

Natural-technological disasters of recent years in Japan and Russia: social and economic consequences

PETROVA, Elena^{1*}

¹Lomonosov Moscow State University

During the last decade, natural hazards impacts on people, the environment, urban and industrial areas, infrastructure and other technological systems were increasing, causing large social, environmental and economic damages in many countries. The number and severity of natural-technological accidents and disasters were also increasing all over the world, because of these impacts. The term "natural-technological" applies to an accident (disaster) in the technosphere (including industrial plants, power stations, transport, infrastructure facilities, communication lines, etc.) triggered by any natural process or phenomenon. Their growth is accounted for: 1) by observed increasing in frequency and intensity of various natural hazardous events; 2) by much more complicated structure and complexity of modern technological systems and facilities exposed to natural hazards, and 3) by increasing advancement of economic activities and population into the regions at natural risk. The most severe consequences for people and the environment have the so-called Natech-accidents, which are accompanying by release of dangerous substances (like chemicals or oil), and accidents at nuclear power stations.

One of the most large-scaled natural-technological disasters having enormous social, environmental and economic consequences occurred on March 11, 2011 in Japan due to a massive 9.0-magnitude earthquake off the northeast coast of Honshu Island, which triggered a more than 30-meter tsunami. The disaster not only caused a large direct and indirect damage to the people (about 20 thousand fatalities) and economy of the country (more than \$500 billion), but also influenced on regional, national and international development reaching a truly global scale. It clearly demonstrated high vulnerability of a human society and modern technosphere to natural disasters; even in a country like Japan that is highly developed and well-prepared to natural risks. A distinctive feature of events, such as of the 2011 Tohoku earthquake, is their multihazard and synergistic nature, as a disaster spawns a secondary disaster that increases the impact on people and technosphere, resulting in simultaneous occurrences of numerous technospherical accidents. The secondary effects of natural-technological accidents can be even much more serious, such as at "Fukushima-1" nuclear power plant. These impacts are the more severe the higher are the population density and concentration of industrial facilities and infrastructure (especially hazardous and vulnerable objects) in disaster-affected areas. In addition, all rapid reaction forces and resources tend to be primarily fighting natural disaster; it limits the capability to eliminate secondary technological impacts, especially in those situations when transport facilities and required infrastructure are destroyed, and economic communications are broken.

The lessons of the Tohoku disaster should be taken into consideration while placing, constructing and operating nuclear power plants and other high-risk facilities. It is necessary to consider carefully possible intensity and frequency of all potential impacts, including natural hazards.

In Russia, natural-technological disasters with catastrophic consequences occur not so often. However, their possibility should be taken into account, especially in the economic development of areas at high natural risk, which is, for example, the Far Eastern region exposed to earthquakes, tsunamis, volcanic eruptions, floods, strong winds, storms, heavy rain- and snowfalls and other natural hazards. The most severe damages caused the Sakhalin earthquake in 1995, which was the most destructive in the Russian history. Severe social and economic consequences cause floods, for example, the flood in the autumn 2013. Natural-technological risk to the regions of Russia was evaluated using a database that was created by the author.

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