

## RELEVANT DECONTAMINATION TASKS CARRIED OUT BY FIREMAN UNITS

### TŰZOLTÓ EGYSÉGEK ÁLTAL VÉGZETT VEGYIMENTESÍTÉS AKTUÁLIS FELADATAI

KUTI Rajmund

(ORCID ID:0000-0001-7715-0814)

[kuti.rajmund@sze.hu](mailto:kuti.rajmund@sze.hu)

#### Abstract

Classical decontamination is a process aims to eradicate the environment-damaging effects of human, natural and constructed environment. It has been carried out primarily by military units, therefore the action steps have been developed accordingly. However in recent years, during eliminating the consequences of several industrial and traffic accidents, the activity performed most often by firefighter units has come into view. Special tools and discharge materials were provided to perform their duties, so it was necessary to change the steps of the procedure. To perform effective decontamination, specially trained executive staff is required, people who are qualified for operating special equipment, devices, and for applying the latest methods. To maintain the expertise and practical skills of the staff, a high level theoretical and practical training is required, where the steps need to be improved continuously. In this article, I systematized and compiled basic tasks which are necessary for firefighter units to execute theoretical and practical training of decontamination, in such a way, that with their application the simplified decontamination tank designed by myself can be safely operated. With this research, I would like to contribute to increasing the efficiency of theoretical and practical training.

**Keywords:** chemical decontamination, training, training levels, practices, control

#### Absztrakt

A klasszikus vegyimentesítési eljárás a mérgező vegyi anyagok humán, természeti és épített környezetet károsító hatásainak a felszámolására irányuló folyamat, elsősorban katonai egységek végezték, lépései ennek megfelelően kerültek kifejlesztésre. Az utóbbi években a különféle ipari és közlekedési balesetek következményeinek felszámolása során került előtérbe a tevékenység, melyet leggyakrabban a hivatásos tűzoltó egységek végeznek. A feladatokhoz speciális eszközök és mentesítő anyagok kerültek rendszeresítésre, ennek megfelelően kellett az eljárás lépéseit módosítani. A hatékony vegyimentesítéshez a speciális eszközöket működtető, a legújabb módszereket alkalmazó, különlegesen kiképzett végrehajtó állomány szükséges. Az állomány szaktudásának, gyakorlati készségeinek szinten tartásához, magas szintű elméleti és gyakorlati kiképzésre van szükség, melynek lépéseit folyamatosan fejleszteni kell. Cikkemben a tűzoltó egységek vegyimentesítésre történő elméleti és gyakorlati kiképzéséhez szükséges alapvető feladatokat rendszereztem és állítottam össze olyan módon, hogy alkalmazásukkal az általam tervezett egyszerűsített vegyimentesítőhely biztonságosan üzemeltethető lehessen. Kutatásaimmal az elméleti és gyakorlati kiképzés hatékonyságát kívánom növelni.

**Kulcsszavak:** vegyimentesítés, kiképzés, képzési szintek, gyakorlatok, ellenőrzés

A kézirat benyújtásának dátuma (Date of the submission): 2017.05.15.

A kézirat elfogadásának dátuma (Date of the acceptance): 2017.11.08.

## INTRODUCTION

Due to the development of science, the amount of produced and used chemicals is constantly increasing. Unfortunately, this process also involves the occurrence of chemical-related accidents. The units of organizations dealing with various remediation are exposed to the presence of increasing number of special and hazardous substance during interventions. Investigators come into contact most likely with hazardous materials within the scope of ADR<sup>1</sup>, when transportation accident occurs. These materials contain compounds which are harmful to human health and environment as well. In these cases, interventions are operated in special protective equipment due to toxicological effects of the hazardous substances, and full personal and equipment decontamination shall be carried out as the closing phase of the works. Decontamination covers efforts to eliminate or minimize adverse impacts on the environment, designed to remove or neutralize toxic materials from persons, different landmarks, surfaces of devices, water and air within a minimum amount of time [1]. Decontamination requires special equipment and material which is effectively applied by specially trained personnel [2]. L. Földi [3] and Z. Grósz [4] deal with the steps of decontamination in detail, but they only applied it in military environment. I have to point out that the process carried out by firefighter units differs from the classical military decontamination process as per the tools used and as per executive staff as well, so there is a difference in training tasks also. I deal with the current tasks of this special training.

## DESIGN REQUIREMENTS OF SIMPLIFIED CHEMICAL DECONTAMINATION

For the efficient and environmentally friendly chemical discharge, there is a need of formation of special discharge space regarding to person and equipment. One of the most appropriate tool to spray out decontamination liquid is mobile water fog generator and the DS 10 manual pumping liquid dispenser [5]. The minimum equipment necessary to design decontaminating site, to ensure the safe disposal of the process and to store hazardous substances, are the following:

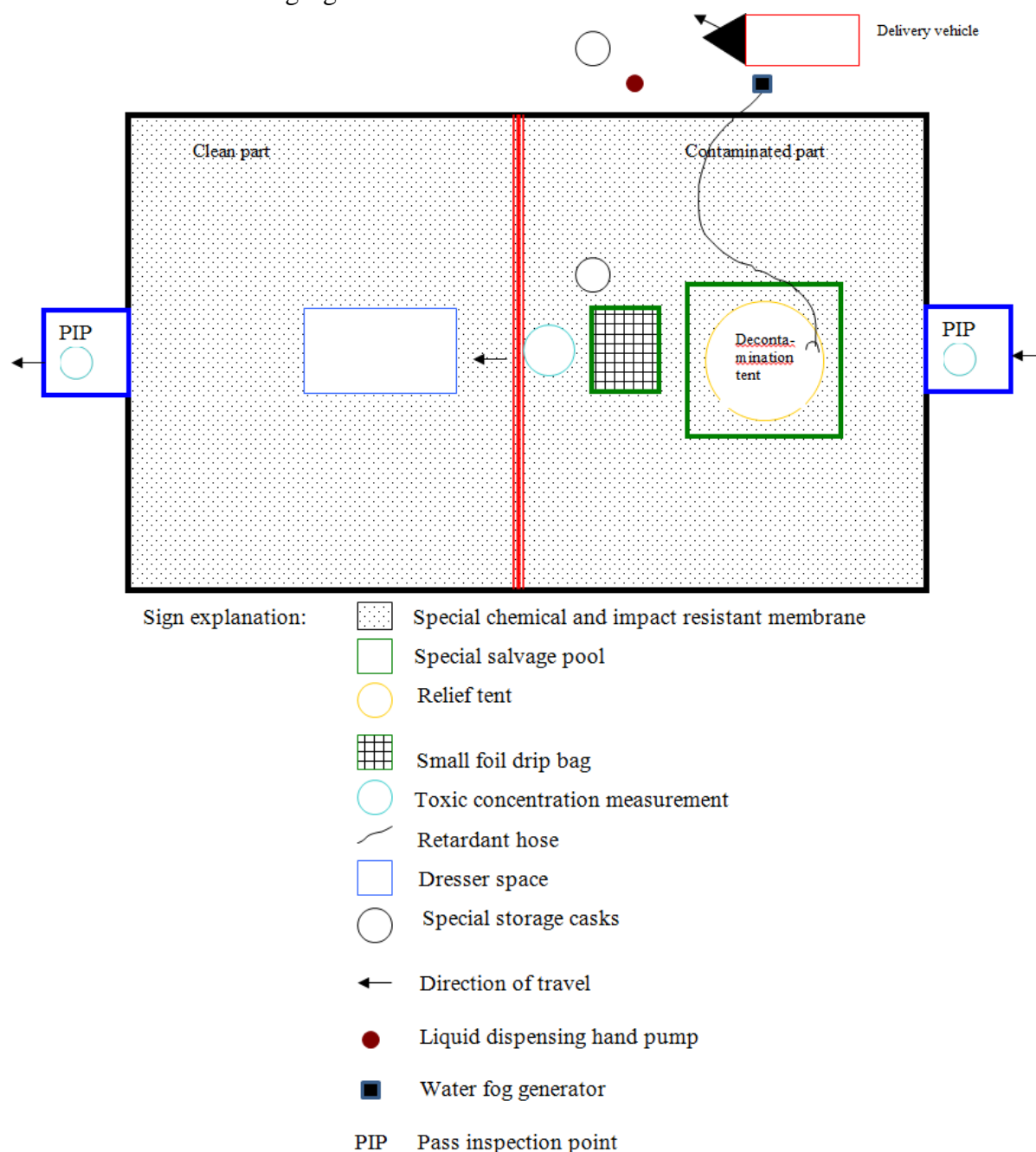
- Special chemical and impact resistant membrane 10x4 meter 1pcs, (+1 spare),
- Special Salvage Pool 1.5x1.5x0.2 meters,
- Special plastic Damage Rescue 0,5x0,5x0.2 meters,
- Relief Tent,
- UNIJET FOG Water mist extinguishing equipment with removable console,
- Hand pump fluid dispensing unit (DS10),
- In a container, at least 100 liters of water (for mixing solution in unit),
- Universal decontaminating Emulsion (Kärcher TDE 202),
- Universal hazardous material storage, lockable container 200 liter (+1 pcs.),
- Hazardous material storage, lockable barrel of 120 liters (+1 pcs.),
- Special chemical storage foil bag 200 liters 2 pcs. (+2 pcs),
- Special chemical storage foil bag 120 liters 2 pcs. (+2 pcs),
- Single Use Protective Clothing (TYVEK), 2 pcs. (+2 pcs),
- Complete Respirator (2pcs.) + reserve bottle (2 pcs.),
- Liquid dispensing hand pump,
- Disinfectant/Antiseptic hand wash unit for the exempted/disabled person.

---

1

Accord européen relatif au transport international des marchandises dangereuses par route (European Convention on the international carriage of dangerous goods by road)

The disposal of the devices mentioned above is preferably carried out in the loading space of a carrying vehicle, thereby creating the conditions for the establishment of discharge site as soon as possible. The outline of the decontaminating site from the above-mentioned devices can be seen in the following figure:



1. **Figure:** Schematic diagram of the design of decontamination site.

(Source: Composition of the author)

## THE PURPOSE OF TRAINING

Some subtasks of the decontaminating tasks performed by the forces of Hungarian Armed Forces are carried out by separate subunits. There are no available separate subunits for simplified decontamination tasks carried out by firefighting forces, to form and operate the

discharge area described above, moreover to operate the devices, only five persons are necessary. It is of particular importance that the interveners are able to complete all the subtasks and manage all the tools. The qualitative education of firefighters is the most important social aspect of disaster management, which covers the area of general and special training based on the latest results of disaster science [6].

It is important to accomplish these tasks carefully, without fail, and if an accident or technical failure occurs, the staff needs to be aware of what to do when necessary. During interventions involving dangerous substances it is particularly needed to implement a thorough decontamination because material spill or incomplete removal could lead to health damage and in severe cases to death [7]. It is also a main objective to enable involved staff to master the steps for identifying hazardous substances, the use of necessary equipment and devices, proper use of equipment used during decontamination and in addition to learn to fulfil tasks safely in the presence of hazardous substances.

## **LEVELS OF TRAINING**

Emergency situations may arise during hazardous material accidents, where liquidation needs greater preparedness and perfect training. The specialized training – like decontamination training – means practical application of the acquired theoretical knowledge and creation and development of skills [8].

Taking into account the aspects of decontamination, the following knowledge should be acquired for the staff involved:

### **Knowledge level:**

- Structure, functions and administration of the organizations intended to damage recovery,
- Basic knowledge of hazardous materials,
- Grouping specialized equipment for different interventions.

### **Comprehension level:**

- Service levels stratification, formalities, contact rules and the order of the instruction implementation
- Requirements, rules relating to the presence of hazardous substances,
- Equipment used during interventions, applicability of specialized equipment, properties of release agents,
- The use of Intervention Policy, physical requirements on persons who carry out the intervention.

### **To know at the level of proficiency:**

- Various remedial implementation of complex tasks,
- Decontamination-related tasks professional completion.

### **Readiness / skill level:**

- Rules applied in the use of personal protective equipment, protective clothing during interventions depended on the presence of hazardous materials
- The application of the procedure is necessary to identify dangerous substances, comprehensive technical devices, rules of instruments.

The only way to guarantee success during intervention in the presence of hazardous materials is when the fastest possible installation of technical tasks are performed equipment relying on the use of specified. Every step of the process is based on a theoretical education, properly described above in the planned levels of knowledge and practical training. This especially refers to each step of decontamination [9].

### **THE PHASES OF TRAINING**

For relevant training, the application of the following stages is essential:

- At theoretical level, it is necessary to master the rules for mixing the solutions required for the decontamination, the use of necessary technical equipment and technology tools, and each step of the discharge process,
- The theoretical knowledge must be transposed into practice, for which practices should be planned and organized. The exercises should be extended to the exercise of the various sub-processes, it should be implemented over a complex exercise according to the following sub-processes.
- The complex practices should always imitate realistic conditions as far as possible.

During each exercise, attention shall be paid to avoid finishing the practice by performing the decontamination duties, the staff needs to master the handling, copying, storage and post-work tasks of the hazardous substances.

### **COMPLEX REMEDIAL EXERCISES**

Intervention performing organizations might not be prepared to a possible elimination of consequences of terrorist acts or a protracted and complex remediation in the presence of hazardous substances [10]. For effective remediation, it is extremely important to maintain the simulation exercises whereby the logistical, medical and technical assistance tasks should also be addressed. Transported hazardous materials could be in solid, liquid and gaseous consistency. During an accident, it must be taken into account that the substances could be released to the environment or transhipped which can cause more problems for liquidation investigators. These problems are needed to be aligned for the participants in the practice also. It is important to acquire the use of additional equipment, special hoses, pumps and drip equipment to trans load, absorb and clear away various hazardous substances. The staff must be prepared of the rules of operation of flares equipment because the trans loading is not easy at the case of frozen liquefied flammable gases. During practices, all attention should be paid on the strict adherence to the necessary precautions while trans loading and transhipping, keeping in mind the environmental safety issues and the environmental tasks should also be addressed [11]. The staff must be prepared to face the challenges resulting from the effects of global warming as well [12].

Considering the facts above, it can be concluded that those remedial exercises which includes intervention and then discharge, in the presence of a hazardous substances where all the steps in handling hazardous materials can be exercised, are not easy to perform regularly. Accordingly, the training should be accomplished in smaller units. It is necessary to separate the practise of smaller steps (e.g.: development of chemical decontamination place, preparation of decontamination solutions, operation of disposal facilities, working in full-body protective clothing, personal and equipment decontamination) which should lead through the whole exercise. Every step must be checked section by section, only flawless execution allows to proceed, and then, in conjunction with the subtask, to examine the whole process in a complex exercise.

## **THE PLAN OF EXERCISES**

During my professional career, I have participated in several interventions in the presence of hazardous substances, so I managed to get liquidation-related experiences, which I could exploit later during missions and planning exercises. As more organizations took part in the remediation, the key objective in the phase of planning and implementing during the exercises was to understand all organizations rescue capabilities and tools, joint problem solving, communication and developing flexible management mechanism.

Therefore, that is why the planning of complex exercises is important, so that chemical decontamination could be inserted exactly into the intervention or the algorithm of remediation [13].

When planning the practices of these functions, it is appropriate to mention:

- Steps after the elimination of hazardous materials accident should be acquainted with the staff concerned according to guidelines set out,
- Exercise intervention in full personal protective equipment (protective gas tight suits, respirators, gas masks),
- Fast, professional implementation of life rescue tasks,
- Practice tactical steps set out on the subject, mounting types,
- Solving Communication Problems,
- Exercise the steps of the chemical discharge procedure, application necessary time constraints of installing and commissioning the equipment [14].

It is advisable to elaborate thoroughly the tasks of the participants in control and the executers, and to revise them later depending on their practical experience. The plans shall be supplemented with power calculation and tactical asset-site drawing [15].

## **MONITORING THE EFFICIENCY OF DECONTAMINATION**

The exercises should be monitored closely when controlling the effectiveness of chemical decontamination. It has a great importance at personal exemption. Protective full-body clothing is made of special materials, which repellent the liquid got on its surface. This phenomenon is easy to observe in practice, water should be sprayed on the protective cloth and water should be watched how it quickly runs off the material. It is hard to tell if the water got on all parts of the clothing, because of its repellent effect. The special discharge solutions contain surfactants, precisely in order to be able to stay on the contaminated surface until the chemical process is complete.

These substances increase the wettability of the solution discharge and improves dispersion on surfaces being exempted. The presence of surfactants on the cloth is not able to quickly repel the discharge solution from the surface, so it can be examined where are those places where the liquid has not reached, and the discharge there must be continued. During the procedure, the check passes (EÁP) should also be subjected to instrumental checks for which the necessary instruments are available in Disaster Relief Mobile Laboratories (KML).

## **CONCLUSIONS**

The intervening staff of damage elimination organizations is often confronted with hazardous substances at various exposed locations. I found that in the case of staff training for these tasks has ongoing and outstanding actuality. In order to ensure a smooth and effective damage elimination, the emphasis should be placed on the training of controlling and intervening staff, particularly with regard to the interventions on hazardous chemicals and chemical discharge tasks.

## SUMMARY

The challenges and threats of today's modernization all justify the need for the continuous development of tools and tactics needed for elimination of damages in the presence of dangerous substances.

At present, the greatest threat is caused by fire events and extreme weather conditions due to global climate change, and beyond these accidents involving hazardous chemicals and chemical disasters. To eradicate all these damage events, a highly skilled and experienced personnel is required.

In my article, I have systematized and constructed the basic tasks of the theoretical and practical training required for safe operation of simplified chemical discharge space I designed so that the process can be efficiently implemented by applying them.

It is essential to ensure the necessary intellectual and financial conditions for quality education and effective training, as well as to maintain knowledge level of executive staff.

## REFERENCES

- [1] KUTI R.: Vegyimentesítőhely kialakításának követelményei, az eljárás személyi és technikai feltételei, Védelem katasztrófa- tűz- és polgári védelmi szemle, XVIII. / 1. (2011) 26-27. p. <http://vedelem.hu/letoltes/ujsag/v201101.pdf> (downloaded: 06. 04. 2017.)
- [2] HALÁSZ L., FÖLDI L., PADÁNYI J.: Climate change and CBRN defense. *Hadmérnök*, VII./ 3. (2012), [http://hadmernok.hu/2012\\_3\\_halasz\\_padanyi\\_foldi.pdf](http://hadmernok.hu/2012_3_halasz_padanyi_foldi.pdf) 42–49. (downloaded: 13. 04. 2017.)
- [3] FÖLDI L.: A Magyar Honvédség tevékenysége a vegyi katasztrófák elleni védelem összefüggés rendszerében, PhD értekezés, ZMNE Budapest, 2003
- [4] GRÓSZ Z.: ABV Védelem alapjai, Tankönyv, ZMNE Budapest, 2003
- [5] KUTI R., FÖLDI L.: Possible use of mobile water fog generators for decontamination tasks, *AARMS Academic and Applied Research in Military Science* Vol. 8, Issue 1 (2009) 127–132. p. <http://www.zmne.hu/aarms/docs/Volume8/Issue1/pdf/12kuti.pdf> (downloaded: 13. 04. 2017.)
- [6] PAPP B.: Az állami szintű katasztrófavédelem elemzési szempontjai nemzetközi környezetben. *Védelem Tudomány* 2, (2017/1) 263-284. p. <http://www.vedelemtudomany.hu/articles/19-papp.pdf> (downloaded 02. 10. 2017.)
- [7] KUTI R.: Milyen mentesítő anyagokat használjunk, milyen eljárásokat alkalmazzunk veszélyes anyag beavatkozások után? *Védelem Online: Tűz-és Katasztrófavédelmi Szakkönyvtár* 203, (2008) 1-6. p. <http://www.vedelem.hu/letoltes/tanulmany/tan203.pdf> (downloaded: 13. 04. 2017.)
- [8] MÉSZÁROS L.: *Pedagógia I. Egyetemi jegyzet*, ZMNE Budapest, 2004
- [9] HORVÁTH G., KUTI R.: Об опыте базовой подготовки профессиональных пожарных к проведению аварийно-спасательных работ в Венгерской Республике, УДК 614.8, АКАДЕМИЯ ГПС МЧС России (Москва 2011), 1-6. п. <http://agps-2006.narod.ru/ttb/2010-5/03-05-10.ttb.pdf> (downloaded: 13. 04. 2017.)
- [10] KUTI R.: Terrorcselekmények kárfelszámolási lehetőségeinek vizsgálata tűzoltói aspektusból, *Védelem katasztrófa- tűz- és polgári védelmi szemle*, XIV. / 3. (2007) 34-35. p. <http://vedelem.hu/letoltes/ujsag/v200703.pdf> (downloaded: 13. 04. 2017.)
- [11] FÖLDI L., HALÁSZ L.: *Környezetbiztonság*, Complex Kiadó Budapest 2009, 20.p.

- [12] HALÁSZ L., PADÁNYI J., FÖLDI L.: Improving the CBRN defence of combat vehicles as a response to the challenges of climate change, Economics and Management, Published by the University of Defence in Brno, VII. / 3. (2013) 31-38. p. <http://www.unob.cz/en/Eam/Documents/EaM%203-2013.pdf> (downloaded: 13. 04. 2017.)
- [13] PADÁNYI J., FÖLDI L.: Tasks and Experiences of the Hungarian Defence Forces in Crisis Management, CONTEMPORARY MILITARY CHALLENGES/SODOBNI VOJASKI IZZIVI 17 / 1. (2015) 29-46. p.
- [14] KUTI R.: Műszaki Mentések I.-II- Egyetemi jegyzet, ZMNE Budapest, 2007,
- [15] KUTI R.: Komplex műszaki mentések tervezésének lehetőségei, Védelem Online: Tűz- és Katasztrófavédelmi Szakkönyvtár, 233, (2010) 1-7. p. <http://www.vedelem.hu/letoltes/tanulmany/tan233.pdf> (downloaded: 13. 04. 2017.)