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### **SAFETY OF HUNGARIAN DANGEROUS ESTABLISHMENTS – REVIEW OF THE INDUSTRIAL SAFETY’S AUTHORITY**

#### *Abstract*

*Storage, processing and use of dangerous substances which are present in industrial activities involve the risk of major accidents. Experiences of recent history show that accidents can result in catastrophic effects to the environment of the dangerous industrial establishment and citizens living there. Therefore, it is understandable that protection against major accidents represent one of the determinant elements in industrial safety, and is a complex activity, which includes the technical and managerial tasks of prevention, as well as the measures targeting the mitigation of the damaging effects of accidents and the protection of the population.*

*Az ipari tevékenységekben jelen lévő veszélyes anyagok tárolása, gyártása és használata magában hordozza a súlyos balesetek bekövetkezésének kockázatát. A közelmúlt eseményeinek tapasztalatai rámutatnak arra, hogy a balesetek katasztrofális hatással lehetnek a veszélyes tevékenység környezetére és az ott lakó állampolgárokra. Érthető tehát, hogy az iparbiztonság egyik meghatározó eleme a súlyos balesetek elleni védekezés, amely komplex tevékenység és magában foglalja a megelőzés műszaki és vezetési feladatait, a lehetséges baleseti események károsító hatásainak elhárítását, és a lakosságvédelmi intézkedések bevezetését.*

**Keywords:** *industrial safety, industrial accidents, dangerous substances, prevention, safe operation ~ iparbiztonság, ipari balesetek, veszélyes anyagok, megelőzés, biztonságos üzemeltetés*

## INTRODUCTION

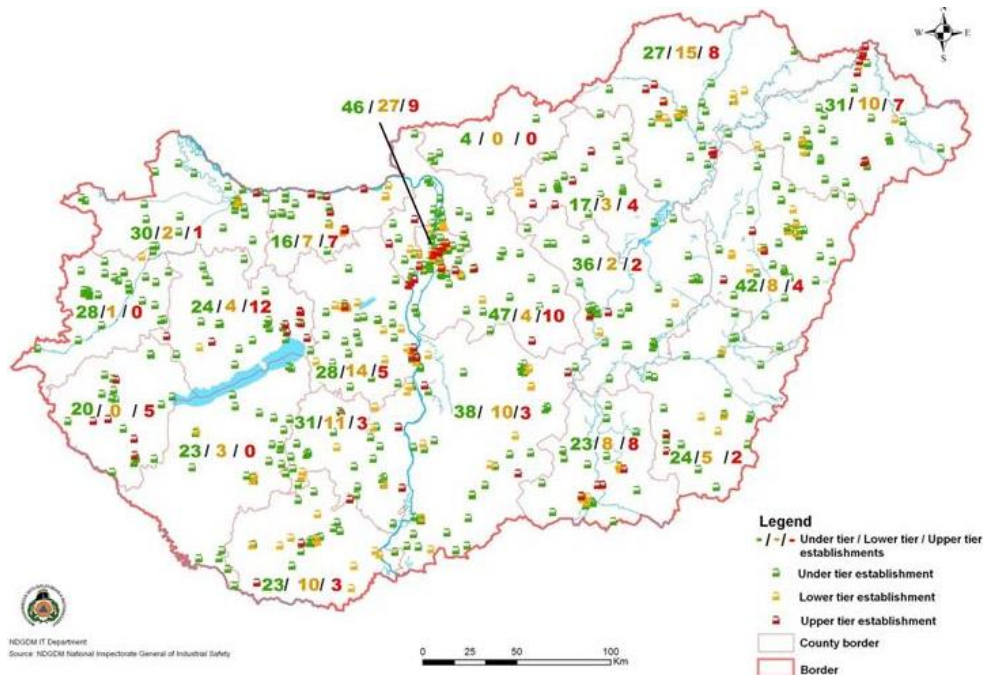
The protection against major accidents involving dangerous substances is based on Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances, that is, the Seveso II Directive. The national legislation was harmonized in 2006, according to this Directive, as amended in 2003; in 2007, the European Commission reviewed the compliance of the Hungarian legislation and deemed it to be EU-compliant. The Seveso II Directive was implemented in Hungary by Act CXXVIII of 2011 on disaster management and the amendments of related acts (hereinafter referred to as “the Disaster Protection Act”) and the Government Decree No. 219/2011 (as of October 20) on the protection against major accidents involving dangerous substances.

## DESCRIPTION OF HAZARD SOURCES INVOLVING DANGEROUS SUBSTANCES

### General information about the dangerous establishments.

The National Directorate General for Disaster Management (Ministry of Interior, NDGDM) established and in cooperation of the 20 regional directorates operates the Industrial Safety Information System which holds data (plant name, registered office, place of business address, status, management, contact information, author of the safety report, supervisor) on more than 730 dangerous plants. The system include data about license requests, safety analyses and safety reports, external emergency plans and other public information submitted by operators of dangerous plants. The system contain all the necessary information required for the implementation of inspection (checking), damage prevention and damage elimination tasks.

Location of the dangerous plants. Hungary has joined the so-called Seveso Plants Information Retrieval System (SPIRS) related to the registration and reporting obligation according to the provisions of the Seveso II Directive. Hungary provides data on the dangerous establishments in Hungary, their activity and location, to this system on an annual basis.



1. figure. Distribution of dangerous plants by counties  
(Source: NDGDM)

Classification of the dangerous plants according to their activity. According to their activity, plants subject to the Disaster Protection Act are divided into the categories specified following: gas industry (87); storage of fertilizers (56); oil industry (44); power- and heating plants (31); deposits and logistics centres (63); general chemical industry (51); manufacture of medicines (13); manufacture and storage of plant-health products (48); explosives and ammunition; pyrotechnics (15); plastics industry (35); dangerous waste (23); produce and consumption of biofuel (9), food industry (95), building industry (19), agriculture (90), heavy industry (35), waterworks, bath, swimming pool (28) and other dangerous plants (27). It appears that the plants in the gas industry and oil industry, as well as those in the domain of manufacture and storage fertilizers are in the largest number, but due to their size and technology the pharmaceutical companies and chemical plants are also important.

Collecting information about emergency incidents and major accidents. The NDGDM registers and analyses the emergency incidents involving dangerous substances and major accidents occurring in Hungary, and in accordance with the provisions of the Seveso II. Directive forwards report to the Major Accident Reporting System (MARS). [3]

### **Statistical description of data sets**

The NDGDM classifies the occurred dangerous events in two main categories in accordance with the legal provisions. The classification is the following:

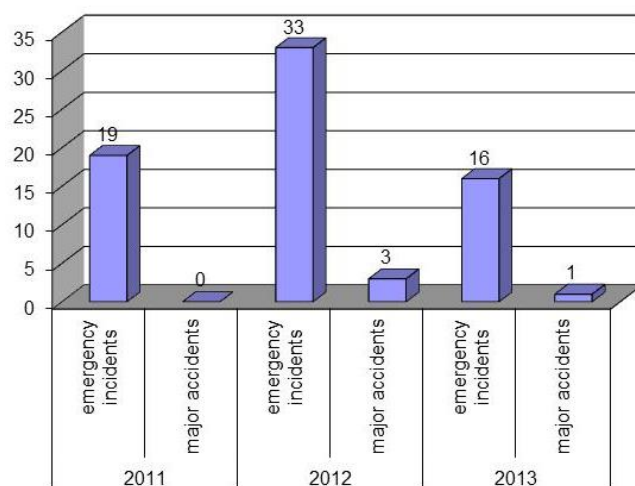
Emergency incident [1]: shall mean the occurrence of such an unforeseen event in the dangerous establishment, in the course of its routine operations or applied technological processes which requires immediate intervention, furthermore, incorporates the potential for the creation of a major accident involving dangerous substances, and has one of the following consequences:

- fire involving dangerous substances,
- explosion involving dangerous substances,
- emission of toxic, carcinogenic substances,
- emission of oxidising, flammable or eco-toxic fluid a quantity of at least 1000 kg,
- emission of other dangerous substances a quantity of at least 0,1% of the upper threshold,
- stop of a dangerous establishment.

Major accident involving dangerous substances [1]: shall mean an occurrence of such an emergency incident which involves the emission of dangerous substances in significant quantities, major fires, or explosions resulting from uncontrolled developments in the course of the operation of any dangerous establishment, and leading to major hazards or damages to human health or the environment, immediate or delayed, inside or outside the establishment.

Any major accident involving dangerous substances having at least one of the consequences described in the related annex dealing with the major accident reporting obligations of the Hungarian and Seveso regulation. [1]

The statistical overview of registered emergency incidents and major accidents illustrates the relevance of the risk area.



**2. figure.** Number of emergency incidents and major accidents in Hungary  
(Source: NDGDM)

4 major accidents occurred in 2012 and in 2013 in lower tier threshold establishments or in upper tier establishments, but not reached the level required to be reported to the European Commission.

## METHODS USED IN THE RISK EVALUATION

According to the national legislation in force, the responsibilities of the NDGDM and of the 20 regional directorates, established in the protection against major accidents involving dangerous substances, include the operation of the administrative authorization system and the supervision and control system for the plants subject to the Seveso II Directive and for under tier plants (establishments under lower-tier threshold is 25%).

Pursuant to its legal obligations, the 20 Directorate for Disaster Management are responsible for the administrative authorization of dangerous establishments of an upper tier of 97 and a lower tier of 128, and of 509 establishments under lower tier threshold (data as of September 05, 2013) in Hungary, as well as for the regular official controls to be conducted in every 1, 2 or 3 years.

### Requirements on the demonstration of safe operation.

The Disaster Protection Act requires the operators of dangerous establishments to demonstrate that their activities do not pose an unacceptable hazard to the population, material assets and the environment, and that they made every reasonable effort to prevent major accidents and reduce their effects. Depending on the dangerous impact, the operator can be required to provide data, prepare safety reports, safety analyses or serious damage prevention plan, and an internal protection plan for the site (as part of the safety report or safety analyses), ensure the conditions for carrying out the responsibilities specified in the internal protection plan, information of the population on the dangerous activities, potential hazards to the population and protection measures taken. [1]

The plants subject to the Disaster Protection Act shall assess the realistic possibility, probability, causes and conditions of major accidents on grounds in the documentation submitted to the authorities. These assessments shall describe the external or internal causes of accidents, and the probable stages of the course of accidents. The operator may use any method to identify the risks and assess the risk of major accidents that are used in the international practice and generally recognised by the professional community. The most widespread method used in Hungary is the quantitative risk assessment method. [1]

The operator – beyond the prompt information obligation - shall forward a preliminary report on the major accident involving dangerous substances occurred in the dangerous establishment in 24 hours after its occurring when the accident complies with at least one of the conditions above. The preliminary report shall include at least the place, date of the major accident, type, supposed reason, dangerous substances involved, immediate effects on man and the environment, and emergency measures taken. [2]

The operator in the event of reporting obligation above shall send a detailed report on the major-accident involving dangerous substances to the regional directorate within 15 days following its investigation. The operator shall send a complementary report to the authority if new fact or circumstance is revealed about the accident. The reporting obligation is independent from the participation of the regional or local bodies of the NDGDM in the response to a major accident. The operator informs the authority on the emergency incident occurred in the dangerous industrial establishment within fifteen days following its investigation. [3]

The regional directorate shall inspect if it necessary on-site the coverage of reality of the report, the circumstances of the emergency incident or major accident and requests further information from the operator. The regional directorate obliges the operator to eliminate the technical, management and control inadequacies revealed in the report by providing sufficient time frame and the operator shall inform in written the authority about the measures taken.

Necessary to carry out complex calculations involving the application of dispersion models in the performance of quantitative risk analysis. The spread of the different materials is strongly dependent on the weather situation and the material characteristics, but it is very difficult to calculate accurately known even under boundary conditions.

Since the amount of released material may not know ahead of time, hence the propagation models anticipate only very roughly the size of areas at risk from pollutants. The same is true of the dose-response models that describe the effects of various substances in man. Sensitivity to certain substances is highly dependent on the individual and very vaguely predictable concentration as well.

Different methods are used to estimate the likelihood of the accident scenarios. The method is used, when the frequency of occurrence is ordered from repository for standardized accident scenarios, which is based on experience. This method is simple, but - because of the accident sequence of events may differ significantly from our standardized study - can be a serious source of error. Other approach represents the estimating of the probability based on the accident scenarios analysis, that it uses methods such as event - tree and fault tree analysis. It is well established that the census of accidents based on frequency of occurrence allows a more complete risk assessment, as the qualitative methods. Critics of this approach state that uncertainties arise on the frequency of causal events. [3]

### **Prevention and preparedness requirements of safe operation**

Evaluation of the risk posed by dangerous establishments. An important step in the evaluation of the risk assessments submitted in the safety documentation is to compare the risk indices calculated on the basis of these assessments with the authorization criteria defined in the legislation. The most important authorization criteria are the value for individual risk and social risk:

Individual risk: this indicates the frequency of deaths (fatal event/year) of those present at a site as a result of a major accident involving dangerous substances. In terms of acceptability, the individual risk is usually taken into account when the persons present at the site are those who are permanently there.

Social risk: this indicates the frequency of deaths (fatal event/year) of a group present at a site (area) as a result of a major accident involving dangerous substances. The acceptable level of the social risk also depends on the number of persons involved in the accident. In terms of

acceptability, the social risk is usually taken into account when large masses of people are present at the site (such as workplaces or shopping centres).

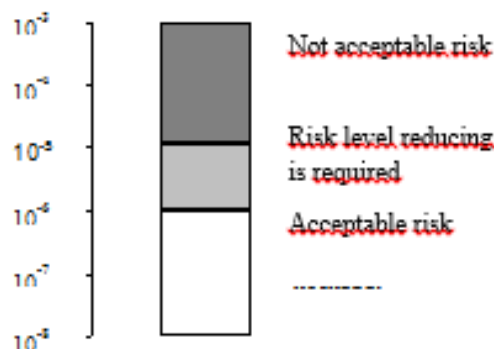
Acceptability of the individual risk. An acceptable level of risk exists if the residential area is in a zone where the individual risk of death as a result of a major accident does not exceed  $10^{-6}$  event/year.

It does not indicate an acceptable level of risk if the individual risk of death in a residential area is between  $10^{-6}$  event/year and  $10^{-5}$  event/year. In this case, the regional directorate shall require the operator to take measures to reduce the risk associated with its activity or to ensure the conditions for safety measures (such as alarm, personal protection and isolation) to reduce the risk level.

It is not acceptable if the individual risk of death in a part of the hazard zone exceeds  $10^{-5}$  event/year. If this risk cannot be reduced in the local planning procedure, the regional directorate shall require the operator to limit or terminate its activity.

This may basically involve several things:

- If one (or more) residential building(s) is (are) in a hazard zone with value exceeding  $10^{-5}$  event/year, the operator of the dangerous establishment shall terminate the dangerous activity or the part of the activity which causes a specific threat;
- The operator shall transform its technology so that the buildings affected are outside that zone;
- The operator shall buy the buildings concerned and terminate their function as residential buildings (or any other function that makes them suitable to receive large masses of people). [2]



**3. figure.** Acceptance criterion for individual risk [2]

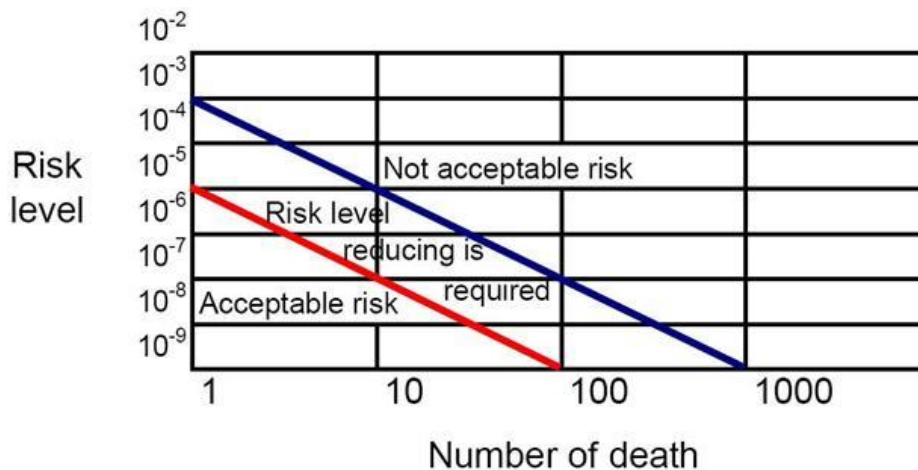
Acceptability of the social risk. The x-axis of the F-N curve shows the number of deaths (N). This number shall be displayed on a logarithmic scale so as the lowest value displayed is The y-axis of the F-N curve indicates the total frequency of accidents causing N or more deaths. This cumulated frequency should be plotted on a logarithmic scale so as the lowest value displayed is  $10^{-9}$  1/year.

The social risk is acceptable without conditions if  $F < (10^{-5} \times N^{-2})$  1/year, where  $N \geq 1$ .

The social risk is acceptable with conditions if it is between  $F < (10^{-3} \times N^{-2})$  1/year, and  $F > (10^{-5} \times N^{-2})$  1/year, where  $N \geq 1$ .

In this case, in order to reduce the risk associated with the activity, the regional directorate shall require the operator to take on-site preventive safety measures (such as alarm, personal protection and isolation) to reduce the risk level.

It is not acceptable risk if  $F > (10^{-3} \times N^{-2})$  1/year, where  $N \geq 1$ . In this case, if the risk cannot be reduced by other means, the regional directorate shall require the operator to limit or terminate the activity. [2]



**4. figure. Acceptance criterion for social risk [2]**

Demarcation of the hazard zone. In order to mitigate the consequences of major accident, the regional directorate shall designate the limits of the hazard zone around the dangerous industrial establishment based on the safety report or the safety analysis.

Developments may be limited within this hazard zone, and measures to protect the population may be laid down in a specific regulation.

This hazard zone may be divided into the inner zone, the middle zone and the outer zone:

Inner zone: the individual injury risk exceeds  $10^{-5}$  event/year.

Middle zone: the individual injury risk is between  $10^{-5}$  and  $10^{-6}$  event/year.

Outer zone: the individual injury risk is below  $10^{-6}$  event/year, but is above  $3 \times 10^{-7}$ .

In addition to the number of people living in the hazard zone, location, protection and environmental planning, the regional directorate shall determine whether new dangerous industrial establishments may be authorized in a hazard zone and the existing dangerous industrial establishments can be developed to an extent that requires the complementation of the safety report or the safety analysis, based on the dangerous industrial establishments or other structures or buildings in that hazard zone. The regional directorate shall deliver an opinion on the development of the road system, railway network or public utilities, and on other investments or improvements. [3]

Internal and external emergency plans. The operator of a dangerous establishment shall draw up an internal emergency plan meeting the requirements of content and form determined in national legislation to eliminate the consequences of hazards identified in the safety report and safety analysis. The operator shall provide conditions necessary for the accomplishment of tasks defined in the internal emergency plan. The task within the dangerous establishment for limiting the consequences of major accident involving dangerous substances shall be determined by the operator, while the tasks outside the dangerous establishment of the concerned state and municipal organs shall be determined in external emergency plans. The preparation of the external emergency plans is the duty of the competent local organs of the NDGDM with the cooperation of the mayors of the relevant localities endangered. The cost of the preparation of external emergency plans and their exercise are provided in the own budget of the NDGDM. [4] [5]

## SUMMARY

In this article the authors introduced the possible hazard sources related to dangerous establishments in Hungary, and introduced the prevention and mitigation requirements and measures necessary for the safe operation of industrial activities.

The Hungarian industrial safety authority as part of the Hungarian Disaster Management Organisation have been applied the European regulations (Seveso II. Directive) in Hungary since 2002 (more than 12 years). In accordance with the statements of the national reports of Hungarian Competent Seveso Authority the Hungarian regulations on the major accidents protection are in full compliance with the Seveso II. Directive's regulations.

It also should also be stated that the Hungarian regulations and their appliance by the Hungarian industrial safety authority provide a high level of protection of human life and the environment in Hungary.

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