

The experts of the National Disaster Management Organisation actively participate in the elaboration of the "National Risk Assessment Report and Methodology". The goal of this work is to elaborate a method suitable for the analysis of a broad range of events related to significant risks for Hungary, both in terms of probabilities and consequences. An important output of the analysis is the risk chart with the scenarios posing significant risks, broken down according to their relative probability and the severity of their consequences. In the present article the authors report on the results of their professional scientific activities carried out in connection with hazardous establishments. Keywords: industrial safety, industrial accidents, dangerous substances, hazardous activities, vulnerability.

Preface

The experts of the National Disaster Management Organisation actively participate in the elaboration of the document "National Risk Assessment Report and Methodology" (hereinafter: Report). [1] The goal of the workgroup, with the participation of more than 20 professional state organizations, is to elaborate a method suitable for the analysis of a broad range of events related to significant risks for Hungary, both in terms of probabilities and consequences.

On the basis of the guides of the European Union the planned method considers the aspects of the adaptation to climate change, the effects of the individual scenarios on critical systems and installations and handles cross-connections and interdependencies that can be assumed between the scenarios through the concept of individual/multiple risks.

An important output of the analysis is the risk chart with the scenarios posing significant risks, broken down according to their relative probability and the severity of their consequences.

In the present article the authors report on the results of their professional scientific activities carried out in connection with hazardous establishments.

Identification of disaster events

Regarding hazardous establishments, in the present phase of the analysis disaster events with the most severe consequences for major geographic areas of the country, for the people living there, for the economy and natural treasures have been identified. It was a fundamental goal that in line with the Seveso guideline one scenario shall be selected in connection with toxic, explosive and flammable hazardous substances and with hazardous substances causing environmental damage.

The most severe scenarios are selected on the basis of the exposure to dangers as presented in the safety documentation of the individual hazardous establishments, using a scientific approach, by the implementation of the so-called „modified Preliminary Hazard Assessment” (hereinafter: modified PHA). [2]

The aspects of the modified PHA have been selected to be suitable for the screening of the risks occurring in various fields, in accordance with the special aspects listed above and specified by the EU. In the course of the modified PHA the experts of the national disaster management authority have analyzed which of the several thousands of major accident scenarios that can be assumed in the territory of the 700 hazardous establishments in Hungary are probable to occur within 5 or 20-25 years, respectively and which scenarios are affected by the climate change. In the course of the screening a further aspect was that the scenario shall affect critical systems and installations and that the management of the situation and the coordination of damage control tasks shall require government intervention. In addition, the analysis has also checked if the assumed scenario affects our social values, like human health/life, the environment/nature, finances/economy, social stability, governing ability and the territorial manageability of the country.

As a result of the modified PHA the damage event of a container storing 146 tons of liquefied chlorine gas was selected. As a consequence of the damage the toxic gas cloud could endanger some 7,800 people. The damage to a container resulting in the release of 300 tons of acrylonitrile was also selected, which can cause major environmental damage in the vicinity of the Danube River and – because of the toxicity of the substance – can endanger the health of those staying in the surrounding residential and industrial area. Furthermore, the catastrophic damage of a propane/propylene distillation column was also selected, which might trigger air shock waves and heat effects destroying not only the plant but also the surrounding industrial areas, causing economic and human damage. [1]

Evaluation of the effects of climate change

In the course of the preparation of the report the consideration of the effects of climate change was one of the priorities. The effects of climate change, such as heat waves, floods, landslides, cavities can damage industrial installations (including establishments involving hazardous substances, nuclear installations) and equipment storing, processing hazardous substances, thus increasing the probability of major accidents, and the exposure of those living in the surroundings of hazardous installations to hazards. [3]

Due to climate change the weather conditions influence the propagation of hazardous substances potentially released and thus can change the size and location of the area endangered by the harmful effects. On the basis of the climate adaptation strategy of the EU (Brussels, April 16, 2013) the experts of the national disaster management authority determined the effects of climate change that can affect the industry. The most significant effects that might increase the chances of the occurrence and/or consequences of a potential major accident are the following:

Extreme temperature, heat waves. In the summer of 2012 the operators of hazardous establishments announced 11 incidents involving hazardous substances. A part of the incidents could be traced back to technical-technological reasons resulting from extreme environmental parameters (e.g. high temperature).

The disaster management authority received notifications of 14 incidents and further events in the winter of 2012. Technological equipment fail is typically in the period between January and February, most of such failures can be traced back to extreme weather conditions, to the low outdoor temperature. The increased stress of the technological elements resulting from the outdoor temperature and the reduction of the number of periodic maintenance mainly due to financial reasons highly increase the probability of the occurrence of major accidents.

With regard to the consequences, extremely low temperature together with stable atmospheric conditions are an extremely unfavorable condition for human health in the event of the propagation of toxic gases. Gas propagates slowly under such weather conditions and is able to stay in the vicinity of the ground for a long time, thus significantly increasing the risks humans are exposed to.

Flood. As it can be seen in the figure below, there are 121 hazardous establishments operating in Hungary in areas endangered by floods. Sites need increased monitoring; before flood waves actions shall be taken to remove the hazardous substances, wastes and the containers used for their storage, and to transfer them to a safe place, as the water can lift up, sweep away containers and hazardous wastes, thus seriously jeopardizing environmental safety.

Landslide, cavities. There are some 10 such hazardous establishments in Hungary located on young, sedimentary soil creating increased risk of landslide. In addition, mines

under hazardous establishments can also pose a long-term problem due to the collapse of mine cavities. Such data are not all-comprehensive at the present, further analysis is necessary.

Lack of surface waters. In Hungary there are several hazardous industrial establishments in need of high amounts of water (e.g. for technological processes, cooling, fire-fighting). Due to the engineering reserves their water abstraction structures are able to supply the water quantity needed for normal operation at present; however, in the long run bridging and managing intervals of temporary surface water shortage is a strategic challenge.

In the territory of the plants there are water reserves which are sufficient for simultaneous firefighting and for the safe shutdown of the technologies available. However, in consideration of the fact that these installations supply feedstock (petrochemical products, industrial gases) to other players of the industry in Hungary and they play a special role in the supply of the public (production of disinfectants, medicine, medical gases) and that the loss of their function could cause serious disturbances in the supply chain, it is justified to create the conditions needed for the function of the plants even in case of permanent water shortage. [1]

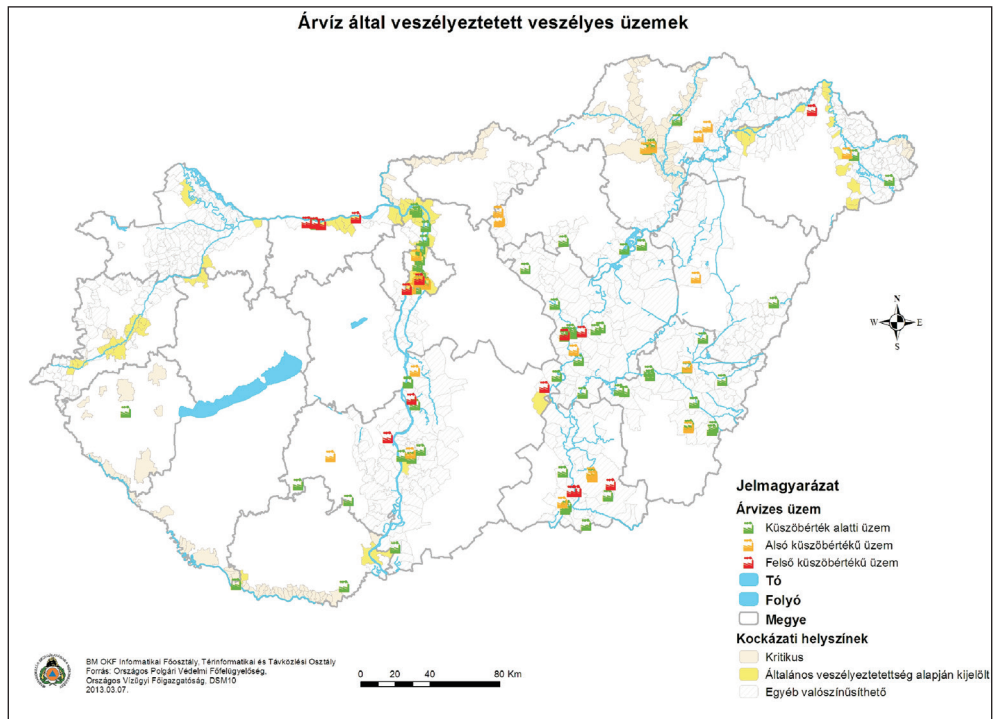


Table No. 1. Hazardous establishments endangered by flood (Source: Hungarian Disaster Management Authority)

Checking the vulnerability of the elements of critical infrastructure

In the course of the preparation of the Reports the experts of the national disaster management authority evaluate to what extent the major accident scenarios selected (on local, regional or national level) can interfere with the operation of the critical infrastructure sectors listed in the legal regulations of Hungary. It can be stated that the consequences of events assumed in the territory of hazardous establishments can, due to the release of toxic substances, impair the quality of surface and subsurface waters and contaminate arable land.

Through the expectedly high number of injuries and fatalities they can overload the healthcare system and can interfere with the road, rail and water transportation system during the emergency response. The loss of the function of hazardous installations can lead to the shutdown of other plants due to reasons listed above. [4]

Emergency response tasks to handle the consequences of major accidents

In the course of the preparation of the Report it is an important aspect that the mitigation of the consequences of the major accident scenarios selected requires the intervention of the government. The tasks related to the mitigation of the consequences of major accidents selected for analysis have been defined in the external and internal emergency plan and in the water emergency response plans.

After the activation of the plans, the staff of the operator, the local and regional organizations of the disaster management authority, jointly with the other state organizations concerned and with the mayors of the settlements endangered carry out the damage mitigation activities, under the management of the central organization of the disaster management authority.

In case of the occurrence of the major accidents selected, the intervention of the government is a precondition to efficient damage control, as it is absolutely necessary for the mobilization of other state organizations (police, ambulance service, military and water experts) and for the harmonization of their activities.

The disaster management authority and its experts specializing in training and in industrial safety explain in detail these legal requirements in their leading scientific works. [5] [6]

Conclusions

In the next stage of the preparation of the Report the detailed analysis of effects and probabilities will be completed (and expressed in figures) and the cross-connections and interdependencies between the scenarios selected as the result of the modified PHA will be mapped. The necessary preparations (definition of the criteria of the effects, setting up probability classes) for these working processes have already been completed.

In the course of the work, the experts of the Hungarian Disaster Management Authority have seen a high number of fields and as a result of further research and the development of these fields, the efficiency of the prevention of major accidents can be improved. E.g. the renewal of the risk analyses is underway at present, the review of models used for the avoidance of hazardous substances and for the analysis of their propagation with regard to the effects is changing, as described above. The long-term objective is to further improve public safety by reducing the risks resulting from climate change as much as possible.

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Veszélyes tevékenységek nemzeti kockázatai

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A magyar katasztrófavédelmi szakemberek aktívan részt vesznek a Nemzeti Kockázat-értékelési Jelentés és Módszertan című dokumentum kidolgozásában. A munka célja olyan módszer kidolgozása, amely alkalmas az ország szempontjából jelentős kockázattal bíró események széles spektrumának elemzésére mind a valószínűségek, mind a következmények tekintetében. Az elemzés egyik fontos végkimenete a kockázati diagram, amely a figyelembe vett jelentős kockázatú eseménysorokat mutatja azok relatív valószínűsége és a következményeik súlyossága szerint. Jelen cikkben a szerzők beszámolnak a nemzeti jelentés elkészítése során a veszélyes üzemekkel kapcsolatosan végzett szakmai tudományos tevékenységük eredményeiről.

Kulcsszavak: iparbiztonság, ipari balesetek, veszélyes anyagok, veszélyes tevékenységek, veszélyeztetettség