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# TECHNICAL SCIENCE

## Occupational safety

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## ANALYSIS OF THE DYNAMICS OF SPREADING HAZARDS IN THE SOCIETY EVOLUTION

Despite the gradual transition of the world's leading countries to the sustainable development model, which was announced at the United Nations Conference on Environment and Development in Rio de Janeiro (1992) and developed at the UN World Summit on Sustainable Development in Johannesburg, the tendencies to the spread of hazards dynamics on the global scale in the last years of the 21$^{st}$ century, not only survived, but also increased. Since the second half of the 20$^{th}$ century, there has been a steady increase in the number of natural and industrial disasters caused by increasing population density and increased number of hazardous facilities which use radiation, chemical, biological, fire and explosion and other hazardous substances in their technological processes. From the 60s of the 20$^{th}$ century to the beginning of the 21$^{st}$ century, the number of accidents at such facilities and the number of deaths in them increased by almost 62 and 10 times, respectively. The financial losses from natural and industrial disasters also grew no less dynamically. If from 1950 to 1975 the losses from them did not exceed 10-20 billion dollars per year, then since the second half of the 70s of the 20$^{th}$ century they were constantly increasing and by the period from 1995 to 2005 they reached the level of 200 billion dollars per year. Analysis of dependencies indicates the steady development of the tendencies that have been formed lately. Between 2014 and 2017, the total number of disasters has increased almost threefold, from 335 to 952 units, the total financial losses amounted to about 629 billion US dollars, and the death toll in them reached more than 600 thousand people. In general, over the past fifty years, the number of reports of natural and anthropogenic hazards has risen by an order of magnitude more, and the number of affected people has increased by 250 times. The industrial-technological revolution, which began at the end of the nineteenth century, has led to the global human intervention in all geographic environments of the Earth, especially in the lithosphere, atmosphere, and biosphere. For example, human geological activities have already exceeded the volumes of natural geological processes. Nowadays, during the construction and extraction of minerals,

people move more than 100 billion tons of rocks over a year, which is approximately 4 times the mass of the material, which is carried by all the world's rivers during erosion. Anthropogenic human impact on the lithosphere leads to large-scale changes in the natural environment, it causes the occurrence of new (techno-natural) processes and phenomena, among which the largest hazard is posed by the induced seismic activity, land subsidence, underflooding and others. Technogenic impacts can accelerate the stress accumulation in the Earth crust which increase the frequency of earthquakes. Anthropogenic impact on the environment conduces to climate changes, causing a concentration increase in the atmosphere of greenhouse gases, aerosols (small particles) and clouded sky. Since the beginning of the industrial era, the general effect of human activity is the global warming – about 1-1.5 degrees, which significantly exceeds by its dynamics the impact on the environment of natural phenomena such as changes on the Sun and volcanic eruptions. This process is particularly intensive in the last 20-25 years. In the process of natural resource use humanity annually moves more than 4 trillion tones of substances on our planet, creates thousands of new chemical compounds, most of which are not included in the cycle of substances and eventually accumulates in the biosphere, causing its pollution. The modern technically oversaturated world is in a state of unstable equilibrium when even a small false action can cause a huge on its scale and consequences industrial or natural disaster. UN data shows that anthropogenic hazards (disasters) rank third among all types of disasters by the number of deaths. Rank first is hydro-meteorological disasters (floods and tsunamis), geological disasters rank second (earthquakes, volcanic eruptions, etc.). The share of the total financial loss from the consequences of industrial disasters, according to some studies, amounts from 20 to 40%, and from natural disasters from 60 to 80%. However, these data require, in our opinion, some refinements towards the anthropogenic component increase, since a very large number of hazards that are classified as natural ones may arise as a result of anthropogenic activity (the destruction of traditional ecosystems – floods, hurricanes, landslides, earthquakes) and vice versa (earthquake, tsunami – accident at the Fukushima NPP - 1). Industrial and to a certain extent natural disasters are based on social reasons as technical systems are designed, manufactured and managed by humans to ensure the achievement of certain socially important goals. Energy, nuclear, infrastructural, transport, ecological, space accidents and disasters are ultimately caused inconsistencies complex systems elements interaction, the creation and operation of

which involves both people and elements of their technologies. Thus, there is the inevitability of building the risk society by humanity in the very structure of modern civilization.

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