EVALUATION OF STATE OF TECHNOGENIC ENVIRONMENT IN LATVIA AND THE WORLD IN THE 21ST CENTURY

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Abstract. The safety of the state infrastructure and population depends on the effective actions of the state, local governments, merchants and authorities in the event of an accident, disaster or emergency situation (hereinafter – ES). One of the most important prerequisites for the existence and safe and effective planned development of the country and society is the identification and assessment of potential risks of the ES, in order to reduce hazards and ensure effective risk management. Hazards can only be reduced by identifying risks at all possible levels and by taking appropriate reasonable decisions to prevent them. The risks involved should be identified for the purposes of their management and efficient planning of preventive measures and to allow preparing the necessary resources on a daily basis, as well as for their efficient management in the ES circumstances. Although risk and safety are the terms extensively used worldwide and potential hazards of economic consequences are measured in millions of euro, there are very few sources of references in the Latvian language regarding risk assessment of technogenic accidents. The goal of the research is to consider the essence of modern technogenic environment in Latvia and the world. To achieve this goal, the following objective is set: to explore and analyse the importance, development and range of problems of the safety system of the global technogenic environment.

Keywords: technogenic environment, accidents, disasters.

Introduction

A lot of people nowadays think that technology makes their lives easier. This assumption is based on the past evolution of humanity, particularly the rapid industrialisation in the 20th century. The effective and targeted development of people and society requires a balance between the social environment, infrastructure and technology. The effects of a technogenic accident in the enhanced hazard objects (hereinafter – EHO) are very different and can have economic, social, ecological and even political impacts. The importance of safety principles is one of the most visible features of safety management. Many of them are enthusiastic and claim to codify a comprehensive safety management strategy [1]. In order to systematise and define common safety concerns, it is important to identify and analyse groups of principles of the common security system with a closely related content.

The focus of the topic is supported by the hereunder described aspects.

The national security system is composed of the institutions that exercise the power and administration of the state and the citizens of Latvia, to whom duties and rights in the field of national security are delegated within the scope of their competence. Stable and sustainable development of the country, as well as the national economy and society, can only be achieved, if there is an effective national security system. The last technogenic accident in 2013 at the *Maxima* store in Riga showed the importance of a stable and efficient state security system in preventing accidents and eliminating the consequences of an accident. Timely planning helps identify, forecast and address internal threats, reduce adverse effects and contribute to the proper functioning of the national security system, public security and democratic development. One of the central elements of the paradigm of development is people and their quality of life and, in this context, the most important indicator of the quality of life is public safety.

The disaster theory provides a universal approach in the context of all leaping changes related to possible changes in the ES, and the efficiency theory provides an opportunity to anticipate potential negative results depending on the resources invested and the technology applied, and it is necessary to mention the theory of complex systems that provides a reply to the question how any type of operation needs to be organised in order to achieve the maximum benefit.

Description of the problem

In the 21st century, most people live and work in big cities, and this gives them considerable advantages compared to residents of rural areas. For example, people living in large cities have more opportunities for self-development and growth, opportunities to find a hobby and a job of interest that makes it possible to effectively realise their knowledge and reach an appropriate standard of living. All

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cities around the world are artificially shaped, and they are designed by people to protect themselves from the adverse effects of natural phenomena such as storms, cold, floods and the like. Such an artificial environment is known as the technogenic environment, or the urbosphere. In modern cities, the infrastructural benefits are not only used to improve living conditions, but also for manufacturing, which is often associated with hazardous technologies and the storage of dangerous substances in small or large quantities. The extent of the circulation of hazardous substances and the quantity of products from the processing industry is increasing every year, and, consequently, consumer and hazard-qualifying producers are also increasing. This statement is confirmed by a study of S. Sivaraman and S. Varadharajan on the explosion of the 4th August, 2020 at a port in Beirut, where an explosion of ammonium nitrate accurred. According to the data of the study, explosion resulted in more than 178 fatalities and injured more than 6500 people, and also left an estimated 300 000 people homeless and registered as an equivalent to a 3.3 magnitude earthquake. The accident was considered to be the largest of its kind and the most severe anthropological disaster of the decade, the financial loss the nation was subjected to post the explosion was estimated to be around 15 billion USD as informed by the governor [2]. This explosion occurred due to the threat of a technogenic environment that exists independently of man and city residents had been exposed to these hazards for several consecutive years. According to the World Bank, more than 50% of the world’s population live in urban areas (in 2007 the urban population was equal to the rural population), while in 2050 this ratio would exceed 65%. Cities account for more than 50% of global GDP, occupying only 3% of land area [3]. In general, according to the opinion of the scientist A. Shakoor and co-authors, by 2050, we will have an estimated 9-10 billion mouths to feed, as a result, the role of the technogenic environment will only grow to meet the needs of these people, [4] together with the resulting hazards.

Essence and issues of the technogenic environment

The technosphere, as a global system, developed particularly rapidly in the 20th century, and without slowing the pace of development, has created an ongoing problem – excesses. Scientists G. Valsamos, M. Larcher, F. Casadei, analysing the explosion in Beirut port, conclude that in the face of continued global urbanization, cities are challenged to satisfy increasing standards in terms of quality of life, environmental conditions, safety, security, health, economic growth and mobility. The concept of “smart cities” aims at utilising advanced technologies, artificial intelligence and high computational capacity to increase their resilience and improve the services provided to the citizens [5]. As a result, this system is increasingly difficult to control and it also affects other systems, such as the biosphere. Further in the text (Fig. 1.), a pattern of exposure between humans and the environment is shown, where a human is described as an environmental element capable of affecting one of the environmental components, thereby also affecting other parts of the environment, the so-called domino or chain effect. The scientific literature does not define this effect in a uniform way, but several of its wordings are summarised in the study of the researcher *A. Necci*, and one of them explains that the domino effect is a cascade of accidents (domino events), where the effects of a previous accident increase the likelihood of a consequential hazard leading to the consequences of a larger accident in this area and at this time [6]. In general, the domino effect appears to be a phenomenon, where one incident could provoke another with more severe consequences than the consequences of the original accident. This effect is clearly seen in the context of global warming, since the worldwide technogenic environment has an uncontrolled impact on the biosphere, and global processes are underway that people are unable to control, such as the increase of average air temperatures and the reduction of the ozone layer. From a synergetic point of view, technoenvironment is an open system, where information and energy are exchanged, so that it is able to respond to the effects of other elements of the system and resonate.

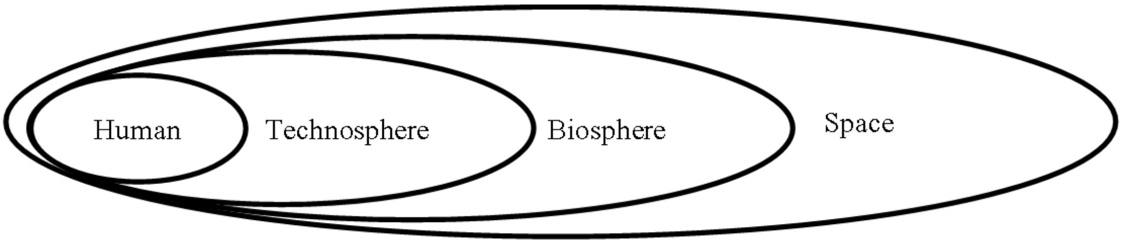

Fig. 1. **Human and environmental interactivity scheme [7]**

The terrestrial biosphere has formed as a result of nature and human interaction. It is a functioning unit with specific characteristics and relationships, a united global ecosystem of the world that exists on earth and develops with the environment. *D. Orlov* explains in his book *Shrinking the Technosphere* that the biosphere is a natural environment, in which all life exists, and which provides us with air, drinking water, as well as wild and cultivated foods, construction materials, natural fibres, fur, leather and more. Still, the technosphere is a parasitic formation that occurs in the biosphere and deals with its degradation [8]. Natural and human harmonious interactions have been disrupted, and this was driven by human propensity to use natural resources in production in return for waste. With account of the scale of this process worldwide, it can be concluded that this is a global trend. In the opinion of scientists *O. Pobol* and *G. Frisov*, the efforts of the United Nations (hereinafter – UN) to implement the concept of sustainable development of the world economy aimed at reducing the negative ecological impact of modern technologies, following the principles of self-banning, renewal and a closed cycle, have proved to be ineffective [9], therefore, it is still topical to reduce hazards of the existing technology and be aware of the potential hazards.

Studies on the technogenic environment have been summarised in many publications, describing its structure and evolution. Compared to previous stages of human development, natural hazards have not changed significantly; still it should be emphasised that the impact of nature on the technogenic environment, such as in the case of floods, has had more drastic effects than 100 years ago. As a result, the effects of floods and other hazards, with their accompanying domino effect, cause more extensive damage, particularly when technoenvironmental EHO are affected.

According to the definitions of the technogenic environment in the international scientific and study materials, technoenvironment (part of the biosphere that is transformed by humans into technical objects) is no alien to the biosphere; it is a qualitatively new phase of its development [10]. Technoenvironment is a region of the biosphere in the past, transformed by humans into technical and technogenic objects, creating a habitable environment. It is a global mix of things, objects, material processes and products produced by society. The technogenic environment is also mentioned in relation to the geo-sphere of land affected by production processes and overflowing with its products. Technoenvironment takes precedence over the biosphere, and, as a result, there are very few areas left on the planet with a natural ecosystem [11].

Technoenvironment is a life environment created by a man using technical means in a natural environment to make better use of it for human socio-economic purposes [7]. At the same time, technoenvironment is a part of the biosphere, which was transformed by a man using technical means, directly or indirectly, to ensure the socio-economic needs of humanity. It is a closed, regional or global technological system relating to the movement of natural resources to be used. It normally covers areas, where cities, villages, production areas, businesses, economic and energy facilities, and transport infrastructure are located and where domestic processes take place [12].

Technoenvironment is a set of all functioning and old, non-operating sites and by-products that have appeared on the ground and in space. These by-products are usually associated with changes in water, air and earth chemical composition and earth crust layers (land cultivation), as well as biogeocenological changes contributed by logging, agricultural land cultivation, drainage of swamps and creation of artificial water reservoirs. Technoenvironment is an environmental-timely system that is socially organised in technical matters [13].

Technoenvironment is the life environment of civilisation that has developed as a result of the industrial and technological revolution. There are different levels of technoenvironment:

- artificial world designed to transform nature and meet human needs;
- technical and other knowledge, technologies that form the intellectual core of the technosphere;
- social institutes, technical organisational links through which people establish the functional sectors of the technoenvironment that ensure its functioning and development [14].

When analysing this term, it can be concluded that the concept of *technoenvironment* is generally understood as part of the biosphere transformed by a man to live conveniently and provide themselves with safe conditions. It involves all sorts of residential areas, agrocenosis, mineral sites and infrastructure used by humans to meet their needs. Paradoxical is the man’s belief in control over nature, which is supposedly provided by the technoenvironment, and the assumption that the control acquired is proportional to the level of human safety and well-being.

The term close to *technoenvironment*, which is often used in one of the ecology industries, is *urboecology*, *urbosphere*. The term *urbosphere*, resulting from the word *urbanisation*, refers to the geographic surroundings that are used or encompassed by urban construction – cities, villages and their connecting communications – and which to some extent cover the interests of the population (recreational site, workplace, resource extraction or another site) [15]. Scientists *E. Likhachev*, *D. Timofeev* and *A. Makkaveev* define the term *urbosphere* as a natural anthropogenic system, which forms symbiosis of natural and man-made forms and architectural objects and is influenced by specific geological and geomorphological conditions, in particular the type of polygenic surface [16]. Urbosphere as a system has a set of standard characteristics: structure, stability, hierarchy and organisation, and it includes not only urban, but also traffic infrastructure, workplaces and other urban environment elements. Urbosphere is a part of the biosphere transformed by human to provide for their needs, as well as comfort and safe conditions. Thus, the terms *urbosphere* and *technoenvironment* are almost identical in terms of expression and content, only to be used in different fields of science – ecology and urboecology.

Initially, the aim of the technoenvironment was to help people and protect them, but with time technoenvironment itself started creating a hazard to modern society, when it was not duly controlled and managed. Any manufacturing process may cause hazard to workers, the environment and people outside the production facility, thus it is important to make reasoned decisions [17] for reducing hazards. Scientists M. Abouzeid and co-authors in connection with the explosion in Beirut port explain the following: Lebanese officials reportedly knew for 6 years of ammonium nitrate storage at Beirut Port but failed to act, showing blatant disregard for public safety [18]. But one of the principles of economic stability in any country and region is to create a secure technoenvironment, since the negative consequences of uncontrolled processes always lead to social, economic and environmental losses. It is therefore essential to foresee the extent of potential losses at a technoenvironmental object by using the loss assessment methodology. The development of a sound methodology is hampered by the large amount of information on the technoenvironmental object, its parameters and the technologies used, as well as the environmental objects, population and other aspects. The loss amount assessment is important at the *a priori* and *a posteriori* hazard assessment stages, in order to eliminate consequences of an accident more efficiently, to justify cash investments in improving and developing the safety system and to help insurance companies that determine the amount of the insurance premium.

Socio-economic consequences of technoenvironmental hazards

Technoenvironment affects the biosphere and focuses mainly on safety concerns and, in particular, the safety of the technogenic environment. For residents, the greatest threat, excluding armed conflicts, is posed by EHO, such as chemical plants, power plants, warehouses of hazardous substances and similar facilities. With account of the scale of the hazard and its impact on the biosphere, it is necessary to highlight the facilities, which are built by using physical work and human knowledge and which, in the event of an accident, pose the most direct threat to other environmental elements. The hazard illustration is provided in Figure 2.

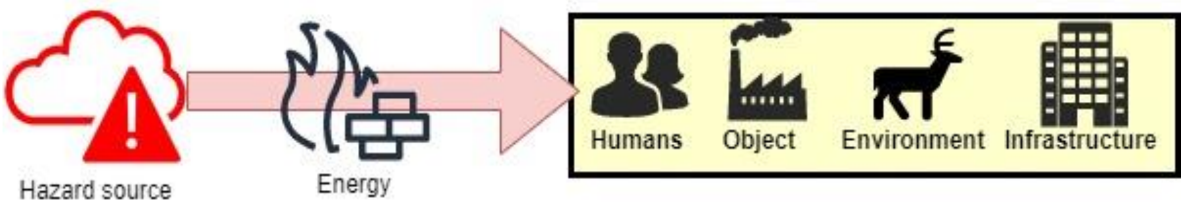

Fig. 2. **Illustration of hazards**

Due to the increasing hazards and threats of the modern technoenvironment, safety issues still remain topical; however, the main problem is that existing hazards cannot be completely eliminated, and people must accept the existing level of hazard for their comfort. In the event of an accident, the socio-economic consequences of the EHO are the total losses associated with the losses of residents, organisations, municipalities and public organisations resulting from the localisation of the effects of the accident and the recovery of living standards in the affected area, as well as the costs to be anticipated in good time, when planning the territory development in order to avoid an escalation of a possible accident [19] and in order to be prepared, when planning the budget, to pay the costs of medical treatment services and compensation to victims. Economic loss indicators are investments in preventive measures related to the reduction of potential damage to the health of the population, workers, costs of costing death benefits, treatment, losses of material values of legal and natural persons [20]. Losses are usually determined during or after an accident, and material damage caused by an accident to natural persons, legal persons or the state as a whole can be avoided.

Direct losses are incurred directly in the area affected by the accident and relate to the affected property and people, but they are usually only part of the total losses, as insurance companies, family members, public bodies and other entities associated with the injured person or affected business may be involved in the accident and environmental damage must also be taken into account. Losses other than direct losses are called indirect losses. They constitute a system where it is very difficult to assess each element, particularly where harmful effects persist in the long term.

The technoenvironment has the main risk change regularities as shown in Figure 3. The risk of the first type increases proportionally to the duration of the impact, as a result, with time the amount of loss exceeds the public benefits from the operation of the technoenvironment. Until the 20th century, the life of humanity went through the A-system period, which means that production-related gains were bigger than losses. In the 20th century, the B-system period began, which means that the system's growth rate is declining, but the danger is increasing. The C-system period is considered to be the worst of the three, as the technoenvironment is not able to provide sufficient benefits to society, which will result in the system operation mostly having a negative impact on the living environment and will result in increased and disproportionate pollution of the biosphere, which is very difficult to struggle with.

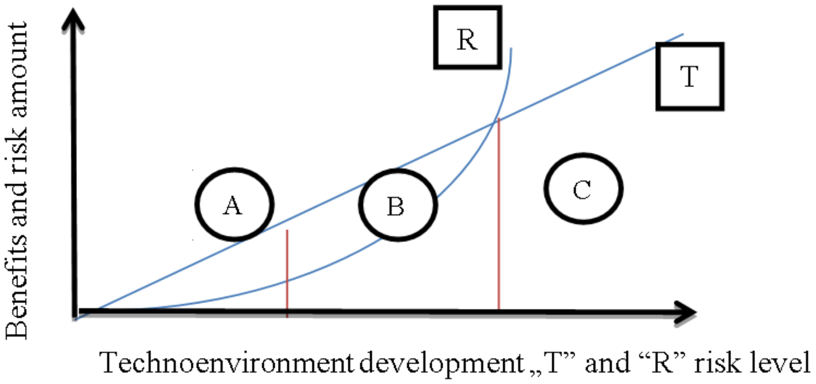

Fig. 3. **Regularities for major risk changes in technoenvironment [16]**

Two key principles have been identified the safety level of EHO depends on. The first principle is *ALAPA* (*as low as practicably achievable*) or the absolute safety principle, which stipulates the necessity to determine the lowest possible level of hazard. The main shortcoming of this principle is the inefficient use of money, or even the increase in danger, as opposed to the desired reduction. The main challenge of the *ALAPA* principle is to determine the permissible level of hazard or how safe the object should be; therefore, the *ALARA* (*as low as reasonably achievable*) principle is currently applied to the global EHO hazard assessment, which provides for the setting of such low risk levels as reasonably achievable [21], which is that the hazard is reduced to an acceptable level. The acceptable risk includes permissible losses, which do not exceed the funds required to cover the losses incurred without deteriorating the overall standard of living. Whereas, the unacceptable risk reduces the quality of life below critical levels, and it is not possible to allocate funds for its restoration in the required amount, for example, the budget is exceeded. This can lead to public discontent, mass riots and political course changes.

The *ALARA* principle may be also indicated in another way in different countries. Very close and similar names for this principle are summarised in Table 1. First, the acronym *ALAP* was introduced, in the early 1970s, it was replaced by *ALARA* in the USA and by *ALARP* in Europe [22].

Table 1

Hazard Assessment Principles

Abbreviation	Explanation in English
ALAP	As Low As Practicable
ALARA	As Low As Reasonably Achievable
ALARA	As Low As Reasonably Attainable
ALARP	As Low As Reasonably Practicable
SFAIRP	So Far As Is Reasonably Practicable

Assessment of losses is the basic duty of the EHO management, in order:

- to systematise and record all accidents according to uniform economic criteria;
- to assess the EHO risks;
- to make reasoned decisions within the framework of the security system;
- to assess measures for reducing hazards and potential losses.

A comprehensive resistance of society and technology to potential disasters is an artificially created environment pertaining to the cross-sectoral research area [23]. In order to provide a comprehensive, independent opinion and view all potential exposure links and interaction between elements in the sociotechnical system, the disaster research process should involve researchers from different fields of science, who have different life experience and use different research methods. Example: when designing and constructing buildings, facilities, objects of infrastructure and other structures, engineers must take into account potential hazards and worst-case scenarios in the respective region of the world, informing about the identified deficiencies the community, entrepreneurs and national supervisory authorities, which are obliged to minimise the risks associated with the probability of an accident, thereby effectively reducing the future losses. According to the opinion expressed by N. Leveson in her research, safety is a basic component of the system, formed as a result of interaction between technical, physical and human components, but the system consists of interrelated components in a dynamic equilibrium position, using feedback and ban controls to promote safe functioning of the system [24]. Accidents usually occur, when management, organisation or technical controls are lost and when the safety limit values of the system are breached. The more complex the design of the system is and the more subsystems and elements it has, the more difficult it is to track and understand the legal relationships of this system, and therefore the risk assessment is encumbered. It is therefore necessary to identify and model all potential accidents and foresee the consequences of their hazards. Accidents are interpreted differently, and statistics are not accurate in different countries, because there is no common system for assessing losses and identifying the consequences. Therefore, an accident that is assessed as a national disaster in one country can be assessed as an accident in another country. This depends mainly on the size of the country and the interpretation of the consequences.

Over the past 20 years, major changes have been made in many dangerous industries around the world to ensure accident-free operation of technological equipment or to minimise the likelihood of an accident. Competitiveness and liberalisation have led to significant market benefits, the quality of products and services has improved. At the same time, new processes and systems made work more complicated because of increased energy performance, pressure and temperature, increased volumes of substances, decreased storage sites and interdependence between industries and technologies. The risk of large-scale accidents has increased, which can cause significant damage to a company's performance and reputation, as well as to people and the national economy [25].

The possibility of technogenic accidents should be reduced in the country to minimise losses to the environment, economy and people. Within the framework of the a priori assessment, it is important to forecast the potential consequences, in order to prepare for potential hazards and to take the necessary decisions; this is the most relevant assessment in the safety management process. The a priori assessment should include a methodology for the EHO examination to assess environmental and economic losses and recommendations for calculating and reducing EHO risks. This assessment differs from an a posteriori assessment mainly due to the fact that no accident data are available, except for possible scenarios and probability.

The scientific literature distinguishes between ES according to their scale and impact, and a more detailed breakdown includes disasters, accidents, incidents, damage, deviations, hazards and threats. Major disasters happen very rarely, and people tend to think they will never happen because a number of negative factors should coincide. The United Nations Office for Disaster Risk Reduction defines the disaster as follows: disaster is a major disruption to society on any scale related to the interaction of hazardous events with risk exposure vulnerabilities and response capacity factors, resulting in one or more of the following types of damage: human, material, economic or environmental losses and their effects [26]. The International Red Cross and Red Crescent Movement defines a disaster as a sudden accident that seriously interferes with the functioning of society or the community and causes human, material and economic or environmental damage beyond the ability of the community or society to cope with its own resources [27]. The lack of a common definition of the term *disaster* makes it difficult to identify the effects of disasters and to compile statistical data. The most important factor for the ES is their uncertainty people and other surrounding objects are exposed to, and it is not possible to know the extent of the impact of the ES consequences.

As a general rule, major and devastating disasters are a major concern for the media, but the general public may not even know about accidents or incidents, so it is necessary to assess the differences between the accidents mentioned above. Accidents and incidents may be considered to be extreme situations of operation of the system [28], and, in the light of the situation descriptions mentioned above, it is clear that identifying and characterising scenarios for dangerous accidents and events is an essential source of information useful for risk assessment.

Hazardous chemicals are usually a complex, dynamic system where multiple factors interact. It is therefore important to have a comprehensive understanding of the sources of risk and the extent of the damage caused by them, as well as their classification, depending on the severity or scale of the incident.

A hazard "is a dangerous phenomenon, a substance, a human activity or a condition, which may cause loss of life, injury or other damage to health, damage to property, cause loss of livelihood and services, social and economic destabilisation or damage to the environment" [29]. A hazard can usually be identified in advance and this term refers to the possibility of a negative event, if timely preventive measures are not taken and if the potential causes of the risk are not addressed. The term "technological hazard", which is "a threat arising from technological or industrial conditions, including accidents, dangerous procedures, a failure of infrastructure or a certain human activity, which may cause loss of life, injury or another damage to health, damage property, damage to livelihood and services, socioeconomic destabilisation or environmental damage" [29]. This is a specifying term and such kind of threat exists only at industrial sites. In general, accidents and incidents can be analysed as the final result of the operation of the system, and hazardous events must be identified and described in order to gather information and to carry out risk assessments [30].

The Centre for Disaster Epidemiology Studies supports research, technical expertise and information on all types of ES, and in particular in the field of health and epidemiology, since assessing and controlling the state of human health after the ES or disaster can identify the most common types of disaster consequences, including life loss and fasting cases, and assess the severity of the accident.

The economic losses incurred by accidents caused by natural disasters between 1980 and 2015 are summarised on the graph in Figure 4, which shows the total global economic losses. The graph highlights the most wide-scale and serious accidents over the years and identifies the country where they occurred. The yellow mark shows the amount of losses in a single major economic accident in a given year. The latest aggregated data in the *EM-DAT* database are summarised in 2016, but each year it is possible to follow data collected in the form of a review, such as 396 natural disasters occurred in 2019, more than 95 million people affected and losses totalling USD130 billion [31].

According to the UN data, floods and tsunami are the most frequent cause of accidents caused by natural disasters in the world in terms of the actual numbers and victims. The second most common cause is earthquakes, volcanic eruptions, and the third is technogenic disasters. The data presented in Figure 1.5 show that, although the level of technology safety has increased, the number of accidents has not decreased, but is relatively stable.

In about 67% of cases worldwide, the main causes of technogenic accidents registered in the *Major Accidents Reporting System* (*MARS*) are low safety levels in the industry and inefficient management of the ecological safety system [32]. The Centre for Disaster Epidemiology Studies divides technogenic disasters into three groups: manufacturing (chemical pollution, explosions, radiation pollution, collapses), transport (accidents in the air, sea, on railway tracks and elsewhere) and mixed types of disasters (occurring in other, unclassified sites).

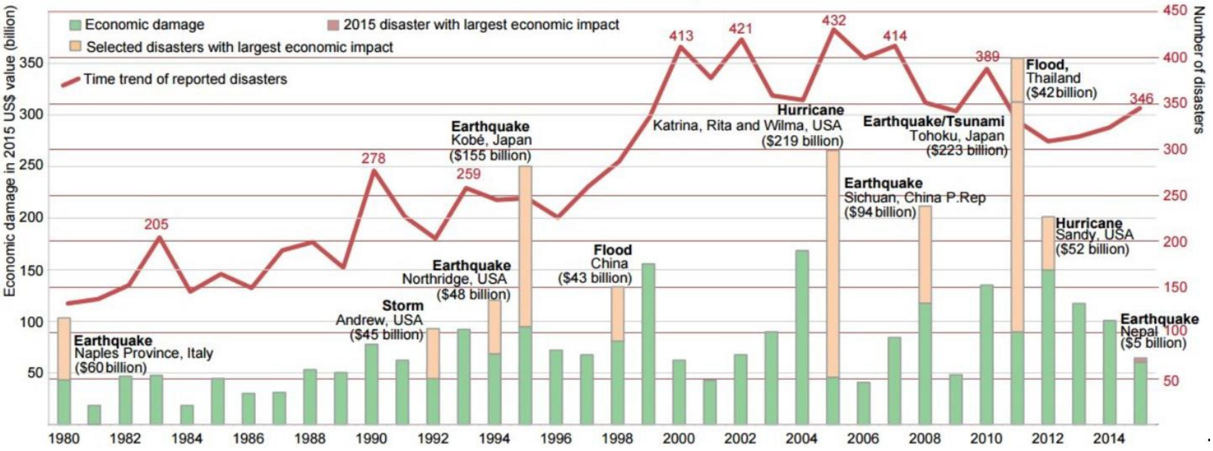

Fig. 4. **Annual events and reports on economic damage caused by disasters between 1980 and 2015 [33]**

At least one of the following criteria needs to be met for the inclusion of the technogenic accident and its consequences in the international database: the amount of damage being at least USD 80 million (USD 32.2 million in the event of an aviation disaster and USD 16 million in the event of other transport disasters), the number of people deceased or missing being at least 20, at least 50 people being injured, at least 2 000 people losing their dwelling. The total statistics for natural and technogenic disasters from 1970 to 2013 are shown in Figure 5, where the number of both types of disasters worldwide has tripled since 1970. The number of technogenic disasters increased dramatically in 2006, coupled with an increase in production volume prior to the global economic crisis.

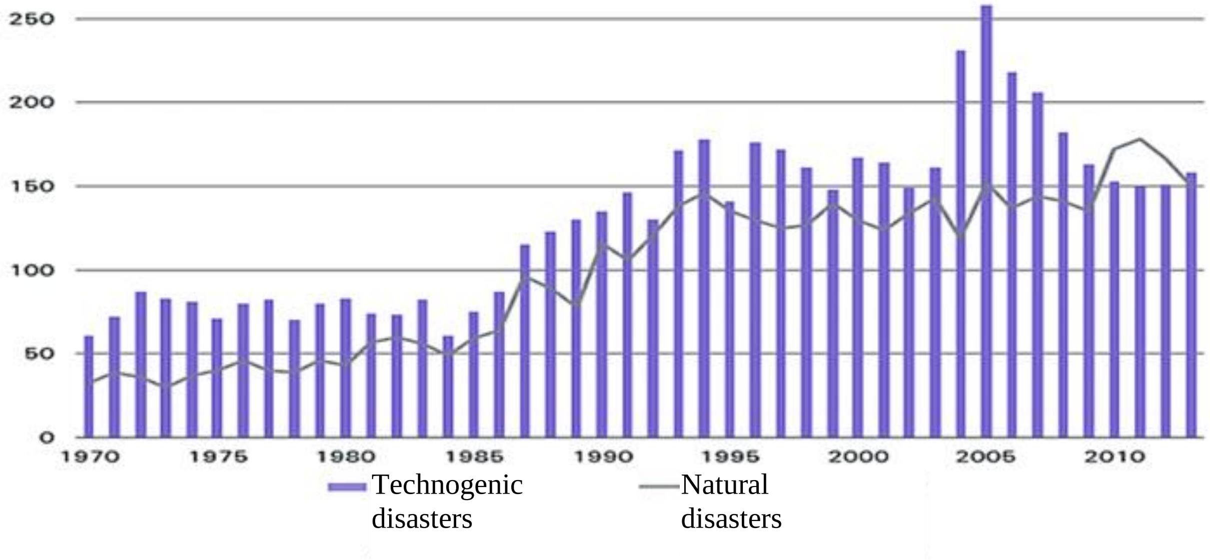

Fig. 5. **Number of natural and technogenic disasters worldwide [34]**

The number of accidents and technogenic disasters caused by natural disasters has increased in the era of industrial development and has largely happened as a result of the acquisition of new, hitherto uninhabited and non-residential sites, such as flood areas or sites in seismic active zones. There are often EHO built in these areas, such as the Fukushima Daiichi NPP, where the earthquake resulted in a tsunami wave that washed down and rendered the essential infrastructure of this power plant inoperable, and the domino effect caused the technogenic disaster. A fire in which raw materials, intermediate products, finished products, manufacturing waste or technological units burn, is regarded as a major fire at a chemically hazardous site. One such fire occurred on 1 June 1974 in Flixborough, England, where 60 000 m^2 of chemicals burned.

Conclusions

1. Technogenic disasters have also been identified to depend on natural factors, such as ecosystem processes, which are affected by an increase in the number of natural casualties, which poses an additional external risk to technogenic sites. In the event of an accident caused by a natural disaster on such sites, the situation may deteriorate, and the extent of the damage may be increased. Most technogenic accidents are caused or occur due to human error as a result of malfunctioning, organisation failures or technical damage of equipment.
2. In order to implement the management of the technogenic environment, the public must understand the extent and consequences of potential losses, identify their current knowledge of the technogenic system and take reasonable protective measures to improve the environment and reduce the consequences. Thus, planning documents based on the a priori assessment of potential losses are a topical issue.
3. The technogenic environment of the 21st century is closely linked to human life and directly influences its quality. The public and man can hardly exist without the effects of manufacturing, a number of approaches have been developed to assess losses from EHO accidents. The use of the hazard assessment procedure is capable of responding to potential external and internal hazards, providing information on potential consequences. When EHO changes, the algorithms for the hazard assessment system are adapted and the risk management process should be regularly adapted to the EHO changes. This highlights the need for a new approach to risk assessment related to the identification of real material losses.
4. With the development of the technogenic environment, the number of ES cases has not decreased and the negative effects are only increasing, despite developments in security systems and the overall world development.
5. In Riga, the threat of the technoenvironment has been found to be more severe than in the rest of the country, due to a large concentration of EHO in one region.

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