

RISK MANAGEMENT IN POPULATION PROTECTION

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Abstract

The Hungarian legal regulation on disaster management getting into force on 1-st of January 2012. covers among other the implementation of the population protection tasks. This authors of this article will introduce the disaster management classification system used for the purposes of emergency management planning. This study will evaluate the special features of the industrial risk management, which consist the assessment of the vulnerability of dangerous establishment and the related emergency planning measures introduced after the appearance of major accidents.

Key words

Legal regulation, disaster management, population protection, risk management, emergency planning.

Introduction

The Hungarian Parliament adopted on September 19, 2011 the *act 2011/CXXVIII. on disaster management and on the amendment of individual, related acts* [1] (hereinafter: disaster management act) which meant a professional paradigm shift with regard to several fields in disaster management.

The renewed requirements related to the protection of the population are stipulated in the *government regulation 2011 CXXVIII. on disaster management and on the amendment of individual, related acts, no. 234/2011 (XI. 10.)* [2] (hereinafter: gov. regulation) and the *government regulation about the protection against major accidents involving hazardous substances, no. 219/2011 (X. 20.)* [3]) hereinafter: major accident regulation) covers the provisions regarding industrial safety at hazardous establishments.

The foundation of the rules of the disaster management classification of settlements and at the same time also the criteria related to the protection of the public have been completely renewed by the disaster management act and its implementing regulations. In the sense of the renewed regulation the risk ranking of the individual settlements is based on the assessment of the typical local dangerous effects. The assignment to a disaster management class shall be complemented with risk assessment in accordance with the definitions applied in the gov. regulation.

The emergency management planning system is based on risk assessment performed during the classification of settlements. The special risk assessment procedures and methods are applied in order to evaluate the industrial vulnerability of civilian sources of danger.

In the present article the author shortly presents the primary results of the research related to disaster management classification of settlements and emergency management planning.

Risk based classification of settlements

In Hungary the technical requirements of the risk-based disaster management were worded for the first time in the gov. regulation, which has changed the fundamentals of the civil

protection classification of settlements. In the sense of the so-called disaster management classification all settlements located in the territory of the country shall be assigned to disaster management classes on the basis of the requirements stipulated in the legal regulation and on the basis of the results of the risk assessment carried out with regard to the settlement concerned as follows:

Settlements that are directly endangered within a radius of 3 km from the nuclear power plant and within a radius of 1 km from the research reactor, or settlements that are at risk because of establishments involving hazardous substances and that are obliged to prepare and external emergency plan or settlements assigned to group I. on the basis of the risk assessment or where this is justified by the impact the dangerous effects exert on each other or by their joint effects shall be assigned to class I.

Settlements that are directly endangered by the nuclear power plant (within a radius of 3-30 km) or settlements that are at risk because of establishments involving hazardous substances but are not obliged to prepare and external emergency plan or settlements assigned to group II. on the basis of the risk assessment shall be assigned to class II.

Settlements that are at risk in case of the release of hazardous substances by an establishment not covered by the disaster management act or that were assigned to class III. based on the risk assessment, shall be assigned to class III.

The technical parameters of the former civil protection classification and those of the present disaster management classification correspond only partially to each other. According to the present regulations, mainly due to the risk assessment procedure, the risks jeopardizing the settlements are assessed on the basis of more detailed criteria.

As a result of this by 2013 all settlements have been assigned. 157 settlements were assigned to class I, 1327 settlements to class II and 1692 settlements to class III. [4]

Risk assessment means, based on the definitions set forth in the regulation, the comprehensive process of the identification, analysis, and assessment of risk.

In the course of the risk identification the potential risks in the area concerned and their effects have to be defined. The procedure includes also the identification of danger sources as well. In the course of the procedure also the statistical data of the area examined, historical data, empirical facts and the results of the available risk analyses carried out earlier shall be considered. Dangerous effects to be considered in the course of the identification of risks are assigned to four groups in the regulation, Annex 2: adverse climatic events, dangers of natural origin, industrial accidents, dangers of civilization origin, dangers of other origin, risks related to critical infrastructure.

The identified risks related to the area concerned shall be grouped and assessed and then based on the results of the risk assessment the risk level of the dangerous effect concerned on the settlement concerned shall be defined. [2, 1.§]

The final result of the risk assessment, i.e. the definition of the risk level of a settlement is possible based on a risk matrix. The risk matrix is a two-dimensional chart, where the vertical axis represents the consequence of the dangerous effect and the horizontal axis the probability of the occurrence (frequency) of the dangerous effect and on the basis of the result of the chart the extent of the risk a certain dangerous effect poses to the settlement concerned can be established. [2, 1.§]

In the gov. regulation, Annex 2. the frequency of the occurrence of the dangerous effects is defined according to the following aspects:

- „rare: the occurrence is not probable during the next few years (10 years),
- not frequent: it can occur, but the occurrence within a few (5) years is not probable,
- frequent: it is probable to occur within a few (3) years,

- *highly probable: the occurrence is highly probable, within one year at least once or several times*". [Annex 2, 2.]

*Table 1
Risk matrix*

Impact	Frequency of occurrence			
	Rare	Not frequent	Frequent	Very common
Very serious	class II.	class II.	class I.	class I.
Serious	Class III.	class II.	class II.	class I.
Not serious	Class III.	Class III.	class II.	class II.
Low value	Class III.	Class III.	Class III.	Class III.

Prepared by: author source: [Annex 2, 2.]

According to the regulations dangerous effects are practically natural and civilization-related danger sources (inland inundation, flood, earthquake etc.).

*Table 2
Dangerous effects*

Dangerous effects			
Adverse climatic events, dangers of natural origin	Industrial accident, dangers of civilization origin	Dangers of other origin	Risks related to critical infrastructure
a) flood b) inland inundation c) extraordinary weather conditions d) geological danger sources: da) earthquake db) landslide dc) collapse de) soil subsidence df) collapse of the river wall	a) establishment subject to the disaster man. act chapter IV. b) dangerous effect due to other installations (agricultural, industrial), the risk of the release of hazardous substance c) distance from a nuclear installation: ca) from nuclear power plant cb) from a research reactor d) traffic routes and nodes: da) transportation of dangerous goods db) significant traffic e) installations, establishments not subject to the disaster management act, chapter IV. operated for military use, involving hazardous substances	a) the vulnerability of surface and subsurface water sources (first of all drinking water sources) b) human epidemic or the danger of epidemic and animal epidemic c) vulnerability due to air pollution reaching the alarm threshold	a) the vulnerability of infrastructures used to satisfy the basic needs of the population b) vulnerability of transportation c) the vulnerability of infrastructure indirectly covering the needs of public administration and of the public

Prepared by: author, source: [Annex 2, 2.]

The frequency values (10 years, 5 years, 3 years, 1 year) belonging to the commands characterizing the frequency of the occurrence of events (rare, not frequent, frequent, highly frequent) are uniformly applied to all types of danger sources in the regulations. With regard to the danger source types (effects) there are no significant (reference) scenario types defined.

The potential consequences of the individual effects are assigned to four groups in the gov. regulation, Annex 2 according to the following rules:

- *“very serious: event causing fatalities or irreversible environmental damage, or major economic damage,*
- *“serious: event causing serious injuries or reversible environmental damage or also economic damage,*
- *“not serious: event causing minor injuries, not causing environmental damage or causing minor economic damage,*
- *minor: no injuries needing medical help or not resulting in economic consequences.”* [Annex 2, 2]

The legal rules stipulate the consequences of the potential effects qualitatively first of all by describing the events harming human health and life, the environment and assets. In the gov. regulation no objective, quantity-based values are assigned to the qualitative definitions like “serious injury”, “less severe injury”, “harm to the environment”. In my opinion this could have potentially caused difficulties in the process of the application of the law. For the uniform application of the law we did not find in this case either a guidance helping the fulfillment of obligations and interpreting the legal or technical rules.

According to the provisions of the regulation in the practice the disaster-specific scenarios (that occurred according to the statistical data) expected in the individual settlements shall be ranked by using a risk matrix on the basis of the frequency of occurrence and of the severity of consequences. There is no law application guidance available as to the procedure and methodology of the implementation of the identification of hazards, furthermore there was no relevant detailed information in scientific literature either.

Emergency management planning

In the settlements the mayor shall, involving the local organization of the official disaster management organization, prepare the emergency management plan of the settlement, taking also the criteria of the sufficient protection level detailed in the gov. regulation, Annex 2. into consideration. The emergency management aspects with regard to the alarming, public protection method, preparation, defense, and initial disaster management set are included in the legal rule.

The mayor shall prepare and publish an information brochure for the public about the content of the emergency management plan. The goal of the information brochure for the public is to make the public familiar with the potential danger sources and with the behavior patterns to be followed in case of potential emergencies. The settlement emergency management plan shall be drilled every three years.

The rules of the emergency management planning are in accordance with the legal institutions serving the same purpose and with the rules of procedure stipulated in the major accident regulation. [5]

Risk assessment of industrial sources of hazard

The *risk analysis* of the industrial sources of hazards, like dangerous establishment must cover the following important elements:

- a detailed description of the internal and external prerequisites (causes) and probability of occurrence of possible major accident scenarios;
- evaluation of the seriousness and possible consequences of the identified major accident hazards;
- description of the technical prerequisites and the applied equipment that are necessary for safe operation of the dangerous establishments;
- the emergency responses for mitigation of consequences of major accidents.

The *internal emergency plan* of a dangerous establishment shall conform the following content requirements:

- description of availability of the means and equipment for mitigation of consequences of major accidents;
- information concerning determination of alarms and intervention measures;
- description of internal and external forces and equipment.

Identification of major accident scenarios creates connection between hazard identification and risk analysis in form of model accident scenarios. We can use the model major accident scenarios to assess compliance of emergency measures (barriers), and to create emergency plans and land-use plans.

The scenarios are usually based on supposition of incidents resulting in emission of dangerous substances. The major accident sequence in the safety report usually describes the way (technical nature) how dangerous substances are released; it can be a fracture of a tank, a pipeline, or leakage of a vessel containing dangerous substances. [5]

It also specifies the effect of the caused incident such as fire, explosion and release of dangerous substances (emission to the environment).

The so called *bow-tie diagram* is a generally used method to demonstrate the major accident sequences and their root causes. The types of *sequences resulting in release of dangerous substances* are the following: pool fire; flash fire; tank fire; jet flame; VCE (explosion of evaporating steam gas cloud); propagation of a toxic cloud; BLEVE (expanding vapor explosion of a boiling liquid); pollution of soil, air and water. [5]

The incidents usually occur at process equipment, storing equipment, pipelines, loading and unloading installations, or during transportation of dangerous substances within the establishment.

Modelling the consequences of a major accident requires input data such as physical and chemical properties of dangerous substances (flammability, toxicity etc.), emission potential (heat radiation, overpressure) releasing properties (quantity, state of aggregation etc.) and weather conditions. The results of this model calculation is specified in terms of seriousness of the (potential) effect. Potential effect is usually expressed in terms of risk to health in the safety reports, although relative damages to property or environment can also be specified.

Emergency planning of dangerous establishments

The operator of dangerous establishment must ensure the conditions of execution of the tasks specified by the internal safety plan. The internal safety plan in an attachment of the safety report of analysis; it is written at the same time as these. Review of the internal emergency plan shall be performed minimum in every three years, and also in case of a priority review of the safety report or the safety analysis, and a protocol is required about this fact. The operator must

regularly inspect the feasibility of the stipulations specified by the plan. He performs a practice every year when they practice in a part of the organization covered by the plan (a plant practice), and every three years when they practice in all of the organizations covered by the plan. [3, 9 §]

The operator details the emergency tasks in the plan by a thorough analysis, and then he determines the prerequisites of execution, the persons, forces and means.

The internal emergency plans include the followings in the order specified by Béla Szakál and his co-authors.

- The forces (manpower) participating in the defence: the management forces, the responsible manager and management of the damage control measures, the emergency organizations (plant fire brigade, technical rescue, chemical survey, relief, first aid team, etc.) and the workers performing their emergency tasks.
- Means of defence: personal protective equipment, fire extinguisher and technical rescue means, the special devices such as chemical detector, relief material, explosion limit detector, communication devices, alarm and announcement sets, first-aid kit etc.
- Defence infrastructure: fire alarm and monitoring systems, automatic and semi-automatic extinguisher systems, foam extinguisher system, fire water system, alarm system etc. [6]

The plan always consists of the basic plan, and the attachments that contain the requirements about execution of the emergency tasks and other necessary activities.

A part of the plan is description of the activities of controlling major accidents and mitigation of their effects, that consists of the following elements:

- the tasks of defence against the situations, impacts as a result of a major accident, the organizations, forces and means used for the defence;
- the infrastructure, equipment and materials that can be used in the defence of major accidents involving dangerous substances;
- the measures taken for protection of the employees of the establishment, including their alarming, and the behaviour rules after receiving such alarms.

The plan contains a list of those major accident events when we intend to apply the forces, means and infrastructure of the establishment.

The following important element is understanding the emergency management whose main parts are:

- emergency management organization; the names, positions and contact data of people initiating emergency activities, controlling defence, having tasks and responsibilities;
- the names, positions and contact data of people who maintain connection with external organizations, and who work in the operation with the external emergency plan, the emergency response alarm and data supply;
- the necessary technical infrastructure for management and evaluation of the situation and to prepare decisions.

The plan must specify the alarm tasks in work time and after that, the way of the alarm, their required tasks until the arrival, and the means and infrastructure that can be used for the alarms and management tasks.

The description of the tasks in relation to the external emergency plan consists of the following parts:

- the way of alarming the organization who is responsible for initiation of the external emergency plan; the required information in case of an alarm;
- contents of the detailed information after occurrence of the situation, and the way of its communication;
- possibilities of assistance to eliminate the emergency in the vicinity of the dangerous establishment, and its conditions.

In the followings, I summarize the requirements of training of the persons involved in the defence activities (practicing of the plan). The tasks mentioned in the plan were determined

based on each major accident sequence and their possible consequences (effects) that were revealed during the risk analysis. The operator has every prerequisite for execution of the assigned tasks, that is

- enough, and adequately trained and skilled emergency organization,
- emergency equipment in adequate quantity, quality and technical condition,
- emergency infrastructure in adequate quantity and technical condition.

The organization is qualified as adequate for management of emergency tasks if it has a correctly selected management point and the technical infrastructure for management (communication, preparation of decisions, documentation, etc.).

The executing organization is applicable to perform his tasks if:

- forces are available in adequate volume based on the force-equipment calculations, and they are capable to perform their assigned tasks according to the plan,
- they have individual protective equipment, special devices, communication means, materials, and these are accessible for operative application,
- the assigned emergency management tasks can be performed in acceptable time,
- their training and practices have been performed according to the regulations.

The internal emergency plan practice is evaluated as successful if:

- they took in account that performing a part level or complex establishment level practice is due in the actual year,
- they have an adequate plan to conduct the practice that declares the purpose of the practice correctly, and execution of the tasks are practiced according to the purposes,
- their specialist tasks are performed on an adequately professional level during execution of the practices. [6]

Summary

The foundation of the rules of the disaster management classification of settlements has been renewed by the disaster management act and its implementing regulations in line with the expectations of the European Union stipulated by law. The disaster management classification of settlements takes place on the basis of a new an advanced risk assessment meaning the comprehensive process of the identification, analysis, and assessment of risk.

The endangering effects to be considered in the course of the risk assessment have been identified, the frequency of the occurrence of endangering effects and the categories of the potential consequences have been defined, and the criteria for the evaluation of the results (risk matrix) have been developed. For the application of the risk analysis matrix the creation of an implementation guidance customized to the specific danger sources is necessary.

In the course of the risk assessment the adverse climatic events, dangers of natural origin, industrial accidents, civilization-related dangers, dangers of other origin (e.g. the vulnerability of surface and subsurface waters, human epidemic or the danger of epidemic, air pollution reaching the alarm threshold value) putting the settlement at risk and risks related to critical infrastructure shall be considered. The risk matrix is hard to apply to industrial accidents and civilization-related dangers.

The well-founded disaster management classification of settlements is extremely important as it is the basis of the emergency planning of the settlement.

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