# AUTHORIAL EXPOSITION OF DOCTORAL DISSERTATION (PhD)

NATIONAL

UNIVERSITY OF PUBLIC SERVICE

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**ZSOLT CIMER**

**Methodology for the determination of endangerment generated by the activity of below tier establishments producing, using, storing hazardous materials; quantification of risk reduction measures**

Authorial exposition and examiner's report on the above titled doctoral (PhD) dissertation

Budapest

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# Methodology for the determination of endangerment generated by the activity of below tier establishments producing, using, storing hazardous materials; quantification of risk reduction measures

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## DEFINITION OF THE SCIENTIFIC PROBLEM

In case of any possible hazardous materials might be assumed in an establishment, the terms and conditions of protection against major accidents involving dangerous chemical substances (hereinafter referred to as "major accidents") are regulated by EU law, namely by the so-called Seveso II Directive, which aims at the prevention of major accidents as well as the reduction of their negative consequences on civil population and the environment. Application of the Directive is obligatory for the member states.

Notwithstanding the strict Seveso regulation, there have been several foreign and domestic major accidents which have had a direct impact on civil population. The two common characteristics of the major accidents are as follows:

1. The establishments were being out of scope of applicability of the Seveso II Directive at the time of the major accidents took place;
2. The events had direct consequences on civil population, meaning that there were residential area and public establishments in the impact zone of the establishments.

During the analysis of these major accidents it was concluded that the reasons leading to the havaria events were derived and originated from imperfection of the management system, which under the Seveso regulation regime is one of the most crucial criteria of operation. With the help of operating a safety management system the recently happened accidents could also have been prevented and avoided. That is the reason why the competent international authority defined the aim of extending the scope of the regulation which was carried out by reducing the threshold (tier) values of the chemical substances falling under the applicability of Seveso II Directive (listed in Annex of the Directive).

Further to the above, several member states such as Hungary extended the Directive to some further establishments originally falling out of scope of the regime, therefore it has become obligatory for them to ensure the regulations, the terms and conditions of the Directive. The extension was carried by the further reduction of threshold quantities determined for hazardous chemical materials.

In my opinion, several problematic issues have not been solved by the above ad hoc solutions, for instance imperfections of the international and domestic regulations has not been examined and explored and the methodology of establishment identification (i.e. the

methodology to determine the applicability of the Seveso regime's scope) has not been altered. Per the current regulation, there is a disharmony between the establishment identification and the actual endangerment by the establishment, which means that several establishments falling under scope of the Seveso regime do not actually endanger the civil population and the environment, on the other hand, many establishments are not covered by the safety regime since storing less hazardous materials than the threshold but do actually endanger civilians due to their improper location.

In my opinion, the appropriate safety distance itself ensures that in case of an unexpected accidental event the civilians could avoid endangerment. Regarding establishments out of scope of the Seveso II Directive, there has not been worked out a unified international solution for determination of danger zones, thus for reducing the possible negative impacts of a potential major accident. Neither the domestic regulation makes it compulsory in each case to determine danger zones based on the actual potential endangerment.

The scientific areas of methodology regarding establishment identification for the purpose of protection against major accidents involving hazardous chemical substances as well as the of danger zones determination are to be considered as real, current and urgent areas of high importance determined by the real, practical need.

**AIMS OF THE RESEARCH**

In my dissertation I exclusively research areas of prevention of major accidents involving hazardous chemical substances, the methodology of establishment identification as the determination process of applicability of the Seveso regulation as well as the determination of safety areas, danger zones in connection with below tier establishments.

I defined the aims of my research as follows:

1. The examination of establishment identification methodologies applied in connection with protection against major accidents involving hazardous chemical substances by the analysis of both the EU and domestic regulation of activities involving hazardous chemical substances.
2. Proving the disharmony between the actual endangerment and the methodology currently applied for the identification of below tier establishments by analysing the practical

applicability of establishment identification process. Further, to give recommendations regarding requirements of the methodology applied for establishment identification and to evaluate the most wide-spread methods applied in practice for the analysis of endangerment. Based on the above, I aim at working out an establishment identification methodology which is in line with the actual endangerment of civil population.

3. Analysis of the methodology of determining the safety distance surrounding establishments involving hazardous substances, with special regard to below tier establishments based on the international and Hungarian regulations.
4. To work out the methodology of danger zone determination in connection with below tier establishments applicable in land-use (resettlement) planning, including the possibilities of in-zone development.

Due to the complexity of the topic and to the limited length of the dissertation I am unable to include every sub-topic in details. Consequently, the operational conditions of activities and the categories of hazardous substances out of scope of Seveso II Directive as well as any possible extension of the regulation are not subject to the present dissertation.

My recommendation regarding the determination of danger zones surrounding below tier establishments is merely based on the analysis of consequences of accidents involving hazardous chemical substances; I do not examine impacts of any other potential danger sources such as physical dangers in case of a storage tank.

**RESEARCH METHODS**

In order to realize the above aims I have researched and examined the relevant international and domestic regulation and scientific literature. I participated in continuous consultations with many experts from the responsible authorities such as the National Directorate General for Disaster Management, Ministry of Interior (NDGDM) and its local bodies as well as with professors from the Military Engineering Doctoral School of the National university of Public Service. As an external expert I participated in the establishment identification procedure of several domestic companies which in many cases required the thorough examination and interpretation of the relevant legal and scientific background. I have participated as a leader in the preparation of the safety report, safety analysis or major accident prevention plan (hereinafter referred to as “MAPP”) for several domestic hazardous industrial establishments

with different profiles. The experiences gained during preparation of the different safety documentations have been directly relied upon to achieve my research aims. As a teacher of the Fire and Disaster Management Institute of Szent István University's Ybl Miklós Faculty of Architecture, I have also directed the scientific research activity of students from.

**SHORT DESCRIPTION OF THE ANALYSIS CARRIED OUT**

*In the first chapter of my dissertation* I presented the EU and Hungarian regulation on activities involving hazardous substances as well as the method of determining the scope and applicability of the regulation, i.e. the identification of hazardous establishments

The identification is based on the quality and quantity of hazardous chemical materials being present in the establishment at a given time and their relation to the threshold quantity defined in the Seveso II Directive. The group of hazardous chemical materials ("Seveso-materials") is clearly defined and determined. Based on the safety datasheet of the present materials (physical, chemical, toxicological characteristics), it can be determined whether the given material qualifies as hazardous substance per the Seveso II Directive (i.e. if it is a Seveso-material or not) and which group it belongs to. I analysed the adaptations of the Directive by the member states as well as the practical experience on havaria events relating to Seveso-materials in connection with the hazardous establishment identification.

Some member states such as Hungary extended the scope of Seveso-regulation by determining stricter conditions for activities involving hazardous materials. In details I analysed the method used in Hungary in connection with the extension of the regulation.

*In the second chapter of my dissertation* I examined the practical applicability of the establishment identification procedure.

I carried out calculations on the hazardous establishment identification of hypothetic establishments and consequence analysis to determine the endangerment. To ensure the harmony of identification and real endangerment, I determined the criteria of the applicability of danger analysis methods. Based on that I examined the danger analysis methods used in practice. Based on the experience, I have worked out a new methodology for the hazardous establishment identification.

*In the third chapter of my dissertation* I examined the importance of danger zones surrounding below tier establishments in connection with the regulation on land-use (resettlement) planning. I described the regulations of the Seveso II Directive on land-use planning, I analysed the methods used in different countries to determine the danger zones. In case of a hypothetical establishment, I highlighted the other importance of danger zone determination besides the protection of civil population.

*In the fourth chapter of my dissertation* I investigated the practical applicability of danger zone determination. As a conclusion of my research I stated that danger zone determination can be carried out on three bases, however, only the consequence analysis and risk analysis are widespread in practice. I examined the practical application of the method determined in the legal regulation. I also determined the criteria of method applicable in danger zone determination, I worked out the methodology suitable for determination as well as the technical criteria of establishing external (independent) workplaces inside the danger zone.

**SUMMARIZED CONCLUSION**

I proved that in case of below tier establishment the method of hazardous establishment identification is not totally in line with the actual danger (endangerment) that the given establishment mean. I supported my thesis with examples on that there can be establishments which do not fall under the scope of Seveso regulation based on the establishment identification, however, based on the danger analysis they mean potential danger to civil population.

I worked out a methodology for hazardous establishment identification which is in line with the actual endangerment caused by the establishment. This methodology meets all the necessary requirements as follows:

a) It gives a realistic picture on the endangerment caused by the activity involving hazardous materials.
b) It does not require high input, the method is cost-free.
c) It does not require special scientific knowledge to be used.

During my research I pointed out that the local planning within the EU is not coherent as it is based on the national aspects, therefore the member state regulations are not the same, i.e. the methodology for danger zone determination is also different In Hungary, the determination of

danger zones and safety distances is carried out in the land-use (resettlement) plan, but the determination is not based on a unified system of conditions. The environmental protection safety distances are determined based on the statutory charge thresholds; while in case of upper and lower tier hazardous establishments the danger zones are determine from a disaster management point of view based on the individual risk of injury. Currently, in case of below tier establishments only the environmental protection safety distance is determined and only if the environmentally damaging charge/effect is above the charge threshold. The disaster management aspects are not considered in case of environmental charge thresholds. I proved with examples that if danger zones are not identified in the surroundings of below tier establishments the area becomes populated which hinders the operation of these below tier establishments.

I worked out a methodology for danger zone identification in case of below tier establishments which is based on the analysis of consequences, therefore it is in line with the acceptability criteria set by the major accident prevention plan (MAPP).

I pointed out that limitation of establishing workplaces inside the danger zones surrounding below tier establishments hinders the regional development. Therefore I worked out a system of technical conditions for these workplaces which ensures the safety of employees.

**NEW SCIENTIFIC RESULTS**

1. I worked out a new method for hazardous establishment identification which is based on the actual, realistic endangerment of civil population (instead of the recent practice which is based on the quality and quantity of materials present) For this, I thoroughly examined the regulation and the practice of protection against major accidents and compared the internationally accepted methods with the practical experiences.
2. I evaluated the international and Hungarian regulation, procedures and practical experiences and made exact recommendations in order to reduce the endangerment by below tier establishments:
    a. To include the danger zones surrounding below tier establishments in the land-use (resettlement) plan;

b. To legally regulate the process and technical conditions of danger zone determination;

c. To apply the technical criteria on establishing workplaces inside the danger zone in practice.

**TECHNICAL APPLICATION OF THE RESEARCH RESULTS**

As the result of my research, I suggest application of the new methodology relating to hazardous establishment identification in the following fields:

1. The method (either in itself or as an additional process to the actual method) might lead to the reconsideration of national regulation on the management of major accidents.
2. The establishment identification methodology applied in the EU regulation related to upper and lower tier establishments is compulsory to the member states. At the same time, the methodology I propose is fully in harmony with the goals of Seveso II Directive, so it can become suitable (naturally only after the analysis of the results of the thorough impact assessment) even as an addition to the procedures stated in the Directive. As a result, industrial establishments actually endangering the inhabited areas or nature would fall under scope of the regulation, thus the continuous need for scope extension based on the experiences would cease.
3. I suggest the application of my recommendations on the determination of danger zones surrounding below tier establishments and on the disaster management condition system of workplaces in the danger zone in the following fields:

    a. The determination of danger zones can be the basis of land-use (resettlement) planning process and of the modification of the relevant legal background.

    b. As a cost-effective risk reducing measure, the compliance of disaster management condition system can be ordained in the course of authorising working activity in the danger zone if the social risk value as a permit condition is not satisfactory.

## RECOMMENDATIONS

I recommend the utilisation of my dissertation and its findings to industrial safety professionals of the Ministry of Interior and the National Directorate General for Disaster Management, Ministry of Interior and its local organisations.

Furthermore, after proper reediting I recommend the utilisation of my dissertation as lecture notes to the National University of Public Service, the Fire and Disaster Management Institute of Szent István University's Ybl Miklós Faculty of Architecture and other institutions of higher education as well as the official disaster management education.

## LIST OF PUBLICATIONS BY THE DOCTORAL CANDIDATE RELATED TO THE TOPIC


[1] Cimer Zsolt - Dancsecz Balázs: Robbanásveszélyes terekben történő munkavégzés, a robbanásvédelmi dokumentáció készítésének tapasztalatai, Munkavédelem és Biztonságtechnika, XXII. Évfolyam 2010. 1. szám 22 – 26. oldal

[2] Cimer Zsolt - Dr. Szakál Béla: Risks of the Road Transport of Dangerous Goods, Konferencia so zahraničnou účasťou: Súčinnosť záchranných zložiek IZS pri dopravných nehodách NA PK, Nitra 2009.09.30. – 10.01., ISBN: 978-80-85418-67-5

[3] Cimer Zsolt - Dr. Szakál Béla: A védelmi tervezés kockázatcsökkentő szerepének minimális követelményei, Munkavédelem és Biztonságtechnika, XIX. évfolyam 2007. 2. szám 15-23 oldal

[4] Cimer Zsolt - Dr. Szakál Béla: Analyses of professional dilemma surfaced when drafting the respective hungarian regulations The science for population protection 2/2010. pp31-45. o. ISSN1803-568X

[5] Cimer Zsolt: „Possible effects of dangerous substances and technologies harmful to the environment, the human life and health" és „Specimen documents" c. fejezetek szerzője, Dr. Kátai-Urbán Lajos (szerk.), „Guidance on the implementation of regional and local tasks for the prevention of major accidents involving dangerous substances", Közép- és Kelet Európai Környezetfejlesztési Intézet, 2005.

[6] Cimer Zsolt: Mennyiségi veszélyeztetettségértékelés c. fejezet szerzője, Dr. Kátai-Urbán Lajos (szerk.), „Ipari Biztonsági Kockázatkezelési Kézikönyv a

veszélyes anyagokkal kapcsolatos súlyos balesetek elleni védekezés szabályozás alkalmazásához", KJK KERSZÖV, Környezetvédelmi Kiskönyvtár sorozat, 2004.

[7] Cimer Zsolt: Következményelemzési eredmények felhasználása a védelmi tervezésben c. fejezet szerzője, Dr. Kátai-Urbán Lajos (szerk.), „Ipari Biztonsági Kockázatkezelési Kézikönyv a veszélyes anyagokkal kapcsolatos súlyos balesetek elleni védekezés szabályozás alkalmazásához", KJK KERSZÖV, Környezetvédelmi Kiskönyvtár sorozat, 2004.

[8] Cimer Zsolt - Dr. Halász László: A kémiai biztonsági jogszabályok változása, a CLP és a SEVESO II. irányelv kapcsolata, Hadmérnök, V. Évfolyam 1. szám - 2010. március, 87 – 98. oldal

[9] Cimer Zsolt, Dr. Szakál Béla: A veszélyes áru közúti szállításából származó kockázatok meghatározásának lehetősége, Hadmérnök, V. Évfolyam 2. szám - 2010. június, 115 – 126. oldal

[10] Cimer Zsolt, Dr. Szakál Béla: Ipari robbanások romboló hatásának összehasonlító értékelése egy megtörtént eset példáján, Tudományos Közlemények 2008, V. évfolyam I. szám, SZIE Ybl Miklós Építéstudományi Kar, 31-37 o.

[11] Cimer Zsolt, Kátai Urbán Lajos, Dr. Szakál Béla: Településrendezés követelményei a veszélyes üzemek környezetében, Munkavédelem és Biztonságtechnika 2005. I. sz. pp. 23-26 oldal

[12] Dr. Szakál Béla, Cimer Zsolt, Dr. Kátai Urbán Lajos, Dr. Sárosi György, Dr. Vass Gyula: Iparbiztonság I., Veszélyes anyagok és súlyos baleseteik az iparban és a szállításban (ISBN 978-963-89073-3-2.), Korytrade Kft. Budapest, 2012.

[13] Dr. Szakál Béla, Cimer Zsolt, Dr. Kátai-Urbán Lajos, Dr. Vass Gyula: Iparbiztonság II. A veszélyes anyagokkal kapcsolatos súlyos balesetek következményei és kockázatai, Egyetemi Tankönyv, ISBN: 9786155445002, TERC Kereskedelmi és Szolgáltató Kft., 2013. pp. 62-63.

[14] Cimer Zsolt: Bányászati Zagytározók ipari biztonsága, SZIE Ybl Miklós Építéstudományi Kar Tűz- és Katasztrófavédelmi Intézet, Intézeti Tudományos Konferencia, 2012. (ISBN:978-963-269-340-8)

[15] Cimer Zsolt: A katasztrófavédelmi törvény kiterjesztésének műszaki feltételrendszere a veszélyes anyagot felhasználó vállalkozások vonatkozásában, SZIE Ybl Miklós Építéstudományi Kar Tűz- és Katasztrófavédelmi Intézet, Intézeti Tudományos Konferencia, 2011. (ISBN:978-963-89164-1-9)

## PROFESSIONAL ACADEMIC BIOGRAPHY OF THE DOCTORAL CANDIDATE

| **PROFESSIONAL EXPERIENCE** | |
|---|---|
| Date | 2014 – |
| Name of the Company | **SZIE YMÉK Fire and Disaster Management Institute** |
| Post | Adjunct, Deputy Vice Director of the Institute |
| Main activities and responsibilities | Teaching |
| Date | 2012 – |
| Name of the Company | **SZIE YMÉK Fire and Disaster Management Institute** |
| Post | Adjunct |
| Main activities and responsibilities | Teaching |
| Date | 2008 – |
| Name of the Company | **Fire – Chem Ltd.** |
| Post | Managing director |
| Main activities and responsibilities | Work Safety, Fire and Disaster Management |
| Date | 2005 – 2011. |
| Name of the Company | **National Directorate General for Disaster Management, Ministry of Interior Department of Main Supervision** |
| Post | Leading supervisor on duty |
| Main activities and responsibilities | Countrywide supervision on duty and tasks related to the international contact center |
| Date | 2001 – 2005. |
| Name of the Company | **National Directorate General for Disaster Management, Ministry of Interior Department of Industrial Accident Prevention and Supervision** |

| | |
|---|---|
| Post | Main Lecturer |
| Main activities and responsibilities | Introducing the Seveso II Directive domestically; hazardous industrial establishment supervisor |
| Date | 1999 – 2001. |
| Name of the Company | **Hungarian Army**<br>**Chemical Safety Information Centre** |
| Post | Analysing and evaluating, senior officer |
| Main activities and responsibilities | ABV protection |
| Date | 1999 – 1999. |
| Name of the Company | **Extruform Ltd.** |
| Business branch | Production of plastic foils and sheets |
| Post | Technologist |
| Main activities and responsibilities | Controlling technological settings |

**STUDIES**

| | |
|---|---|
| Date | 2008 – |
| Name and type of the educational institution | **ZMNE Engineering Doctoral School** |
| Education | |
| Level of education | |
| Date | 2004 – 2006. |
| Name and type of the educational institution | **Ybl Miklós Engineering College** |
| Education | Fire and Disaster Management Major<br>Fire and Disaster Management Engineer |
| Level of education | College Diploma |
| Date | 1999 – 2002. |
| Name and type of the educational institution | **Budapest University of Economic Sciences** |
| Education | Business Economics Major<br>Engineer - Economist |
| Level of education | University Diploma |
| Date | 1993 – 1999. |
| Name and type of the educational institution | **Budapest University of Technology and Economics**<br>Chemical Engineering Faculty<br>Chemical Engineering Major |
| Education | Chemical Engineer with a Diploma |

| | |
|---|---|
| Level of education | University Diploma |
| PERSONAL COMPETENCIES | |
| NATIVE LANGUAGE | Hungarian |
| OTHER SPOKEN LANGUAGES | English, pre-intermediate level |
| | German, intermediate level |
| OTHER QUALIFICATIONS | Labour safety technician |
| | DNV SAFETI software course |
| | The theoretical bases of quantitative risk evaluation and quantitative risk evaluation in practice HU03/IB/EN03-TL PHARE course |

Budapest, 25 February, 2014

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