

**MIKLÓS ZRÍNYI NATIONAL  
DEFENCE UNIVERSITY**

PhD Board

**TÖRÖK BÁLINT ZOLTÁN**

RETIRED FIRE GUARD OFFICER, LIEUTENANT COLONEL

**Tactical and technical development possibilities of fire service intervention  
in road accidents during transportation of dangerous substances**

Synopsis of PhD thesis and official critical reviews

Budapest

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Consultant:

Dr. habil Cziva Oszkár, Fire Guard Colonel, PhD

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## **Formulation of the scientific issue**

The regulations of the SEVESO II – 96/82 EC Directive – affect the logistical store-houses and the reloading terminals of dangerous goods, and also specify the quantitative levels of minimum and maximum threshold values. The decrease of the threshold values resulted in the increasing number of factories bound by SEVESO II in Hungary. The chemical companies intend to stockpile within the limits of threshold levels, which requires an intensive logistical background. Their aim is to store just as much of the amount of the critical chemicals in the factory as it is needed for production. This issue involves the hazard of transporting the surplus by road.

Transporting dangerous goods is considered to be a hazardous operation. Its hazardous nature is rooted in the dangerous substance itself and in the conditions of transport. Transport by road is known to be one of the most dangerous operations in the world, with the highest rate of severity and mortality. The vehicular transport of dangerous goods is regulated by the ADR (Accord européen relatif au transport international des marchandises dangereuses par route); the European Accord of the International Transport of Dangerous Goods by Road. This accord provides the security regulations, by the enforcement of which – disregarding force majeure – the transport may basically be considered safe.

Problems may be caused not only by improper cargo preparation, improper cargo immobilization or indiscipline of transporter but also very often by improper documentation, fraudulent misrepresentation as for the content of cargo or by contempt of the Highway and Traffic Code. Evidently, several other issues exist apart from the above mentioned ones, here, only the most typical problems have been highlighted.

According to the survey by the Environmental Protection Agency (EPA), USA, the first person intervening in emergency may be exposed to any of 1.5 million chemicals, which include dangerous substances ranging in number from 33,000-63,000. These 63,000 chemicals are called 183,000 different names and 7/8 of them are so little-known that there is only a small chance to analyze and evaluate the possible measure of danger which health is likely to be exposed to.

During operations in response to emergency physical, chemical and bio-hazards may be detected. Physical hazards include, among others, dangers related to fire, explosion and

reactivity. Biohazards include exposure to the effects of chemicals through inhalation, swallowing and skin or eye contact.

Whereas the preventive side is comprehensively regulated in details, there is no guidebook for actual accidents which is easy to use, simple and defines the strategy of reconnaissance, tactics of intervention, force and instrument requirements and the necessary safety regulations on the damage site during the short time available.

My research mainly focuses on disaster relief of road accidents during transportation of dangerous goods, stages of disaster relief, primary intervention of the fire service, basic data access for emergency analysis. In my study I also intend to detect and describe the sources of danger and determine the algorithm of intervention required for the successful elimination of danger, to determine a new degree of individual protection.

The development of the chemical industry and the expanding road transportation of dangerous goods require a constant attention on the part of the participants concerned in disaster relief. My ambition is to encourage and contribute to keeping in step with these issues.

### **Objectives of research**

1. To explore the factors endangering the health of fire-fighters participating in disaster relief; by means of analyses focusing on road accidents during transportation of dangerous goods, also including uncontrolled release and effects of dangerous substances and waste materials.
2. On purpose to increase the security of imposed forces, to find a device which
  - is compatible with the existing and applied forms of equipment of individual protection
  - may be applied together with the existing protecting equipment
  - helps fire-fighters and external protecting forces to watch the metabolic functions of the intervening forces, helps control the functioning of the respiratory apparatus
  - enables fire-fighters and external forces to send help in case of alarm or emergency.

3. To compile an easily manageable data sheet for primary and rapid evaluation of the situation, for detection of dangerous substances carried out by fire-fighters, for gathering and recording basic data required for intervention. Intervention in the presence of dangerous substances is an operation which requires processing a great amount of complex information, activities of high complexity and presence of forces in great strength.
4. To provide assistance to primary fire service forces intervening in road accidents in the presence of dangerous substances; with the help of restructuring of scope during disaster relief and introducing a method of intervention to manage the situation.

### **Methods of research**

The legal background associated with the protection against fire and disaster, scientific works, historical reviews, analyses, statistics are adapted and explored from an explicit and objective aspect, with the aim of providing a topic-related summary.

Current research is based on the professional publications of Budapest Fire Department, The National Directorate General for Disaster Management; on the library research of Miklós Zrínyi National Defence University, and the educational material of Miklós Zrínyi National Defence University. Further fields of research include specialist periodicals concerning fire and disaster protection; daily papers; studies; essays; data, comparative tables and regulations issued by national authorities; sources and websites on the Internet concerning the procedural rules of partner organizations as well as my own experience.

### **Summary of research according to chapters**

**Chapter I** is a summary of hazards inherent in manufacturing, storage and transportation of chemicals placing special emphasis on transportation, especially – relying on statistical data – on the road transportation of dangerous goods and the related tendencies and experience.

It is claimed that the neglected amount of law-specified tracing may be attributed to the fact that the applied sanctions may not be considered deterrent on one hand; on the other hand, a law-abiding attitude cannot be traced. According to security reports and analyses submitted by plants bound by the SEVESO directives and the current legislation, and based on the scope of the reporting companies, it is assumed that the actual number of consignments with route tracing exceeds the current number.

Taking into consideration the issues above and the defaults found during supervisions it is claimed that the road transportation of dangerous goods involves nearly the most unexpected factors nowadays. There are disaster relief conditions of high complexity, and the consequent endangerment has a dramatic effect on the environment and on intervening forces.

Special attention has been paid to the nuclear systems in Hungary, the dangers of transporting radioactive substances as well as to the procedure of intervention in the presence of these substances. The issue is highly up-to-date due to the launching of the National Radioactive Waste Storage near Bataapáti in 2009.

Various types of harms endanger human life and health during disaster relief in the presence of dangerous substances. **Chapter II** is a short but comprehensive summary of the factors endangering the health of fire guard forces primarily intervening on the damage site. It describes the hazards and harmful effects of chemical and radioactive substances on the living organisms in their environment, the threshold values of permissible and irreversibly damaging doses and their symptoms. Reference is made to the importance of security measures in emergency and that of individual protection.

**Chapter III** deals with the forms of equipment of individual protection of the fire service during intervention in the presence of hazardous substances. It describes the generally applied forms of protective equipment for the head, body and respiration, and presents their limits and disadvantages in case of emergency use.

I demanded the need for the application of a user-independent solution, which provides information with absolute certainty about the physical conditions of the people participating in disaster relief, about the stability of their respiratory protection, and at the same time, reduces the unnecessary data communication, liberating communication channels.

**Chapter IV** presents the development of the intervention supervision system, the most state-of-the-art telemetric unit, conditions of its application and its technical parameters. This

system is so recent that no tactical principles have been laid down yet for its application that could be regarded as a paragon. At the end of the chapter I worked out the principles of its application, and a way of its location and handling, in the topic of choice.

I came to the conclusion that with the effective application of telemetric equipment and the integration of the proposed tactical elements during disaster relief it is possible to develop a system of deployment supervision on the damage site, which provides a chance to permanently watch the physical and mental states and conditions of the intervening forces.

**Chapter V** provides a detailed review of the system of intervention in the presence of dangerous substances in Hungary. Special emphasis was put on the methods and criteria of the necessary exploration that is always prior to the intervention, since disaster elimination may not be started in the absence of the essential information about dangerous substances; the environment and the fire service are exposed to harmful effects.

I concluded that the procedural rules of disaster relief of road accidents during transportation of dangerous substances are badly organized and confused. There is no specified procedural sample in existence which could be followed by the intervening fire guard forces, or a method of decision making which could be followed by the leaders.

I demanded the need for the introduction of a system of decision making and procedural order, which makes the work of the commanders on damage site and that of their subordinates more rapid, more effective and safer. The need mentioned above is justified by the analysis of a recent event, in which I pointed out the existing problems. Furthermore, I have claimed that the compilation and introduction of a special data sheet is necessary. It should include the basic information necessary for making a decision on imposing forces and equipment, tactics on the part of commanders on the damage site. It should also be handled by the fire guard unit exploring the actual damage site. Finally, I determined the basic criteria of the data sheet.

In **Chapter VI** I pointed out that in the events of road transportation of dangerous goods the intervening fire service and its leader do not even possess the crucial information in most cases. Reconnaissance, being the integral part of the basic activities, is extended with numeral special tasks, the response to which basically determines the tactics of interbention, the need for forces and equipment. The previously gathered information must be made exact, verified on the premise as part of the reconnaissance of great importance, moreover, additional information must be obtained.

As the aforementioned task requires extraordinary precision, I intend to provide help by means of compiling on my behalf the Data Sheet for the Exploration of Dangerous Substances. The data sheet may be the integral part of the process and instruments of exploration, it makes this activity easier, and at the same time basic information may be recorded for further use for commanders on the damage site, helping them with planning and organizing activities.

Use of the data sheet is recommended in case of interventions in the presence of dangerous substances; following a brief theoretical and practical training.

**Chapter VII** provides an analysis of the operations concerning disaster relief of road accidents during transportation of dangerous substances from the side of practical execution. Having analyzed the American, German and British procedural systems, and also taking the Hungarian regulations into account, I worked out an algorithm of making decision during intervention. I divided the set of activities into a primary and a secondary line, and highlighted the elements of offensive nature. I strove to be accurate and clear-cut, I demonstrated the work process by means of charts and diagrams which are easily interpreted. The sequent operations, which are easily executed by the question-answer method, are suitable for the disaster relief of road accidents in the presence of any complex, hazardous substances, with the greatest possible protection of the intervening units.

The application of this method is recommended as completion of the existing regulators, as basic procedural method.

## **Conclusions**

In my thesis I examined the harms and effects of hazards which fire-fighters are to cope with in their profession. I concluded that a major insecurity during intervention may be associated with the presence and uncontrolled release of dangerous substances. The issue is even more serious when it occurs in unfamiliar location and situation, and not according to previous anticipations, plans and security measure. This factor was what led to the research of road accidents during transportation of dangerous substances.

Several sections and subsections of the Regulations of Fire-Fighting and Engineering Rescue Operations, approximately 50 articles refer to the required measures of disaster relief.



There are not any leaders at the fire department who actually knows all of them; and there are not any commanders on the damage site who would be able to consult them under the pressure of the intervention. There are no priorities marked in the Regulations, coherence cannot be detected between the operations, the particular steps are not sequent. Virtually, it is a list of rules to be observed.

The commanders on damage sites do not have time to do it as they have to make quick decisions, co-ordinate the units, decide on the operations to be done. It all should be carried out in a manner which is professional, clear, logical and avoids endangering the health and life of the subordinate fire-fighters. In addition, commanders should communicate with partner organizations and authorities.

Having explored the problem fields, relying on specialist literature and on my experience gained in Hungary and abroad, I propose the introduction of a system of intervention supervision, as well as the simplification of specialist detection of hazardous substances in my thesis. I also propose the introduction and regular application of a special Data Sheet compiled on my part. I analyzed and outlined the algorithm of decisions in the primary process of disaster relief in the presence of dangerous substances, dividing it into various stages.

### **Latest scientific achievements**

- 1) Based on objective principles I explored and classified **the possibilities and effects of the uncontrolled release of dangerous substances and waste materials**, relying on statistical data. I came to the conclusion that transportation of dangerous goods by road involves several unexpected factors and also, the complex activity of disaster relief and elimination means endangerment with dramatic effects on the environment and on the intervening forces.
- 2) Analyzing the devices and equipment of individual protection I pointed out the defects and I demonstrated the **intervention supervision system**, which is based on the principle of telemetry and suitable for keeping track of the data of individual metabolic functions. I also worked out the principles of its tactical application and location in disaster relief of road accidents during transportation of dangerous substances.

- 3) To provide help for specialist detection of chemicals and dangerous materials carried out by the fire service, I estimated the risks and types of hazards on the damage site, and the need for essential information for handling them. It resulted in my **developing and compiling a data sheet** which is easy to use and supplies easy assessment.
- 4) By means of restructuring the operation management in disaster relief, paying attention to priorities, I isolated and highlighted the primary elements of operations, divided the system of disaster management into action stages and, in such a way, I developed an intervention method that bears the character of a **decision tree**. With the application of this method, the commander in charge of fire-fighter forces may be able to supervise the disaster relief rapidly and professionally, with the smallest degree of endangerment.