

Maastricht University

The Management of and Response to Incidents with Hazardous Materials in the Euregio Meuse Rhine

Bachelor Thesis

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Table of Contents

1. Introduction	3
1.1 The Euregio Meuse Rhine	4
1.2 Background	6
1.3 Research Question.....	7
2. Methodology	7
2.1 Limitations of the Study	8
3. Time Table	9
4. EU Framework	10
4.1 The Seveso Accident and its Ramifications	10
4.2 Civil Protection Mechanism	10
4.3 EU CBRN Action Plan.....	11
5. The System in Germany.....	11
5.1 History of Civil Protection in Germany	11
5.2 German Ambulance System	12
5.3 New Strategy for the Protection of the Population in Germany	13
5.3.1. Risk Categories and Care Levels	14
5.4. Governmental Levels and their Responsibilities	15
5.5 System in Practice	17
5.6 The work of the Analytical Task Force.....	19
5.7 Legal Background	20
5.8 Headquarters (Krisenstab)	20
5.9 Communication with the population.....	22
6. Experiences with the German system.....	22
7. Results.....	23
7. 1 A comparative analysis of the Dutch system.....	23
7.2 Cooperation in the EMR.....	25
7.2.1 Agreements in the EMR	25
7.2.2 Cooperation in Practice	26
8. Discussion, Conclusion and Recommendations.....	28
8.1 Discussion.....	28
8.2 Conclusion and Recommendations	31
Abbreviations	34
References.....	35

1. Introduction

The American Red Cross defines a disaster as „an occurrence (...) that causes human suffering or creates human needs that the victims cannot alleviate without assistance” (American Red Cross, 2007).

In order to react properly to a disaster, assessment of the current situation is the first necessary step. In disaster assessment, firstly, the impact which the hazard has had on a society needs to be determined. Then, needs and priorities for immediate emergency measures are set to save and sustain as many lives as possible. Finally, available resources are stated and possibilities for facilitating and expediting long-term recovery and development are explored (Sri Lanka Core Group for Disaster Management, 2005). It is the task of the responsible agency in the country to inform the authorities and the population about what is known and possible uncertainties. Decisions on how to deal with the situation must be made by the authorities to represent the population (BBK, 2010a). Assessment of needs and resources is necessary in all possible disaster scenarios, however, if responsible contact persons are already known, delivering appropriate care is tremendously simplified. Assessment is needed during all phases of a disaster. However, in the first phase the location and magnitude of the problem are assessed and then the responsible contact persons can take over. It is important to include all sectors and all likely affected areas and to identify the relationships among them (Sri Lanka Core Group for Disaster Management, 2005).

An important part of disaster management is emergency planning in case of incidents with hazardous materials (HAZMAT). HAZMAT substances can get into the environment both deliberately and accidentally and might become a danger to the population in the affected area (BBK, 2011a). Sometimes forces in the natural environment, such as wildfires and consequences of the global warming are also responsible for the release of hazardous materials into the air, as it was the case with the eruption of an Icelandic volcano in 2010. Toxic gases were produced and ash was spread, which hindered airplanes from flying and could have easily hampered emergency operations (Centers for Disease Control and Prevention, n.d.). In order to show the best possible reaction to such an incident, guidelines and emergency operation plans and procedures are necessary, as well as regular emergency preparedness activities and trainings. Especially during the first 24 hours, i.e. the acute phase, appropriate and well managed response is of high importance to protect as many people as possible (Centers for Disease Control and Prevention, 2011).

In case of HAZMAT incidents not only the direct location of the incident is affected: for instance chemicals in form of gas, fumes or liquids can easily travel to other places and do not stop in front of borders. Especially in case of terror attacks, not only local, but also regional or global effects can be the consequence, which require cooperation between different agencies and countries. This cooperation must be planned well for all possible scenarios, as the prediction of a disaster is basically not possible (BBK, 2010b).

1.1 The Euregio Meuse Rhine

The Euregio Meuse Rhine (EMR) gives home to nearly four million inhabitants, and includes the “Regio Aachen”, the German speaking part of Belgium, the Belgian provinces of Liege and Limburg, and the South of the Dutch province Limburg (Euregio MR, n.d.).

In North Rhine-Westphalia (NRW) alone, ten big chemical parks exist of which many are located in the Euregio Meuse Rhine (see map). Together they have a share of over 30% of total chemical sales in Germany (Fachvereinigung Chemieparcs/Chemiestandorte im Verband der Chemischen Industrie e.V., n.d.). In the years 2005 to 2008, more than 1000 traffic accidents with HAZMAT transporting vehicles occurred, of which 14% led to the release of hazardous materials (BBK, 2011b).



Map showing the 10 big chemical parks in North Rhine-Westphalia (Fachvereinigung Chemieparcs/Chemiestandorte im Verband der Chemischen Industrie e.V., n.d.)

In Belgium and the Netherlands the chemical industry plays an important role as well: In Belgium, 94 000 jobs are directly related to the chemical and life sciences industry and the Belgian chemical industry accounts for more than 6% of the total European turnover, while the share of the EU population is only 2% (essenscia - Belgian Federation for Chemistry and Life Sciences Industries, n.d.). In the Netherlands a significant growth of the chemical industry occurred over the past years, and now 64000 people are employed in this sector (Vereniging van de Nederlandse Chemische Industrie, n.d.). Some of the world's largest chemical companies are Dutch, for instance Akzo Nobel and DSM, which both have production sites in the Euregio.

Biological dangers, such as microorganisms and toxins, can appear in different forms and are not necessarily bound to a certain location (BBK, 2011c). Global warming might even lead to new toxins and microorganisms travelling to the EMR and representing unknown consequences and dangers for the future. This can affect animals and plants, and consequently the provision of food. If drinking water is affected, usually a large area is concerned directly. Lastly, also a terrorist attack using biological agents is a possibility, as it happened in the USA and other countries in 2001 with the anthrax letters (BBK, 2011c).

Nuclear power plants and radioactivity can also constitute a danger to the area. Even though in North Rhine-Westphalia no nuclear power plants are active anymore, radioactive material is still stored in the region (Stauber-Klein, 2011). In the Netherlands, one nuclear power plant exists in the South-East, however, the country is planning to extend the existent one and build at least one additional plant. In Belgium, a large-scale nuclear power plant is situated in Tihange, approximately 20km south-west of Liege, and located on the right bank of the Meuse (Stauber-Klein, 2011). With the Meuse running through the Netherlands, this is an increased risk for the area. Additionally, France transports radioactive waste to a temporary storage facility in Northern Germany once a year. This transport does not necessarily cross North Rhine-Westphalia, as the route is changed every year to reduce disturbances in form of protests. However, if this route is chosen, the Euregio might be affected in case of incidents on the way (Spiegel Online, 2011).

Due to the location of the EMR in Europe, many HAZMAT transports go through the area. This means an increased risk of accidents during transportation, which imply a risk for the population. Additionally, a big share of the chemical industry of the countries is located in the Euregio, which involves a significant risk of incidents at the production site. Because the EMR is densely populated (301 inhabitants per km² (interreg, 2001)), many people are affected in case of an emergency and the area could even become the target of terrorist

activities. Especially bioterrorism constitutes an increased risk (BBK, 2011c). Due to those factors, the Euregio has enhanced needs for HAZMAT emergency planning involving all three countries.

1.2 Background

In the EMR, collaboration is directed by the EMRIC+ project. In this project, partners from different institutions in Belgium, Germany and the Netherlands work closely together with fire and rescue services in the area and specialists for the different topics. One major topic of the project is HAZMAT incident management and risk communication (EMRIC+, 2011). While the EMRIC+ team already has knowledge of the Dutch system, the German and Belgian systems are not well known yet. In order to facilitate cooperation, EMRIC+ will launch an investigation into the German and Belgian workforce. This paper will only focus on the collaboration among the Netherlands and Germany.

In Germany, a new strategy for the protection of the population was published in 2002. Before that, after the Cold War, German agencies believed it not to be necessary to mobilize all protection systems at short notice. However, after the attacks on the World Trade Center in 2001, this perception changed and the new strategy was developed to protect the German population. Part of the strategy is to work together with the EU and use common coordination procedures in case of severe incidents (BBK, 2010b).

So far, Germany and the Netherlands have cooperated in some areas of disaster management, such as sharing of an ambulance helicopter and using of ambulances from the other country when this will be faster. Also, in case of a large disaster, patients are received in all the hospitals of the EMR. However, no specific agreements exist on HAZMAT incidents, neither during the acute phase nor regarding preventive measures (EMRIC+, 2011). This can also be seen clearly on the German site: The BBK states that different disciplines cooperate in Germany in order to develop concepts for HAZMAT emergency planning (BBK, 2011a) . However, no direct cooperation with other countries or among border regions is stated. One of the reasons for this is the different legislative systems in the countries. In the past, for example in the case of a large fire in the Netherlands, measurements were conducted both on the Dutch and the German side of the border, and different instructions were given to the population (Goertz & Prast, 2010). To avoid this in the future, better risk communication is necessary. The aim of the EMRIC+ project is therefore to gather more information on HAZMAT incident capacities in Germany and to support collaboration between the countries

in the EMR in case of these incidents. EMRIC+ encourages the exchange of best practices in the Euregio, however, only on a voluntary basis.

1.3 Research Question

As stated, it is of high importance for the EMR to develop a network of responsibilities in the case of HAZMAT incidents. This thesis will look upon the current situation and possibilities that exist for further collaboration. Additionally, the effectiveness of different approaches will be compared to find out which improvements are possible.

Therefore, the research questions of this thesis are:

1. How is HAZMAT emergency planning organized in Germany?
2. How can and do Germany and the Netherlands cooperate in case of HAZMAT incidents?
3. Which recommendations can be given to the EMR to improve collaboration and quality further?

2. Methodology

In order to answer the research questions, different materials were studied. The university library was used to find general literature and definitions. Due to the fact that frequent changes occur in HAZMAT management, no information about the current situation could be provided there, though. Thus, an extensive literature search was conducted online, including databases such as Pubmed and Google Scholar, to find recent articles about HAZMAT management. Additionally, websites of government agencies were used to find country specific information. To gain insight into the German disaster management system, brochures of the “Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK)” (federal agency for the protection of the population and disaster management) were studied and the website was looked upon closely to stay up to date with the current development. The website of the “Bundesministerium des Innern” (Federal Ministry of the Interior) was of importance, as the decisions of the federal government were explained extensively there. Additionally, the website of the “Bezirksregierung Köln” (district government Cologne) gave detailed information about specific procedures in the government districts and in NRW.

Furthermore, three interviews were conducted with responsible persons in the German part of the EMR. The institution provided the contact information to reach the relevant people and

acquire knowledge about HAZMAT emergency planning in the EMR. Four emergency doctors in charge were interviewed, one of them working as an emergency doctor in Aachen, one as the head of the emergency room of the academic hospital in Aachen, and the other two interviewees were emergency doctors within the Analytical Task Force in Cologne. All of them have studied at least a few semesters of chemistry and had already made personal experiences with HAZMAT incidents. The emergency doctors in Aachen both made frequent experiences with cross-border emergency help. The interviewees did therefore deliver much information and improved the research with personal experience.

Since the thesis was written during a placement at EMRIC+, information was also gathered through the placement there: at a large information event the different projects of EMRIC+ were introduced and information about cross-border cooperation was given. Additionally, different meetings of sub-projects were visited, and minutes of the previous meetings were read, to see the development of the cooperation in the Euregio.

Focus was also put on the effectiveness of the strategies and methods used in the countries. To do so, a comparative study was conducted, comparing the German to the Dutch system. With the help of insights of international cross-border best practices and standards, the effectiveness of the EMR system was evaluated and recommendations were given to improve the effectiveness and approaches used there.

2.1 Limitations of the Study

Practical work is different from the legal basis. Therefore, the structures described explain the way incidents should be handled in a theoretical and quite basic way. It is stated what the functions of the emergency services are and who responsible is. However, in practice this changes, as no incident is the same and different factors play a role in the control of disasters, such as a specific chemical set free or a special working environment like a nuclear plant. Hence, it can be tried to follow given structures; in the specific incident situation it is normal to digress from the common way, though. Thus, all strategies described are only theoretical and it cannot be expected that the practical work follows the same steps.

The number of interviewees was quite low with only four experts interviewed. However, they were partly from different fields and the experts in their specific area. Therefore, their opinion is important as they are more likely to change current processes and progresses in the HAZMAT medical field and they are working with these kinds of incidents more often than other emergency helpers.

It was tried to compare approaches used in the EMR to methods applied in other cross-border environments. However, due to time constraints and language barriers, it was not possible to do extensive research. The English articles and reports from English speaking countries found were very general and did not state any details. After researching the situation in the EMR this is understandable, though, as different methods are used not only in other countries but already in other fire departments. Thus, it is not possible to generalize any specific approaches used in one country and compare them with another country. Only general recommendations were given for cross-border cooperation, such as establishing or improving communication between countries. Since this advice is the same for the EMR, it did not seem to be necessary to describe it for general cooperation among countries. Additionally, all experts interviewed stated that in their opinion the disaster management in the EMR is already on a very high level and that the countries involved cannot necessarily learn from other countries, but are more of a good example for other cross-border cooperation situations.

3. Time Table

The thesis was written between February and July 2012. Since a placement within the EMRIC+ project was strongly connected to the research activities and thereby with the writing of the thesis, no specific time frame could be set in advance. It was decided together with EMRIC+ which interviews were conducted and the date they were conducted. However, an approximate time frame can be given.

Development of research proposal	January
Extensive literature review	January - March
Selection of instruments for data collection	February – March (in collaboration with EMRIC+)
Data collection	February – May (in collaboration with EMRIC+)
Conducting interviews	May
Analysis of data	February – June (in collaboration with EMRIC+)
Writing of thesis	May - July
Reporting of findings	Presentation for GGD Zuid-Limburg on June 19, EPH conference on June 21, written thesis in July

Due to the fact that another bachelor thesis was written within the same project focusing on the cooperation between the Netherlands and Belgium, this thesis puts main focus on Germany. The German system is explained in detail and compared in relevant points with the Dutch system. The cooperation in the EMR is explained from a German point of view, meaning that the cooperation between Germany and the Netherlands, and Germany and Belgium is outlined.

4. EU Framework

4.1 The Seveso Accident and its Ramifications

In 1976, a serious accident occurred at a chemical factory in Seveso, Italy, releasing large amounts of dioxins. An area of 15 km² with 37 000 inhabitants was contaminated. The health effects, however, are not completely clear, as no appropriate exposure assessment was performed (World Health Organization, 2010). As a result to this incident, the EU Directive 82/501/EEC – the so called Seveso directive – was adopted, aimed at the prevention and control of such accidents. To include more chemical facilities, the first directive was replaced by the so called Seveso II directive, the Council Directive 96/82/EC¹, which was later on extended further (European Commission, 2012a). A proposal for a successor directive was adopted in 2012, which will come into force in 2015, especially introducing stricter standards for inspections and strengthening public access to safety information (European Commission, 2012b). The Seveso incident, thus, brought attention to HAZMAT incidents and the prevention of them in all of the EU member states.

4.2 Civil Protection Mechanism

In 2007, a Community civil protection mechanism² was established in order to improve the coordination of civil protection in case of large scale incidents, occurring or threatening to occur both inside and outside the EU. A Monitoring and Information Centre (MIC) was established which stores information about the available assistance and intervention teams in the EU countries. In case of a large scale disaster, the MIC can be contacted by the affected country in order to establish contact to suitable intervention teams in the EU. A Common Emergency Communication and Information System (CECIS) was developed to simplify and

¹ Council Directive 96/82/EC: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0082:EN:HTML>

² Council Decision of 8 November 2007 establishing a Community Civil Protection Mechanism: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:314:0009:0019:EN:PDF>

improve the communication between the EU and the countries' contact points. Also, lessons that were learned during an intervention are collected by the MIC and spread through the participating countries to improve the quality in the future (European Union, 2010)

4.3 EU CBRN Action Plan

In 2009, the Council of the European Union published the EU CBRN Action Plan, which deals with strengthening chemical, biological, radiological and nuclear (CBRN) security in the EU. In the area of prevention, the action plan asks to prioritize high-risk CBRN materials and the related facilities, and to focus on the safety surveillance of these. Also, it is stated that detection standards for the EU will be developed and the exchange of best-practices among the EU countries will be encouraged. Existing measures, including emergency planning, will be further developed to assure an appropriate response to CBRN disasters. The all-hazard approach should reduce the threat of and damage from CBRN incidents, whether they occur accidentally, naturally or intentionally (European Parliament, 2010). The Action Plan also brought focus back to HAZMAT incidents among the EU countries and actively involves them in analyzing possible hazards.

5. The System in Germany

5.1 History of Civil Protection in Germany

After World War II, no measures of civil protection were installed in Germany. It was only possible to protect the population after the Federal Republic of Germany was founded in 1949. One year later, a first commission was established, the "Kommission zum Schutz der Bevölkerung gegen atomare, biologische und chemische Angriffe" (commission for the protection of the civil population against atomic, biological and chemical attacks), today called "Schutzkommission beim Bundesministerium des Innern" (Protection Commission with the Federal Ministry of the Interior) (BBK, 2012). Also the "Bundesanstalt Technisches Hilfswerk (THW)" (German federal agency for technical relief) was developed in 1950, relying almost exclusively on volunteers (THW, n.d.). Amendments to the basic law in 1956 allowed Germany to build up federal armed forces, which have the competency to legally decide on the measures of civil protection. These amendments were a prerequisite for finally building up a civil protection system. In 1957 the first legal act about measures for the protection of the civil population was published and a first federal agency for civil protection was established (BBK, 2012). However, the attacks in New York on September 11, 2001 led

to a renewed focus on the need to protect the population (Baltus, 2012). As a response to this and the major flooding in Eastern Germany in 2002, the “Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK)” (federal agency for the protection of the population and disaster management) was established in 2004. This is now a central organization of general civil protection (BBK, 2012). Due to events involving many people, namely the World Youth Day 2005 in Cologne, and the soccer World Cup in 2006 in all of Germany, strategies were developed to rescue many possible victims and involve help from regions not directly involved in the incident (Baltus, 2012). However, Germany is dependent on volunteers for civil protection: in whole Germany, the volunteer fire brigade consists of 1.3 million members and the THW of 80 000 volunteers. Additionally, medical help relies on the half million volunteers of the „Deutsches Rote Kreuz (DRK)“, „Arbeiter-Samariter Bund (ASB)“, „Deutsche Lebensrettungs-Gesellschaft (DLRG)“, „Johanniter Unfallhilfe (JUH)“ und “Malterser Hilfsdienst (MHD)” (Bundesministerium des Innern, 2012a).

5.2 German Ambulance System

The ambulance system that applies in case of “normal” accidents is also used for incidents with hazardous materials. This system is a two-tier emergency system: To each emergency a rescue vehicle with ambulance attendants responds. However, in severe cases the emergency doctor comes in a separate emergency response vehicle or by rescue helicopter (BAND, n.d.). Emergency doctors are usually trained surgeons, anesthetists or internists. They typically receive special training which allows them to work as emergency doctors. They work in the pre-hospital field only and treat the casualties right at the accident site (however, for German emergency physicians only 13% of operations are accident related, the majority of actions take place because of medical emergencies) (BAND, n.d.). Because of the two-tier system, the emergency doctor is often the first person to arrive on the site of accident. The emergency physician then treats the victims in such a way that they can be transported by the rescue vehicle to a hospital and receive further care there. For that, all potentially necessary medications are in the emergency response vehicle and accompany the doctor. If necessary, the emergency doctor can leave to another accident right away and does not always accompany the rescue vehicle to the hospital (BAND, n.d.).

The second tier is the rescue vehicle with ambulance attendants. They come in case of not very severe accidents to help the victims, however, also in case of severe accidents to support the emergency doctor and to transport the patients to a hospital. Ambulance attendants have not the same status as emergency doctors, by law they are not allowed to administer all

pharmaceuticals and treatments. Nevertheless, they sometimes treat patients in ways they are not allowed to, to ensure the survival of the patient before the emergency doctor arrives or if the situation is more severe than expected. However, this is their own judicial risk (Bundesärztekammer, 1992).

5.3 New Strategy for the Protection of the Population in Germany

After the attacks of 9/11 and the major flooding in Eastern-Germany in 2002, a new strategy to protect the population was developed in 2002, the “Neue Strategie zum Schutz der Bevölkerung in Deutschland” (new strategy for the protection of the population in Germany) (BBK, 2010b). In there it is stated that the local level is responsible for combating daily dangers, and the responsible levels raise in accordance with the danger level. Thus, the states support the local level in both provision of material and defense against endangerments. Since 2002 both federal government and states have a common responsibility including coordination, information, guidance and provision of resources in case of large scale incidents. The incidents for which the federal government has main responsibility are classified as dangers through natural disasters such as hurricanes and floods; dangers through large accidents, also with dangerous goods; dangers through large scale industrial incidents (including chemistry, biotechnology, nuclear plants); dangers through pandemics; and dangers through international terrorism (Bundesministerium des Innern, 2012a). In order to combat these dangers, the federal government has own resources, which are also used by the states in their own defense systems, and helps in case of supra-regional incidents with the workforce of the THW, the federal police, and possibly the federal armed forces (BBK, 2010b).

The strategy depicts six major flaws in the current situation: lacking sensibility and awareness of the complexity of the topic by politicians; missing common danger and risk analyses; unavailable aligned alarm and action plans; absent quickly deployable detection and analysis techniques; incomplete warning and information system for the population; and not extensively enough developed media and public relations (BBK, 2010b). The strategy suggests different measures to combat these flaws, and some have already shown success in the previous years. Therefore, the main aims stated in the strategy are the comprehensive and effective protection of the population and their basis of existence; the continuous guarantee of safety and order; and an as fast as possible restoration of the familiar social and economical ways of life in all areas in case of an incident (BBK, 2010b).

5.3.1. Risk Categories and Care Levels

In the strategy it is illustrated that the risk of large scale incidents and dangers increases regionally with the amount of people living or employed there, with critical infrastructures, and present industry and technology. Therefore, larger cities agglomeration areas are of higher risk for planned incidents than regional areas, which are more in risk of infrastructure destroying natural events (BBK, 2010b). Thus, the strategy states different risk categories or protection and care levels respectively. These categories are categorized from level I to level IV.

Risk level I consists of the comprehensive, standardized protection through the fire department, ambulance services and others against daily dangers. Risk level II includes uncommon dangers, which can usually be averted with the available emergency services. Risk level III means an enduring increased local or regional special protection for establishments, localities and areas with considerably increased risk. Risk level IV, eventually, is a declared special protection through exclusive special operative provision (such as Task Forces) and infrastructures (centers of expertise) of exceptional danger levels, determined through federal government and states (BBK, 2010b). The special protection forces of level IV need to be deployable supra-regionally.

For the medical care also four levels exist: Care level I includes basic and regular care in the protection against daily threats. Care level II contains basic and regular care for special situations and involves the civil and disaster protection forces. Level III implies special care at locations with a higher risk for dangers such as large cities and areas with industry and critical infrastructures or special traffic systems. In these areas the basic and regular care is quantitatively and qualitatively enhanced, and helpers receive special training. Care level IV implicates exclusive medical special care, for that the presence of a Task Force dealing with chemical and biological dangers and the specific medical knowledge of the experts is needed (BBK, 2010b).

The levels of risk protection and medical care correspond to each other (BBK, 2010b).

The local level is responsible for deciding when which phase starts. This is necessary, as e.g. when there is a major accident in a small village help from other emergency services is needed right away. However, in case of such an accident in a bigger city, the local emergency services can deal with the problem themselves (Baltus, 2012).

5.4. Governmental Levels and their Responsibilities

The responsibilities in Germany and more specifically in the EMR are quite complex. For an easy overview, they are explained in table 1.

As stated before, the federal government is only responsible for civil protection and the states are responsible for disaster protection (Bundesministerium des Innern, 2012b). Before 2009, this was strictly separated. However, the states asked the federal government to also take some responsibility and action not only in the case of defense, but also to help in case of natural disasters, major casualties and terroristic attacks. A law³ taking this up became operative in April 2009. Now the federal government helps the states in case of these major incidents, and the states can plan in all the resources of the federal government for their own disaster management plans (Bundesministerium des Innern, 2012c).

The core of the crisis management in Germany lies on counties, the Kreise and kreisfreie Städte. In NRW, there are 30 Kreise, 22 kreisfreie Städte and the Städteregion Aachen. They are responsible for comprehensive ambulance services and regularly make plans stating the number and locations of ambulance stations and their operative area, the number of necessary ambulance coaches and emergency doctor's vehicles and their hours of operation, the time in which the first means of qualified care has to arrive at the place of emergency, and further quality requirements (Bezirksregierung Köln, 2011). Kreise have the possibility to employ private companies for ambulance services to supplement the ambulance service of the Kreis. However, specifically set conditions apply. The Bezirksregierung is responsible for examining whether the measures taken by the Kreise are working and are sufficient or not, and they can check this at any time. Also, the Bezirksregierung is the connection between the Kreise, responsible for ambulance services, and the Ministry of Health, Emancipation, Nursing and Aging of NRW (Bezirksregierung Köln, 2011).

Generally, it can be said that the higher the complexity of the incident, the higher the level in the government to give advice and support the lower governmental agencies. The federal government takes responsibility in the state of defense (BBK, 2010d).

³ Gesetz über den Zivilschutz und die Katastrophenhilfe des Bundes (ZSKG) (law regarding the civil protection and disaster assistance of the federal state): <https://www.denis.bund.de/luekex/info/06866/Zivilschutz-%20und%20Katastrophenhilfegesetz.pdf?PHPSESSID=a0f946630f2c9c9ed834286d1824dd1a>

English term	German name	Explanation	Responsibilities (in the EMR)
Federal State/ Federal Gouvernement	Bundesebene		Bundesministerium des Innern (BMI): Sets framework for civilprotection (Zivilschutz und Katastrophenhilfe-gesetz), contents are filled and maintained by BBK BBK: Gives advice to and supports state and county level
State	Bundesland		NRW (North Rhine-Westphalia) - Landesgesundheitsministerium (state health ministry; takes care of hospital emergency plans) - Landesumweltamt (state environment agency; includes all environmental compartments)
Upperregional/ Government districts	Regierungsbezirk	Governed by the “Bezirksregierung“ (district government) and led by the “Regierungspräsident” (literally government president)	Regierungsbezirk Köln (Cologne) is responsible for the German part of the EMR - Chemical laboratory - Analytical taskforce
Counties/ Districts	Kreise and kreisfreie Städte	<ul style="list-style-type: none"> • Kreise consist of some villages aggregated in one district and have together one district government • kreisfreie Städte are 	<ul style="list-style-type: none"> • Städteregion Aachen (since 2009), a fusion of the former Kreis Aachen and kreisfreie Stadt Aachen • Kreis Düren • Kreis Euskirchen

		larger cities (usually more than 100 000 inhabitants) with their own government	<ul style="list-style-type: none"> • Kreis Heinsberg ➔ Working voluntarily together as the REGIO Aachen e. V. (Regio Aachen, n.d.)
Local level	Städte und Gemeinden		<ul style="list-style-type: none"> • Gesundheitsamt (identical to municipal health service NL) • Environmental department

Table 1. Governmental levels and their responsibilities in Germany.

The state NRW supports the municipalities and private aid organizations financially regarding fire and disaster protection. In 2004, 67 million Euros were spent for these purposes, of which 34 million were generally used for investments in whole NRW, and the Regierungsbezirk Köln received 7,8 million specifically (about the same as in the previous years) (Bezirksregierung Köln, 2008).

5.5 System in Practice

In case of large incidents with chemicals, the following is the normal order of happenings in NRW. Firstly, the steps are explained and in the next section the legal background for these steps is given.

The incident commander (IC) is responsible for all steps taken, however, in practice he is supported by experts of other fields to make good decisions. Usually the IC is part of the fire department, as they normally arrive first on the site of incident. After taking in the situation, the IC can order more personnel if needed. The IC is also responsible for the risk assessment, even if he is not trained in this area. However, there is usually a chemical expert from the fire department who can analyze the situation and gives advice to the IC. He can also state risk levels for the specific chemicals (Baltus, 2012).

In case it is not clear which chemicals have leaked it is possible to request an analytical task force (ATF) to the place of incident (described in section 5.6). If it is or becomes necessary, the IC publishes an announcement for the population (via Bezirksregierung and Innenministerium), which can be spread via radio and TV to warn the population. In some cities, e.g. in Aachen, sirens are still available that can be started to make people turn on their radios (Baltus, 2012).

The medical side of HAZMAT incident management in Germany is somewhat problematic (Baltus, 2012): The emergency doctors usually arrive before the chemical expert from the fire department and have to treat patients affected by chemicals. However, often they do not have much knowledge about chemicals, yet have to judge about the treatment methods. Additionally to the first knowledge of the fire department, “Giftinformationszentralen” (toxin information centers) can be called. The problem is that they usually only deal with single chemicals and not with mixtures of chemicals or extremely large amounts. Nevertheless, for these cases the chemical industry has developed its own information system, TUIS (“Transport- Unfall – Informations – und Hilfeleistungssystem”; transport, accident, information and assistance system). They have three ways of helping: 1. Advice via telephone, 2. Expert (usually chemist) comes to incident site, 3. Works fire brigades of chemical companies come to help the local fire department (they can only be requested from authorized people such as police and fire department) (Verband der Chemischen Industrie, 2012). However, this help is normally for the fire service side and not necessarily for the medical side (Baltus, 2012). Another way to gain more information is via deNIS (“deutsches Notfall Informationssystem”, german emergency informationsystem). There, the headquarters of the emergency services can access scientific data about a variety of chemicals and communicate with each other (BBK, 2010e). The headquarters can also contact the German weather services to check the changes in wind and weather for specific areas (Baltus, 2012). Additionally, some parts of the deNIS website are open to all visitors and show different information about how citizens can help themselves, and where they can find further information, not only about HAZMAT incidents, but general information about health, the organization of emergency systems and the situation in other (European) countries (BBK, 2010e; deNIS, 2012).

In case decontamination becomes necessary, there are more than 50 decontamination places in NRW with a capacity to decontaminate 50 people per hour (Innenministerium des Landes Nordrhein-Westfalen, 2008). Including build-up and getting to the site of incident it can take up to two hours before the first patients can be treated (Baltus, 2012).

In case of large incidents not only the IC is responsible, but an incident command consisting of experts from different fields is in charge. In case of large incidents affecting more than one Kreis or kreisfreie Stadt, the Bezirksregierung forms a “Krisenstab” (crisis committee), the head of which is the political leader of the area (Bezirksregierung Köln, 2008).

5.6 The work of the Analytical Task Force

As decided in June 2002 in the “new strategy for the protection of the population in Germany”, the resources available in the country are spread in a way based on the actual need in different regions (BBK, 2010c). For this allocation, four different levels exist, including the normal measurement systems of the municipalities, special exploration trucks in normal areas and at focal points for possible threats, up to the provision of Analytical Task Forces (ATF). Since July 2010, seven ATFs are spread in Germany, of which two are located in NRW, in Cologne and Dortmund. The other ATFs are located in Munich, Mannheim, Heyrothsberge in Saxony-Anhalt, Berlin and Hamburg. These locations were chosen because of the already existent experience and chemical knowledge of the staff. The ATF in Cologne is the closest to the EMR and therefore usually responsible for HAZMAT incidents there.

The main task of ATFs is a fast analysis in case of large scale incidents with dangerous substances: For that, personnel with scientific backgrounds and much experience in HAZMAT incidents travels with mobile measurement stations to the incident site. Due to the scientific background of the personnel, a complete assessment of the measurement results is possible and concrete advice to manage the situation can be given. More specifically, the ATF advises the incident commander, detects and identifies chemical substances, monitors large areas via remote sensing, assesses the situation and predicts the development, and suggests appropriate measures. The focus of the ATF are analytics, the logistics that are needed have to be provided by the requesting incident site, such as power, decontamination facilities, and general treatment (BBK, 2010c). The ATF normally arrives with their own emergency doctors, though, who are specialized in and experienced with HAZMAT incidents (Blomeyer & Lechleuthner, 2012). The incident commander is still responsible for all decisions and the ATF only gives advice.

Because specific protections against threats can only be introduced when the hazardous substance is exactly known, the ATF is equipped with modern and mobile measurement devices. With them, it is possible to identify aerially, liquid and solid substances and often also substance composites. These devices include, among others, gas chromatographs, infrared spectrometers, and infrared remote sensing systems.

Because the EMR is located in NRW with two ATFs, incident commanders there can request the ATF directly, while ICs in other federal states without an ATF have to go via a specific agency of the federal government, located within the BBK (BBK, 2010c). The locations of the ATFs were also chosen in such a way that every region in Germany can be reached within two to three hours. Cities in the EMR are usually reached faster, normally within an hour

(Brokmann, 2012). So far, the ATF in Cologne has not had any operations outside Germany, Blomeyer and Lechleuthner (2012) believe that this should easily be possible, though. The “new strategy for the protection of the population in Germany” also states that the federal republic of Germany will offer the ATF’s services Europe-wide via the Civil Protection Mechanism (see section 4.2) (BBK, 2010b).

5.7 Legal Background

The “Gesetz über den Zivilschutz und die Katastrophenhilfe des Bundes (Zivilschutz- und Katastrophenhilfegesetz – ZSKG) “⁴ (law regarding the civil protection and disaster aid of the federal government (civil protection and disaster aid law)) regulates the tasks of the federal government regarding civil protection and regulations under international law, including self protection, warning of the population, measures for the protection of health, helping organizations and helpers and their legal relationships, the costs of civil protection, and others (ZSKG, 1997). There, it is stated that the federal government is responsible for civil protection in the state of defense, and only supports the states in CBRN protection. The administrative tasks of the federal government are allocated to the BBK (§4). Furthermore, it is stated that the federal government complements the equipment of the states needed in fire control, CBRN protection, and medical services organization and care (§13). The responsible agencies according to state law can order that hospitals prepare operation- and alarm plans for health care (§21). The federal government bears all additional costs that arise for the states and districts through this law (§29). Regarding CBRN protection, the federal government pays for (1) the placement of vehicles and personal CBRN equipment, (2) the examination and education of helpers, and (3) the guarantee that the ATFs are always in operational readiness to support the local incident commander in complex CBRN situations (ZSKG, 1997).

5.8 Headquarters (Krisenstab)

In case of large incidents, the mayor or county commissioner is politically responsible. For the coordination of administrative measures he receives help from the “Krisenstab der Verwaltung” (headquarter of administration) and for the coordination of operational measures on the spot he is supported by the “Führungsstab/Technische Einsatzleitung” (operational

⁴ Gesetz über den Zivilschutz und die Katastrophenhilfe des Bundes (Zivilschutz- und Katastrophenhilfegesetz – ZSKG), originally from 25.03.1997, lastly amended through article 2 no. 1 on 29.07.2009: <http://www.gesetze-im-internet.de/zsg/BJNR072610997.html>

headquarter/ technical incident command). Depending on the incident, the headquarters are differently composed, sometimes also including experts of corporations of critical infrastructures (BBK, 2010d) .

It needs to be differentiated between headquarters on the local level and the state government. As stated before, on the local level the mayor is politically the leader and mandates the leader of the headquarter, who then chooses further members (Innenministerium NRW, 2005). On state level, the tasks of the headquarters are undertaken by the coordination group of the state. There, administrative-organizational and operational-tactical fields of duties are combined in one group, with a focus on administration but highly supporting the operational side of the incident command (Innenministerium NRW, 2005). On all levels, 24-hour ability to act must be ensured. Headquarters are only constituted for a limited amount of time after a large incident, or when there are more than normal coordination and decision needs. However, the headquarters do not make any operational decisions, as these are made by the incident command. For the cooperation of headquarter and incident command it is important that information about the situation is exchanged frequently. To support this, they should be located in spatial proximity and dispatch exalted delegates as contact persons. They do not influence the work of each other, though, and if conflicts should arise, the political leader becomes responsible for making decisions (Innenministerium NRW, 2005).

In the coordination group on state levels different domains exist: the 'interior commission' is responsible for securing the working ability through organizing rooms and personnel; the section 'situation and documentation' documenting the decisions and developing prognoses; the domain 'citizen information and media' works with the press and also analyzes available information from the media; the 'permanent members' are liaison officers of the police and delegates from different administration levels and areas such as security, health or environment who are competent to give a ruling and prepare administrative decisions, while being contact persons to their sending institution; and the 'incident specific members' who are called upon in specific occurrences, share their professional expertise in either the coordination group or the incident command, never both (Innenministerium NRW, 2005).

Additionally, there is the interdepartmental coordination group. This group is composed of representatives from both the federal government and states, and partly from the economy, and works as an advisory body. Different groups are composed of experts from specific fields, so that they can give recommendations and help with their expertise in specific domains. However, because of the very differently organized structures in all states and economy, the

help of the interdepartmental coordination group can only be requested if specific agreements on how to communicate and help were arranged long beforehand (BBK, 2010d).

5.9 Communication with the population

The warning of the population in case of large scale incidents is somewhat problematic in Germany: since the removal of the previously comprehensive siren network after the Cold War and no compensation, there is no robust and dependable system to warn the people (BBK, 2010b). Even though sirens are still in use in some cities, not all of the German population can be reached this way (Baltus, 2012). Another major problem is the fact that a large majority of the people has neither theoretical nor practical knowledge, nor experience in self-protection and self-help. They trust in a smooth danger management of the emergency helpers and do not keep in mind that this might not work in case of a large incident (BBK, 2010b). Even if the population can be warned, it is thus not ensured that people also know what to do and react appropriately.

One important measure to solve this problem has already been introduced right after the attacks of 9/11: the satellite-based warning system SatWaS can be used to spread news within seconds over all radio stations in Germany, both public and private (Bundesministerium des Innern, 2012d). Additionally, many internet providers and press agencies joined the system. The German railway company is also informed right away, so that necessary warnings can be given to train drivers and passengers. For the future a possible expansion will be to also include mobile networks so that all people with a mobile phone in this network receive a text with the warning and rules of conduct. However, so far this is only a possibility in the future (Bundesministerium des Innern, 2012d).

6. Experiences with the German system

All experts in the field who were interviewed are convinced that the system in Germany has improved over the past few years. The decisive factor for that seemed to be the attacks of 9/11 as well as large events that took place in Germany, such as the World Youth Day in 2005 or the World Cup in 2006. However, there is still a lot that needs to be done. The relation between science and practice still needs to be improved, as sometimes poor decisions are made. An example is the case of the anthrax letters sent in Germany: instead of having as few helpers getting in touch with it as possible, a large team was sent to remove the letters (Baltus, 2012). Due to the introduction of the ATFs, the analytics in general were improved and more

research was done in that area. Also, this launch drew more attention to the topic of averting HAZMAT incidents in general. However, Baltus (2012) believes that the ATFs seem to be not that well developed in all areas yet. Nevertheless, it might only seem this way in some locations, as there are only few ATFs in Germany and, thus, ATFs are only infrequently used in regions located further away from, in the case of the EMR, Cologne. This relation between science and daily activities seems to be especially problematic in the case of the voluntary fire departments, as volunteers there generally have a normal day job and assist the fire department only when necessary.

The distribution of the decontamination containers in NRW has also contributed to the increase in attention given to HAZMAT incidents. Furthermore, all locations receiving such a container also underwent special training so that the helpers there are better prepared in the case of an emergency. Nevertheless, as the training with the decontamination containers is an additional task, not all regions might be willing to spend extra time on it and, thus, forget about the training received. Especially in fire departments with a lot of other tasks, the interest might be very low (Baltus, 2012). Another weak point might be that some materials in the containers need to be exchanged frequently, and this might become quite expensive over time. Even though the containers were very well equipped when they were allocated, the renewals of material in the future need to be paid at the local level.

Due to the fact that all emergency doctors in charge receive special HAZMAT education during their trainings, the medical knowledge should be high enough to treat patients in case of these incidents. However, as HAZMAT incidents only happen rarely, it might only be theoretical knowledge and not actual experience. Thus, the ATFs with a lot of experience in the field can really help and improve the situation for patients.

7. Results

In this section, the German system is compared in relevant points to the Dutch system. The points chosen for comparison relate to the cooperation in the EMR and differences in the systems that might lead to problems in working together. Also, specific agreements that exist already are explained shortly to give some information about the legal background.

7.1 A comparative analysis of the Dutch system

In the Netherlands as well as in Germany, the fire department is responsible for measuring the exposure of, for instance, a chemical in case of a HAZMAT incident. However, in the

Netherlands, the GAGS then take over and assess the toxin and its effect and the risk for the population and patients, both short- and long-term. The GAGS are experts in environmental medicine and can thus estimate the health risks and also make sure that the symptoms stated by the patients are in accordance with the symptoms that should in theory be produced by the chemical as identified. If it is not in accordance, another trigger has to be looked for to figure out which chemical has leaked. There is also the possibility that many people show symptoms without knowing that a chemical even got released, and then the GAGS conclude which kind of chemicals were released based on the symptoms described. In some sense, the GAGS can be seen as the point of connection between the fire department and the doctors actually treating the patients, and suggest which steps should be taken (Gielkens, 2012). As such, they can be compared to the emergency doctors of the ATFs who have advanced knowledge about chemicals and the health effects. However, the GAGS do not treat patients. Another difference is that they often give advice by telephone and do not always travel to the site of incidence. GAGS also make sure that the follow-up steps of the health department are appropriate and sufficient for the situation. This is in contrast to Germany, where the health department takes over after the acute phase and makes the decisions from that point on. The 24-hour stand-by of the GAGS ensures that (medical) knowledge can always be requested. In comparison to that, the public health department in Germany cannot always be reached and does also not always have the expert knowledge. However, all emergency doctors in charge learn about HAZMAT incidents during their training and should therefore know at least the basics (Brokmann, 2012).

Another difference is the GRIP structure, in which HAZMAT incidents are classified into GRIP levels 0 to 5. The GRIP structure is multi disciplinary, i.e. police, fire department and medical services are included. GRIP 0 includes normal daily work of the operational services, such as a small fire with chemicals. The more severe the incident is or the larger the area affected, the higher the GRIP level. GRIP 3 comes to pass when the health of a large group of the population in one area is affected, e.g. in the case of a fire involving asbestos. The levels GRIP 4 and 5 start when the incident crosses the gemeente and the provincie border, respectively. Depending on the GRIP level, it is clear who exactly needs to be informed of the incident. The GAGS usually are called from level 1 to give advice (or sometimes also for GRIP 0 if it is not clear which chemicals are involved). In the case of higher levels, they sometimes also travel to the site of incident to give advice on the spot (Gielkens, 2012). Such a structure specifically for HAZMAT incidents involving all operational forces is missing in Germany, as explained in section 5.3.1.

7.2 Cooperation in the EMR

The cooperation in the EMR is based on agreements between the countries that ensure the legality of cross-border help. However, these agreements are only basic. In practice, the cooperation in the EMR goes far beyond what is made explicit in the agreements.

7.2.1 Agreements in the EMR

An agreement between Germany and the Netherlands exists on mutual assistance in the event of disasters including serious accidents. It is called the Gensch agreement⁵. However, in this agreement it is stated that the emergency services in the border regions have to make own agreements with each other regarding cross-border cooperation (Genscher Abkommen zwischen der Bundesrepublik Deutschland und dem Königreich der Niederlande über die gegenseitige Hilfeleistung bei Katastrophen einschließlich schweren Unglücksfällen, 1988). In the EMR the EUMED project deals with medical cross-border cooperation in case of large-scale incidents. In this cooperation different EUMED alarm stages are known to all partners and helpers from across the border, and appropriate help can be demanded clearly and easily (EMRIC+, 2012). However, this project only deals with medical personnel and “normal” accidents. There is no agreement on helping in HAZMAT incidents or exchange of knowledge regarding chemicals in case of such incidents.

For the cooperation between Belgium and Germany, two agreements exist: the Mainz agreement⁶ involves two border states in Germany (NRW and Rhineland-Palatinate) and the Walloon region in Belgium (including the German speaking part). Additionally, there is the agreement between Germany and Belgium regarding mutual help in case of disasters or major accidents⁷. However, the former only regulates cooperation between the two countries legally, and states which measures need to be taken before cooperation can occur (Abkommen zwischen dem Land Nordrhein-Westfalen, dem Land Rheinland-Pfalz, der Wallonischen Region und der Deutschsprachigen Gemeinschaft Belgiens über grenzüberschreitende Zusammenarbeit zwischen Gebietskörperschaften und anderen Öffentlichen Stellen, 1996). The latter is more specific and states that both signatory parties are committed to help each other in the case of disasters or major accidents accordingly to their means and the clauses of this agreement. Assistance in the domains of combating atomic and chemical dangers, and medical help is stated specifically. It is also stated that a continuous, strong cooperation

⁵ Gensch agreement: <http://www.ifrc.org/Docs/idrl/I147DE.pdf>

⁶ Mainz agreement: http://www.espaces-transfrontaliers.org/de/publikationen/accord_de_mainz.pdf

⁷ Agreement between Germany and Belgium: <http://www.ifrc.org/Docs/idrl/I475FR.pdf>

between the two countries has been established and that knowledge will be exchanged through, among other things, the organization of conferences on specific issues of relevance. It is also mentioned which materials must not be brought over the border into the other country, and how the costs for the operation are handled (Abkommen zwischen der Bundesrepublik Deutschland und dem Königreich Belgien über die gegenseitige Hilfeleistung bei Katastrophen oder schweren Unglücksfällen, 1982).

7.2.2 Cooperation in Practice

A recent example illustrates the cooperation in practice: At Chemelot near Sittard/Geleen, nitrogen was released, and a cloud of nitrogen dispersed over Dutch Limburg. After an hour, the Dutch fire department announced that the cloud left the Netherlands and was now over Belgium, and people in the Netherlands did not have any complaints. However, since Belgium's topography is higher, the people there did have complaints. This is a typical example where cooperation should be improved: fire departments should inform their colleagues across the border as soon as possible so that they can start preparations and inform the population about a coming danger. Even though an incident might not lead to problems in one region, it can easily do so in another region (Blomeyer & Lechleuthner, 2012; Gielkens, 2012).

In theory, headquarters inform each other right away when there is an incident that might affect the other side. However, it is not clear if it always works in practice the way it should (Baltus, 2012; Brokmann, 2012).

There are no specific agreements or regulations regarding medical help in the case of HAZMAT incidents, but there are agreements on general cooperation that might also be used in these specific cases. However, especially with Belgium, many topics seem to be not regulated yet, for instance the transport of patients, neither on the financial side nor on the patient allocation side. Brokmann (2012) stated that from his own experience as an emergency doctor crossing the border, the Belgian system would need more clarity for foreign emergency helpers: It seems to be problematic to give clear instructions to foreign helpers about which hospitals should be approached, and sometimes money issues arise even though it is clearly agreed upon how the financial side is organized. In case of large incidents, it works out somehow, but the situation is far from being as well regulated as the cooperation between the Netherlands and Germany (Brokmann, 2012). Due to the different levels and authorities in Germany, the German system seems to be quite complex. Blomeyer and Lechleuthner (2012) believe that this seems to be better organized in the Netherlands, as the

organization is on a more central level. Generally it is agreed, though, that the cooperation in the EMR is much better than in other cross-border regions. Especially the cooperation between Germany and the Netherlands is working well due to good coordination. The cooperation with Belgium works well on a practical level, but there is no coordination of operating principles yet (Brokmann, 2012). Most situations work really well in practice, the only problem is to make contracts or agreements between countries beforehand (Blomeyer & Lechleuthner, 2012). The same troubles exist with the exchanging of data: Data protection in Germany is regulated in laws for each state, whose laws are quite far-reaching, and therefore inhibitive of cross-border data sharing. For specific cases there are laws that open up the data protection and it is only problematic for special circumstances for which there is no additional law. However, this is also the case in exchanging valuable information about HAZMAT incidents. The exchange therefore happens in practice as well, but is legally very complicated, also due to the fact that the laws are very hard to understand for individuals (Blomeyer & Lechleuthner, 2012).

When it comes to treating patients, there are no problems, as the rule is normally that everybody treats the patients in such a way as it would also be done in the home country. It would be helpful, however, for involved parties to know whether there are specific regulations applicable in proximal countries, not only in regard to treating patients but also regarding other rules. For example, it is not always clear what happens with the water used in a decontamination container: can it just be emptied out into the next drainage, or does it need to be drained in a specific place?

It would be useful for all people at the incident site to know more about these regulations, as the incident commander already has much work and cannot necessarily help out all the time. The same rule as in medicine, everybody does it the way it would also be done at home, might also be a solution for HAZMAT incidents. However, some strict limits would need to be known so that no laws are broken and no possibly bad consequences occur, as HAZMAT incidents can have extraordinary impacts (Baltus, 2012).

One remaining problem is to demand appropriate help from across the border. It is still not a habit to request that, e.g. this many people need to be decontaminated, and to ask to send the right material and personnel for that. Instead, in this case it is only asked for the decontamination container and no details are stated, which makes the process far less effective and efficient due to incomplete communication. A concept similar to EUMED would also be desirable for HAZMAT incidents, so that only a level needs to be named and

material and personnel with the capacity to treat a determined amount of people can be sent (Baltus, 2012).

Frequent exercises are organized for experts from across the border, in which concepts of the different countries are explained to each other (Brokmann, 2012). However, only some emergency doctors in charge take part in these exercises, and the knowledge about other systems stays, thus, among a small group of experts.

Another problem that was mentioned by all interviewees is the bringing of pharmaceuticals illegally over the border, when travelling from Germany to an emergency in the Netherlands. German emergency doctors have narcotics with them as part of their standard equipment. This is illegal in the Netherlands, though. Even though in practice it is never a problem, a legal basis for that would be worth striving for to prevent any problems in the future (Baltus, 2012; Blomeyer & Lechleuthner, 2012; Brokmann, 2012).

8. Discussion, Conclusion and Recommendations

8.1 Discussion

Cultural diversity and thus different approaches and strategies are a given in Europe with its many different countries and a long history. Some approaches might therefore be just right for one region, but would be less applicable in another region. However, regions should learn from each other and exchange best-practices to achieve the best strategies possible for their citizens. Also, cross-border cooperation is of high importance, especially in areas that are located closer to emergency institutions of other countries. Due to the location of Zuid-Limburg in the EMR, Belgian or German emergency helpers can often be at an accident site in parts of the Netherlands much faster than Dutch helpers. In the case of large HAZMAT incidents, this is even more the case, as many helpers and specialists in the HAZMAT area are needed and Dutch helpers would need to travel from areas located more in the North down to the South. Thus, in this location it makes sense to collaborate closely with the surrounding countries. However, not only the Netherlands profit from the cooperation, also Belgium and Germany can ask for help from across the border and do not need to wait for helpers coming from distant locations in the own country. Additionally, as stated before, best-practices and expert knowledge can and should be exchanged.

The first step where knowledge and best-practice can be exchanged is the job of the GAGS in the Netherlands. Since GAGS are the connection between the pure measurement side and the treatment side, very specific knowledge is present and good advice in special situations can be

given. The knowledge and skills to give advice are much more advanced than these of “normal” emergency doctors in Germany. Thus, all interviewees were convinced that GAGS is a great function, and it might be considered to introduce something similar knowledge-wise in Germany. However, in the EMR and along the whole Dutch-German border, the German side could benefit from the knowledge already now by cooperating more closely with the Dutch side.

Vice versa, the Netherlands could benefit from the knowledge and specific skills of the ATFs in Germany. As was already stated in the section about the ATFs, it seems to be possible quite easily to use the ATF not only in Germany, but also in Belgium or the Netherlands. However, it would be of use to identify whether such a cooperation is already included in agreements between the countries (such as the EUMED project), or whether new agreements should be made in advance. Since the operation of an ATF is quite expensive (as a large amount of material and personnel is needed), it should be agreed in advance whether the financing works as in the daily cross-border collaboration, or whether specific financing schemes apply.

Due to the fact that (large) HAZMAT incidents occur too rarely to gain enough experience and specialization to react appropriately, centralization is very important. This way, fewer experts have better skills. In the EMR this end can only be achieved through cooperation. However, if there is even more collaboration in the future, it would also make sense to get to know the other systems better, especially the treatment criteria used across the border. If these are known well, it might also be possible to standardize methods further.

The experts all stated in the interviews that there is no legal base for cooperation between the countries regarding HAZMAT incidents. This is true, as there is no specific regulation focusing only on these incidents. However, the agreements stated above partly include cooperation regarding CBRN incidents or give a base for further agreements. It seems like this is not well known and more attention should be drawn to the already existing agreements. As stated before, HAZMAT incidents do not occur often. Thus, it is of really high importance that HAZMAT management is not forgotten, only because no large disasters occur. This is both the case for the general population and professionals. For the population, better general knowledge and education needs to be achieved so that people know about first steps that need to be taken in case of disasters and understand further instruction given to them. Training for professionals such as the employees of the fire department needs to be continuous and always on a high level. Although this knowledge and training might only be theoretical, this is still much better than not knowing what to do at all. Baltus (2012) described that their contamination container arrived about a year ago and one training session took place.

However, since no acute incident occurred, the container was not in actual use yet. He also explained that the fire department has to spend additional hours on such a training session, and, therefore, no further session took place thus far. Also the interest in such trainings is not that high among most fire men and the chance that incidents occur is too little to raise interest (Baltus, 2012).

Also politics need to be involved more closely. A change in political thinking did already occur after the attacks of 9/11 and big events such as the World Youth Day and the soccer world cup. Baltus (2012) stated in the interview that he thinks that in the past, dealing with disasters was politically not really wanted. Additionally, all agencies and sections tried to push the responsibility towards another agency so that no progress occurred (Baltus, 2012). After the political change, however, the government developed the federal agency for the protection of the population and disaster management (BBK), which is now only dealing with disasters and working closely together with the federal level in Berlin. Also in NRW a new section in the government was founded, which is responsible for non-police protection against threats and which develops concepts for incidents in NRW. Thus, NRW seems to be on a good way and the German government is very willing to help and fund disaster management systems. Moreover, the cooperation among the different states works, also on a political level, relatively well and easy. The political problem still is the cooperation with other countries, which is really important for border regions. This is another point that needs to be improved in the future.

Communication is another crucial point for improvement. As stated before, it is complicated in Germany to warn the population in case of incidents and often instructions given to people are not understood correctly. The population needs to be educated beforehand about most important behaviors, such as staying inside a house and closing windows instead of going on the street to see what is happening in case of HAZMAT incidents. Also the understanding of people needs to be enhanced: it should be clear to all citizens that in case of a necessary decontamination, the first step is to take off the clothes worn. However, in practice this is often a problem and efforts at persuasion are needed (Blomeyer & Lechleuthner, 2012). It is often contra-productive that in many cases of HAZMAT incidents nothing at all is done before an expert arrives at the incident site. To improve that, basic knowledge in all parts of the population should be present.

Citizens normally react to what is told by the media. This often leads to hysteria and panic among the population. Thus, it is very important to communicate to the press that no different statements should be given to the population by different press agencies as this leads to

confusion and possibly anxiety among the population. To improve this, the press and population should be informed immediately and in a very sufficient way by the incident commander (or the commissioned press spokesman) so that wild speculations by the press become unnecessary or at least do not reach the citizens. The trustworthiness of information given to people by the chemical industry is always problematic: It often seems that the chemical industry downplays information and makes dangers appear harmless. To reduce that, a contract between the “Verband der chemischen Industrie” (union of the chemical industry) and the German Red Cross exists. In the areas where the contract is valid, a medical expert informs the population about risks instead of spokespeople from the chemical industry. It is hoped to make the information appear more trustworthy. It should be thought about introducing this concept in more areas and on higher levels, to give true information to the population through apparently more trustworthy sources.

To ensure best possible results in case of an incident, it is on the one hand important to improve the knowledge of the population, and on the other hand to continuously train the real experts. However, in between the population and experts, there should be stepped knowledge, so that a better response is possible. An example for that should be the basic knowledge of all emergency helpers to block access to the area around an incident site and to start emergency decontamination as soon as possible. In some way this is already the case in NRW: In the process of spreading the decontamination containers in NRW, knowledge of the people involved was renewed and more attention drawn upon basic measures (Blomeyer & Lechleuthner, 2012). Also hospitals need specific advice to know what to do with victims of a HAZMAT incident. Because there are no decontamination facilities in emergency rooms in Germany, it is even more important to warn hospitals in advance so that they can prepare a decontamination facility. Also, since doctors in hospitals do not often see patients of HAZMAT incidents, it makes sense for experts in this field to accompany the patients to the hospital so share knowledge and give specific advice. This is already done by the ATF emergency doctors Blomeyer and Lechleuthner; it should become more common among other experts as well, though. Communication and exercises between the different institutions involved is thus very important, and also improves the situation considerably (Blomeyer & Lechleuthner, 2012).

8.2 Conclusion and Recommendations

Even though incidents with hazardous materials are well managed in the EMR, some aspects and measures still need to be improved.

First of all, communication with the population is one of the most important facets when dealing with HAZMAT disasters. Thus, the communication needs to improve regarding the understanding and the warning of the population. Since the sirens in Germany were removed, a new means of warning the population in case of incidents is necessary. Different approaches are already in development, as more measures than the SatWaS system (see section 5.9) are necessary. Currently, the states and federal government are testing in how far it can be realized to make citizens aware with the help of smoke alarms, wireless alarm clocks and with the help of mobile communication (i.e. sending text messages with a warning to mobile phones). The tendency is to include several of these technologies, in addition to the already existing SatWaS (BBK, 2009). Another interesting option that is thought about is to equip new cars with alarm sensors so that the cars start honking whenever the population needs to be alerted (Baltus, 2012). No matter which approach will be further developed, it is important to keep this issue in mind and actually build up a system to warn citizens if it becomes necessary.

Communication also includes general information that should be given before an incident even occurs and this knowledge should be disseminated among a large number of citizens. During the Cold War, self-protection used to be taught in school and all students knew how to behave in case of different disasters. Even though there is no continuous danger nowadays, it would still be very useful to include this in the curriculum – again – as well. However, not only education in the school can achieve the spreading of knowledge, also more attention to the topic in the media could be helpful. Regular leaflets to every household can also inform the population better and in case of leaflets, specific regional characteristics could be included as well. With all different possible options it is important to make sure that nearly all people would have the possibility to be informed and to not exclude any groups of the population.

Another way to inform at least some citizens would be to make open days or larger events in fire departments. There, the attendees can be educated about self protection, learn how to react in case of incidents and learn about the work of the fire men and related (medical) staff first-hand. Even though not ideal, additional training sessions for the emergency helpers, e.g. with the decontamination container, could be included as well during these events, as there is usually no time for such trainings in the daily work. However, it would be much better to include these sessions in the normal working schedule once in a while, as then the motivation would be higher among the staff. Generally, it needs to be made sure that trainings continue over the years, no matter how often incidents actually occur. Thus, some additional time should be planned in for training sessions in some way in each fire department.

Another way to keep up training sessions with the decontamination container would include political involvement: The decontamination containers were well equipped with all needed materials when they were distributed among the different fire departments in NRW. Now, some materials need to be replaced, as they are becoming too old. This needs to be paid by the sections who maintain the container themselves (i.e. at the local level) and will become quite expensive over time. It might be worth thinking about distributing the most important materials again to the sections so that they are up to date again and have all the materials needed. This distribution could also be connected with the promise of the fire departments to do more training sessions with the decontamination container.

A lot of research in analytics is conducted at the moment (Baltus, 2012). It is important to work with the results and include potential new methods in a timely manner to ensure the highest possible quality.

Generally, since every incident is different it cannot be expected that emergency helpers always react in the exact right way. However, some standards can and should be routine work and should, thus, be practiced regularly.

Also the cooperation in the EMR, although good already, should be improved further. This should be done both on a political and a practical level. On the political level, the development of cross-border agreements should be simplified and it should be made possible (i.e. legal) to exchange data with neighboring countries. On a practical level, it should be striven to know the systems of the other countries to such an extent that specific approaches across the border are clear and known to all emergency helpers and that maybe even some methods and approaches can be standardized in the future. To improve collaboration and ensure the same quality of treatment in the entire EMR, getting to know the other systems should become an important part of the education of emergency doctors in border areas. It needs to be made sure that also Belgian emergency helpers are actively involved.

However, it should be kept in mind that a variety in cultures, law systems and methods used should be seen as positive, as this way the learning process can be enhanced and knowledge and best practices can be exchanged.

To conclude, the shared opinion of all experts interviewed can be echoed: The current situation in the EMR is one of the best in the EU and the quality of approaches used is of a very high standard. Other countries can still learn much from the cooperation as it is performed in the EMR (Baltus, 2012; Blomeyer & Lechleuthner; 2012; Brokmann, 2012).

Abbreviations

ATF	Analytical Task Force
BBK	Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (federal agency for civil protection and disaster aid)
BMI	Bundesministerium des Innern (federal ministry of the interior)
CBRN	Chemical, biological, radioactive, nuclear
CECIS	Common Emergency Communication and Information System
EMR	Euregio Meuse Rhine
EU	European Union
HAZMAT	hazardous materials
IC	Incident Commander
MIC	Monitoring and Information Centre
NRW	North Rhine-Westphalia
THW	Technisches Hilfswerk (Federal Agency of Technical Relief)

References

- Abkommen zwischen dem Land Nordrhein-Westfalen, dem Land Rheinland-Pfalz, der Wallonischen Region und der Deutschsprachigen Gemeinschaft Belgiens über grenzüberschreitende Zusammenarbeit zwischen Gebietskörperschaften und anderen Öffentlichen Stellen.* (1996, March 08). Retrieved from Espaces Transfrontaliers: http://www.espaces-transfrontaliers.org/de/publikationen/accord_de_mainz.pdf
- Abkommen zwischen der Bundesrepublik Deutschland und dem Königreich Belgien über die gegenseitige Hilfeleistung bei Katastrophen oder schweren Unglücksfällen. (1982, December 04). *Bundesgesetzblatt*(41), pp. 1007-1014.
- American Red Cross. (2007). *Be Disaster Safe*. Retrieved from American Red Cross: http://www.redcross.org/preparedness/familymodule/FAM_Be_Disaster_Safe/fam%20BDS%20Glossary.pdf
- Baltus, T. (2012, April 19). Organization of CBRN medical help in Germany. (J. Brehm, Interviewer)
- BAND. (n.d.). *International Visitors Section*. Retrieved from Bundesvereinigung der Arbeitsgemeinschaften der Notärzte Deutschlands (BAND) e.V.: <http://www.band-online.de/index.php?aktiv=26&inhaltvon=26&menuoffen=1>
- BBK. (2009). *Warnung der Bevölkerung mit dem Satellitengestützten Warnsystem (SatWaS)*. Bonn: BBK.
- BBK. (2010a). *Methode für die Risikoanalyse im Bevölkerungsschutz*. Bonn: BBK.
- BBK. (2010b). *Neue Strategie zum Schutz der Bevölkerung in Deutschland*. Bonn: BBK.
- BBK. (2010c). *Die Analytische Task Force (ATF) - Informationen zu Leistungsspektrum und Anforderungswegen*. Bonn: Bundesamt für Bevölkerungsschutz und Katastrophenhilfe.
- BBK. (2010d). *Bevölkerungsschutz in Deutschland - Information für Betreiber Kritischer Infrastrukturen - Managementfassung*. Bonn: BBK.
- BBK. (2010e). *deutsches Notfallvorsorge-Informationssystem (deNIS)*. Bonn: BBK.
- BBK. (2011a). *CBRN-Schutz*. Retrieved from Bundesamt für Bevölkerungsschutz und Katastrophenhilfe: http://www.bbk.bund.de/DE/AufgabenundAusstattung/CBRNSchutz/cbrnschutz_node.html
- BBK. (2011b). *Chemische Gefahren*. Retrieved from Bundesamt für Bevölkerungsschutz und Katastrophenhilfe: http://www.bbk.bund.de/DE/AufgabenundAusstattung/CBRNSchutz/Chemie/ChemGef/chemgef_node.html
- BBK. (2011c). *Biologische Gefahren*. Retrieved from Bundesamt für Bevölkerungsschutz und Katastrophenhilfe: http://www.bbk.bund.de/DE/AufgabenundAusstattung/CBRNSchutz/Biologie/BioGefahren/biogefahren_node.html
- BBK. (2012, January 5). *Chronik des Bevölkerungsschutzes in der Bundesrepublik Deutschland im Überblick*. Retrieved from Bundesamt für Bevölkerungsschutz und Katastrophenhilfe: http://www.bbk.bund.de/DE/DasBBK/Geschichte/geschichte_node.html
- Bezirksregierung Köln. (2008, September 16). *Katastrophenschutz*. Retrieved from Bezirksregierung Köln: http://www.bezreg-koeln.nrw.de/brk_internet/organisation/abteilung02/dezernat_22/katastrophenschutz/index.html
- Bezirksregierung Köln. (2011, November 16). *Rettungswesen*. Retrieved from Bezirksregierung Köln: <http://www.bezreg->

- koeln.nrw.de/brk_internet/organisation/abteilung02/dezernat_22/rettungswesen/index.html
- Blomeyer, R., & Lechleuthner, A. (2012, May 14). Involvement of the Analytical Task Force in Disaster Management in the Euregio Meuse-Rhine. (J. Brehm, Interviewer)
- Brokmann, J. (2012, May 15). Organization of Hazmat incident management in the Euregio Meuse-Rhine. (J. Brehm, Interviewer)
- Bundesärztekammer. (1992, November 2). *Stellungnahme der Bundesärztekammer zur Notkompetenz von Rettungsassistenten und zur Delegation ärztlicher Leistungen im Rettungsdienst*. Retrieved from Bundesärztekammer: http://www.bundesaeztekammer.de/downloads/BAEK_Stellungnahme_Rettungsassistenten.pdf
- Bundesministerium des Innern. (2012a). *Neue Strategie zum Schutz der Bevölkerung in Deutschland*. Retrieved from Bevölkerungsschutz/Krisenmanagement: http://www.bmi.bund.de/DE/Themen/Sicherheit/BevoelkerungKrisen/Rahmenkonzeption/rahmenkonzeption_node.html
- Bundesministerium des Innern. (2012b). *Bevölkerungsschutz und Krisenmanagement*. Retrieved from Bevölkerungsschutz / Krisenmanagement: http://www.bmi.bund.de/DE/Themen/Sicherheit/BevoelkerungKrisen/bevoelkerungskrisen_node.html
- Bundesministerium des Innern. (2012c). *Gesetz über den Zivilschutz und die Katastrophenhilfe des Bundes (ZSKG)*. Retrieved from Bevölkerungsschutz / Krisenmanagement: http://www.bmi.bund.de/SharedDocs/Standardartikel/DE/Themen/Sicherheit/Katastrophenschutz/ZSKG.html;jsessionid=3F761D8C7AB55B1A70A42A2D57C6556A.2_cid165?nn=106274
- Bundesministerium des Innern. (2012d). *Satellitengestütztes Warnsystem (SatWas)*. Retrieved from Bevölkerungsschutz / Krisenmanagement: http://www.bmi.bund.de/SharedDocs/Standardartikel/DE/Themen/Sicherheit/Katastrophenschutz/Sat_Komm_System.html?nn=106192
- Centers for Disease Control and Prevention. (2011, April). *Public Health Emergency Response Guide for State, Local, and Tribal Public Health Directors - Version 2.0*. Retrieved from CDC - Emergency Preparedness and Response: <http://emergency.cdc.gov/planning/responseguide.asp>
- Centers for Disease Control and Prevention. (n.d.). *Volcanoes*. Retrieved from Centers for Disease Control and Prevention: <http://emergency.cdc.gov/disasters/volcanoes/>
- deNIS. (2012). *Was ist deNIS?* Retrieved from deutsches Notfallvorsorge-Informationssystem: <https://www.denis.bund.de/index.html>
- EMRIC+. (2011, February). *EMRIC+ Zusammenarbeit für die Sicherheit*. Retrieved from Euregio MR: www.euregio-mr.com/intern/pdf/nieuwsbrief%20emric%20DU.../file
- EMRIC+. (2012). *EUMED - Grenzüberschreitende medizinische Hilfe bei Großschadensereignissen in der Euregio Maas-Rhein*. Maastricht: EMRIC+.
- essenscia - Belgian Federation for Chemistry and Life Sciences Industries. (n.d.). *Key Figures*. Retrieved from essenscia - Where Chemistry Meets Life Sciences: <http://www.essenscia.be/EN/essenscia/Key+figures/page.aspx/1223>
- Euregio MR. (n.d.). *Bevölkerung*. Retrieved from Das interaktive Zukunftsportal der Euregio Maas-Rhine: <http://www.euregio-mr.com/de/euregiomr/allgemeines/bevoelkerung>
- European Commission. (2012a, April 4). *Chemical Accidents (Seveso II) - Prevention, Preparedness and Response*. Retrieved from Environment: <http://ec.europa.eu/environment/seveso/index.htm>

- European Commission. (2012b, July 11). *Chemical Accidents (Seveso II) - Review of the Legislation*. Retrieved from Environment: <http://ec.europa.eu/environment/seveso/review.htm>
- European Parliament. (2010, December 14). *Strengthening Chemical, Biological, Radiological and Nuclear Security in the European Union - an EU CBRN Action Plan*. Retrieved from Eurlex: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2012:169E:0008:0023:EN:PDF>
- European Union. (2010, August 8). *Civil Protection Mechanism*. Retrieved from EUROPA Summaries of EU legislation: http://europa.eu/legislation_summaries/justice_freedom_security/fight_against_terrorism/128003_en.htm
- Fachvereinigung Chemieparke/Chemiestandorte im Verband der Chemischen Industrie e.V. (n.d.). *The Federal State of North Rhine-Westphalia*. Retrieved from German Chemical Parks and Sites: <http://www.chemicalparks.com/parks/Seiten/NorthRhineWestphalia.aspx>
- Genscher Abkommen zwischen der Bundesrepublik Deutschland und dem Königreich der Niederlande über die gegenseitige Hilfeleistung bei Katastrophen einschließlich schweren Unglücksfällen*. (1988, June 7). Retrieved from IFRC: <http://www.ifrc.org/Docs/idrl/I147DE.pdf>
- Gielkens, C. (2012, May 14). Comparison of Dutch and German Hazmat Incident Management Systems. (J. Brehm, Interviewer)
- Goertz, T., & Prast, H. (2010). *Teilprojektplan Aktion 4 - Innovation und Forschung*. EMRIC+.
- Innenministerium des Landes Nordrhein-Westfalen. (2008, March). *ABC Schutz Konzept NRW »Verletzten-Dekontaminationsplatz 50 NRW« (V-Dekon 50 NRW)*. Retrieved from Institut der Feuerwehr: http://www.idf.nrw.de/service/downloads/pdf/v_dekon50.pdf
- Innenministerium NRW. (2005, January 26). Krisenmanagement durch Krisenstäbe bei den kreisfreien Städten, Kreisen und Bezirksregierungen bei Großschadensereignissen (§ 1 Abs. 3 FSHG) im Lande Nordrhein-Westfalen. *Ministerialblatt für das Land Nordrhein-Westfalen*(4), pp. 62-64.
- interreg. (2001). *PCI INTERREG III-A Euregio Maas-Rijn*. Retrieved from interreg Euregio Maas-Rijn: http://www.interregemr.info/old_nl/infomaterial/infomaterial.php
- Regio Aachen. (n.d.). *Die REGIO Aachen in der EUREGIO Maas-Rhein*. Retrieved from REGIO Aachen - die Partnerinstitution der Euregio Maas-Rhein: <http://www.regioaachen.de/>
- Spiegel Online. (2011, November 28). *Thousands of Protesters Obstruct Nuclear Waste Transport*. Retrieved from Spiegel Online International: <http://www.spiegel.de/international/germany/0,1518,800319,00.html>
- Sri Lanka Core Group for Disaster Management. (2005). *Guidelines for Disaster Management - A Compilation of Expert Guidelines on Providing Health Care*. Sri Lanka: Ministry of Healthcare, Nutrition and Uva Wellassa Development.
- Stauber-Klein, B. (2011, March 22). *NRW ist von Kernkraftwerken umzingelt*. Retrieved from Der Westen: <http://www.derwesten.de/politik/nrw-ist-von-kernkraftwerken-umzingelt-id4453704.html>
- THW. (n.d.). *Die Geschichte des THW: Faszination Helfen*. Retrieved from Bundesanstalt Technisches Hilfswerk: http://www.thw.de/DE/THW/Geschichte/geschichte_node.html
- Verband der Chemischen Industrie. (2012, May). *TUIS - Die Hotline zum Know-How*. Retrieved from VCI: https://www.vci.de/Downloads/Publikation/32_TUIS_Brosch%C3%BCre_2010.pdf

Vereniging van de Nederlandse Chemische Industrie. (n.d.). *Facts and Figures About the Dutch Chemical Industry in 2010*. Retrieved from VCNI:

<http://www.vnci.nl/feiten/chemie-in-nederland/chemistry-in-the-netherlands.aspx>

World Health Organization. (2010, May). *Dioxins and their effects on human health*.

Retrieved from World Health Organization:

<http://www.who.int/mediacentre/factsheets/fs225/en/>

ZSKG. (1997, March 25). *Gesetz über den Zivilschutz und die Katastrophenhilfe des Bundes (Zivilschutz- und Katastrophenhilfegesetz - ZSKG)*.