**Road accident** - event which took place during movement of the road vehicle as a result of which people died or were traumatized or the damage to property is caused.

**Shelter** - (a building designed to give) protection from bad weather, danger, or attack.

**Technogenic safety** - lack of risk of emergence of accidents and/or catastrophic crashes on potentially dangerous objects, and also at subjects of managing which can create real threat of their origin. Technogenic safety characterizes condition of protection of the population and the territories from emergency situations of technogenic nature. Ensuring technogenic safety is special (specific) function of protection of the population and the territories from emergency situations.

**Vulnerability** - The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

**Warfare** is engagement in violent conflict, or the activities involved with violent conflict.

**Warning**: 1) something that makes you understand there is a possible danger or problem, especially one in the future; 2) notice of a possible danger or problem, so that it can be prevented or avoided; 3) a statement or piece of information that tells people that there might be a danger or a problem in the future.

**Warning system** - complex of organizational and technical actions, the equipment and technical means of the notification, equipment, means and communication channels intended for timely finishing signals and information on emergence of emergency situations central and to local executive bodies, the companies, organizations, the organizations and the population.

**Weapon** - In general, humanitarian law prohibits any weapon “of a nature to cause superfluous injury or unnecessary suffering” and any that may have indiscriminate or excessively injurious effects. This is an ancient principle, linked to the axiom that “the right of the parties to the conflict to choose methods or means of warfare is not unlimited” (API Art. 35).

**Zone of emergency situation** - the separate territory, the water area where there was emergency situation.

## REFERENCES


1. The Civil Protection Code of Ukraine. Available at https://zakon.rada.gov.ua/laws/show/5403-17

2. Law of Ukraine On Voluntary Amalgamation of Territorial Communities. Available at https://zakon.rada.gov.ua/laws/show/157-19#Text

3. Resolution of the Cabinet of Ministers of Ukraine on the approval of the Regulation on the State Environmental Monitoring System. Available at https://zakon.rada.gov.ua/laws/show/391-98-%D0%BF

4. Resolution of the Cabinet of Ministers of Ukraine on the approval of the Regulation on the Unified State System of Civil Protection. Available at https://zakon.rada.gov.ua/laws/show/11-2014-%D0%BF/ed20180613

5. Resolution of the Cabinet of Ministers of Ukraine on the approval of the Procedure of Training Civilians How to Act in the Event of Emergency. Available at https://zakon.rada.gov.ua/laws/show/444-2013-%D0%BF#Text

6. Directive of the Cabinet of Ministers of Ukraine on the approval of the Strategy of Reforming the System of the State Emergency Service of Ukraine. Available at https://zakon.rada.gov.ua/laws/show/61-2017-%D1%80

7. Directive of the Cabinet of Ministers of Ukraine on the approval of the Concept of Developing and Modernizing a Centralized Disaster Alert System. Available at https://zakon.rada.gov.ua/laws/show/43-2018-%D1%80#Text

8. Orders of ministries and other agencies:

- On the approval of the Regulation on Monitoring of Potentially Hazardous Objects. Available at https://zakon.rada.gov.ua/laws/show/z1238-03

- On the approval of the Regulation on the functional subsystem for safe operation of housing and utility assets of the unified state system of civil protection. Available at https://zakon.rada.gov.ua/laws/show/z0972-17

- On the approval of the Organizational-Methodological Guidelines for Training Civilians How to Act in the Event of Emergency for 2020-2021. Available at https://zakon.rada.gov.ua/rada/show/v0738388-19#Text

9. On the state of Ukrainian legal framework regulating civil protection in the context of priorities of the Sendai Framework for Disaster Risk Reduction. Analytical report. Available at https://r2p.org.ua/wp-content/uploads/2021/02/report-on-civil-protection_3p-consortium-eng-1.pdf

10. Sendai Framework for Disaster Risk Reduction 2015-2030 of 18.03.2015. Available at https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

11. Gasser, Hans Peter. “Protection of the Civilian Population: Civil Defense.” In The Handbook of Humanitarian Law in Armed Conflicts, edited by Dieter Fleck, 209–92. New York: Oxford University Press, 1995

12. The Practical Guide to Humanitarian Law. Available at https://guide-humanitarian-law.org/content/article/3/civil-defense/

13. ICRC. Basic Rules of the Geneva Conventions and Their Additional Protocols. 2nd ed. Geneva: ICRC, 1988. Available at http://www.icrc.org/WEB/ENG/siteeng0.nsf/htmlall/p0365?OpenDocument&style= Custo_Final.4&View=defaultBody2.

14. ADVISORY SERVICE ON INTERNATIONAL HUMANITARIAN LAW. Available at https://www.icrc.org/en/document/icrc-advisory-services-international-humanitarian-law