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## **23. HAZARD MATERIALS EMERGENCY EXPERIENCE IN CROATIA**

Dr. Branimir Molak,  
Zagreb, Croatia

### **INTRODUCTION**

Under the crises or emergency situations are assumed such phenomena which can massive endangered the inhabitants (life and health), goods and environment. In all phases in the emergency management mutual work of many governmental and communities organizations and persons of different specialties are necessary. Community needs work with crises before they are happened and need to help in recovery from crisis. Like result of modern development there are four phases in emergency management established: mitigation, preparedness, response and recovery. In the world practice governmental body for emergency management very high positioned in governmental hierarchy with high-qualified personal and high authority need be establish. For long time in Croatia experts wrote about it but up to now there are no improvement. Damagcs from natural hazards in Croatia are dominant in peacetime, but is necessary to prepare communities also for human cause / technological hazards.

Hazard materials (toxic chemical substances) are only one of group of technological hazards. Other arc: fire and explosions, radioactivity, break of supply, interior disturbances (terrorism is one in-group) and dam failures. During the war in Croatia (1992/1993) was known what is necessary to do to protect people in case of chemical emergency. In all activities for decrease damages, based on the factors: hazard analysis, authority, organization, communication, resources and emergency plans was known. Only the problems has been the necessity of binding all operative organizations in comprehensive and efficient emergency system (everywhere this is task of emergency management agency which is expert organization of government in case of crises). The same situation in Croatia is up to now. Also there are not emergency plan in Croatia in the case of accident in NPP Krško near border in Slovenia relatively close to Zagreb.

### **COMMUNITY PREPAREDNESS AND UNCONTROLLED HAZARD MATERIALS RELEASE**

In the World and also in Croatia are many chemicals in use, which can endanger people, goods and environment in the case they are deliberated into environment without control. It can endangered people in zones of few hundreds meters up to few tens kilometers from the sources of deliberation of hazard materials. Necessary is to have community preparedness with preparedness of every inhabitant for the case of crises caused by uncontrolled release of hazard chemicals.

Community preparedness for hazard chemical release is important factor for rescue and protection of people, goods and environment. Community need be prepared for such crises to decrease their consequences. Preparedness mean that is known five segments in some geographical region (county) which is in analysis. They are also useful in all other type of crises, and these segments are:

1. Hazards Analysis
2. Authority
3. Organizational Structure
4. Communication
5. Resources

Of course, all these five segments are necessarily to be implanted in written document: Emergency plan, which in the case of hazardous materials release in all communities (counties) need be established.

Results of solving the emergency management problems in hazardous materials releases with some modification can be used also in other types of technology/human cause emergencies and also in natural hazard emergencies. Some results are also applicable in other fields of management.

Responsibility for safety of inhabitants, goods and environment in democratic societies are usually on government (president, or county chief) and necessary is that the government take care for preparedness of her area in crises.

There are many questions that need answers to assessing community preparedness in case of hazardous materials release. These questions may be used for assessing the emergency plan as well as the emergency program in general. Resource limitations and results of hazard analysis will strongly influence the necessary degree of planning and preparedness.

### **Hazards Analysis**

Hazard Analysis includes the procedures for determining the vulnerability of a geographical area to a hazardous materials release, for identifying potential sources of hazardous materials release from fixed facilities that manufacture, process, or otherwise use, store, or dispose of materials that are generally considered hazardous in an unprotected environment. This includes an analysis of the potential or probable hazard of transporting hazardous materials through a particular area.

A hazard analysis is generally considered to consist of identification of potential hazards, determination of the vulnerability of area as a result of existing hazards, and an assessment of the risk of hazardous materials release (probability and consequences).

Figure 1 shows Hazards analysis and Figure 2 show Vulnerable zones a) fixed facilities b) along transportation routes. Figure 3 show Vulnerable zones: ammonia, chlorine, arsine and phosgene in relation to release rate, meteorology and terrain. On Table 1 shown are Results of calculations of vulnerable zones for some hazardous materials in Zagreb. Results are determination of vulnerable zones by mathematical models for some chemicals (results are performed in the war in year 1992). Acronyms: LOC – Level of Concern, IDLH – Immediately Dangerous to Life of Health.

There are a lot of questions which need answers to assess is the hazard analysis in some community performed on properly way. Some of these questions are Has the analyses been completed for the area? Does the hazard analysis include that are manufactured, processed, used, disposed, or stored within the appropriate area or safety along transportation routes? Final result of hazard analysis is the risk matrix.

### **Authority**

Authority refers to those authorities or other legal authorities vested in any personal, organizations, agencies, or other entities in responding to or being prepared for responding hazardous materials emergencies resulting from releases or spills.

On Table 2 shown is example of an act for emergency planning and community right to know.

Also like for hazard analysis for the Authority can be given many questions to assess authority for response in case of hazardous materials release in environment. Some are Does clear legal authorities exist to establish a comprehensive hazardous materials response mechanism? Does these authorities delegate command and control responsibilities between the different organizations?

### **Organizational Structure**

Organization refers to the organizational structure in place for responding to emergencies. This structure will vary considerably from one area to other and depend about quantity of hazard materials and other factors of some area. There are two basic types of organizations involved in emergency response operations. The first is involved in the planning and policy decision process. The second is the operational response.

There are many questions for assessment of community organizational structure for the hazard materials emergency. Some of organizations, which need be connected, by emergency management organization (local or governmental emergency management body – does not exist in Croatia up to now) are health organizations, public safety (fire, police, health and safety), transportation, environmental organizations, natural resources organizations, education system, etc. For each organizations authorities, responsibilities, and capabilities must be determined for pre-response (planning and prevention), response (implementing the plan during an incident), and post-response (cleanup and restoration) activities.

### **Communication**

Communication means any form or forms of exchanging information or ideas for emergency response with other entities, either internal or external organizational structure. There are important areas that need be assess by questions: coordination of information, information exchanges, information dissemination, information sources and database sharing, notification procedures and clearinghouse functions.

### **Resources**

Resource means the personnel, training, equipment, facilities, and other sources available for use in responding to hazardous materials emergencies. To the extent that the hazard analysis has identified the appropriate level of preparedness for the area need be established. There is lot of questions for assessment of community resources (personnel, training, equipment, and facilities) for hazard material emergency.

### **Emergency Plan**

The emergency plan is connected by all questions in before five sections. The plan is also special value document and is essential measure of community (local – county) government preparedness for hazard material emergency. Without plan there are no adequate response in case of emergency. There are many questions to assess emergency plan of community.

On Table 3 is shown possible content of hazard materials emergency plan

### **CONCLUSION**

Accidents with hazardous materials releases or spills can make heavy consequence to life and health of people, goods and environment in zone of few hundreds meters to few tens kilometers around of sources of hazard material. It is necessary to inform population about real risk of such accidents (probability and consequences) because they're effective protection in case of emergencies. This is especially important in the case if emergency organization body is not established.

In the second part of article is shown how the rescue and protection system is complicated and need mutual coordinated work of many segments of communities and different subjects. Establishing of system for cope with crises, also such with uncontrolled releases of hazard materials is the role of every democratic society. Government need take care about inhabitants' life and health, about their goods and environment. Solving the

problem – finding the answers to the questions can give information about assessment of community (county) preparedness for hazard materials emergency. Every time when some of hazard materials accident occur in Croatia this make big noise in media, but after this nothing is happened in improving five segment of emergency management and preparing emergency plans.

## SUMMARY

Hazard materials (toxic chemical substances) are only one of group of technological hazards. Other are: fire and explosions, radioactivity, break of supply, interior disturbances (terrorism is one in-group), and dam failures. During the war in Croatia (1992/1993) was known what is necessary to do to protect people in case of chemical emergency. In all activities for decrease damages, based on the factors: hazard analysis, authority, organization, communication, resources and emergency plans was known. Only the problems has been the necessity of binding all operative organizations in comprehensive and efficient emergency system (everywhere this is task of emergency management agency which is expert organization of government in case of crises). The same situation in Croatia is up to now. During the war we have tried to introduce in our practice SARA, Title III and emergency practice from Ohio State Hamilton County's LEPC. We have performed hazard analyses for most dangerous chemicals and chemical weapons (chlorine, ammonia, phosgene and arsine). It was known the LOC, IDLH values of chemicals and was not problem to determine hazard zones for different meteorological conditions. It was calculated (1992) hazard zones (for LOC and IDLH) for chemicals (gas, liquid, and solids) in city of Zagreb. Risk matrix can show us priorities in protection.

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#### **KEY WORDS**

Emergency management, chemical hazard analysis, vulnerable zones, risk matrix, emergency plan

#### **FIGURES AND TABLES**

Figure 1 Hazards analysis

Figure 2 Vulnerable zones a) fixed facilities b) along transportation routes

Figure 3 Vulnerable zones: ammonia, chlorine, arsine and phosgene in relation to release rate, meteorology and terrain.

Table 1 Results of calculations of vulnerable zones for some hazard materials in Zagreb.

Results are determination of vulnerable zones by mathematical models for some chemicals (results are performed in the war in year 1992). Acronyms: LOC – Level of Concern, IDLH – Immediately Dangerous to Life of Health, 1.5 and 5.2 m/s - wind speed, F, D - meteorology stability classes, u – urban landscape.

Table 2 Example of an act for emergency planning and community right to know

Table 3 Possible content of hazard materials emergency plan

## Table 2 **EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT**

Hazard materials emergency

Hazard chemical uncontrolled release reporting (370 + 720 chemicals?)

Hazard chemical inventory reporting (370 chemicals?)

Toxic chemical release reporting - routinely releasing (320 toxic chemicals?)

Data protection - trade secrets

Lists of chemicals

Role of:

Local emergency planning organizations

Citizens

Fire departments

Public institutions

Health professionals

Industry and small businesses

Farmers

State emergency organization

## Table 3 **HAZARD MATERIALS EMERGENCY RESPONSE PLAN - CONTENT**

### **A. INTRODUCTION**

1. Incident Information Summary
2. Promulgation Document
3. Legal Authority and Responsibility for Responding
4. Plan Content
5. Abbreviations and Definitions
6. Assumptions/Planning Factors
7. Concept of Operations
  - a. Governing Principles
  - b. Organizational Roles and Responsibilities
  - c. Relationship to Other Plans
8. Instructions on Plan Use
  - a. Purposes
  - b. Plan Distribution
  - c. Comments About Improvements

### **B. TELEPHONE NUMBERS OF RESPONDERS**

### **C. RESPONSE FUNCTIONS**

1. Initial Notification of Response Agencies
2. Direction and Control
3. Communications and Control
4. Warning Systems and Emergency Public Information
5. Public Information/Community Relations
6. Resource Management
7. Health and Medical
8. Response Personal Safety
9. Personal Protection of Citizens
  - a. In-place Sheltering

- b. Evacuation
- c. Other Public Protection Strategies
- 10. Fire and Rescue
- 11. Law Enforcement
- 12. Ongoing Incident Assessment
- 13. Human Services
- 14. Public Works
- 15. Others

**D. CONTAINMENT AND CLEANUP**

- 1. Techniques for Spill Containment and Cleanup
- 2. Resources

**E. DOCUMENTATION AND INVESTIGATION FOLLOUP**

**F. PROCEDURES FOR TESTING AND UPDATING PLAN**

- 1. Testing the Plan - Exercises
- 2. Updating the Plan

**G. HAZARD ANALYSIS SUMMARY**

**H. TRAINING**

**I. REFERENCES**

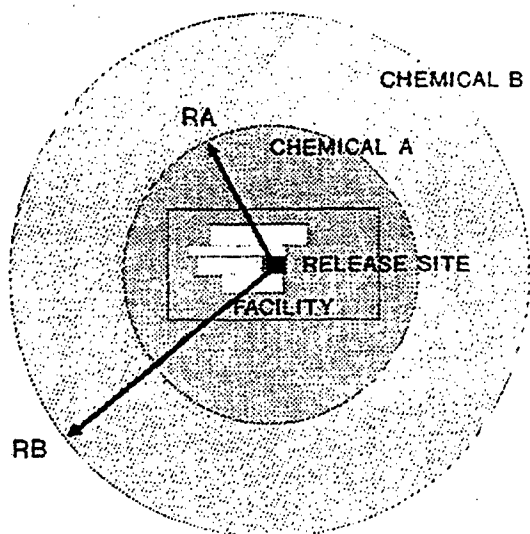
- 1. Laboratory, Consultant, and Other Technical Support
- 2. Technical Library

**VULNERABLE ZONES - ZAGREB**

<b>Chemical</b>	<b>Ammonia</b>	<b>Chlorine</b>	<b>Pot. cyanide</b>	<b>Nitric Acid</b>	<b>Ethylamine</b>
<b>Physical State</b>	Gas	Gas	Solid 20%<100 mcm	Liquid	Liquid
<b>Quantity (kg)</b>	1000	5000	900	50000	50000
<b>LOC (mg/m<sup>3</sup>)</b>	35	7.3	5	26	740
<b>IDLH (mg/m<sup>3</sup>)</b>	350	73	50	260	7400
<b>Rate of Release (kg/min)</b>	100	500	18	140	1358
<b>Vulnerable zone (km)</b>					
<b>1.5m/s, F, LOC</b>	1.3	9.6	1.4	1.9	1.0
<b>5.2m/s, D, LOC</b>	0.5	2.4	0.5	0.6	0.3
<b>1.5m/s, F, IDLH</b>	0.5	2.1	0.5	0.5	0.3
<b>5.2m/s, D, IDLH</b>	0.2	0.6	0.2	0.2	0.2

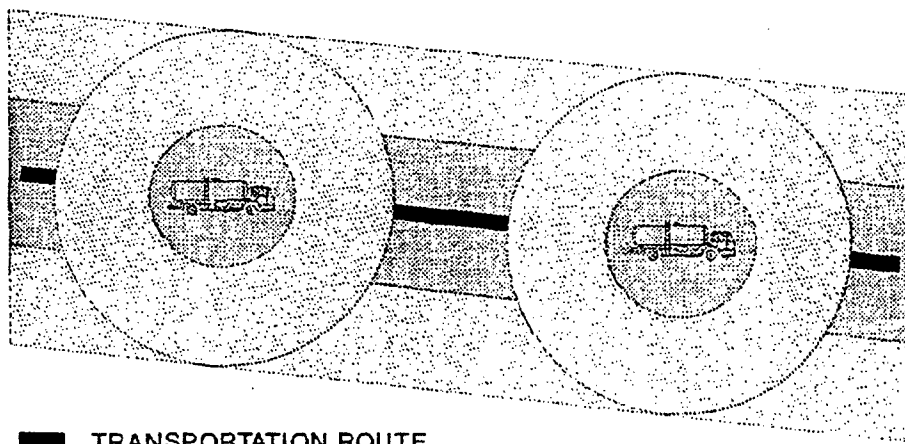


a) VULNERABLE ZONES



RA - VULNERABLE ZONE RADIUS FOR CHEM. A (Conc. LOC A)  
RB - VULNERABLE ZONE RADIUS FOR CHEM. B (Conc. LOC B)

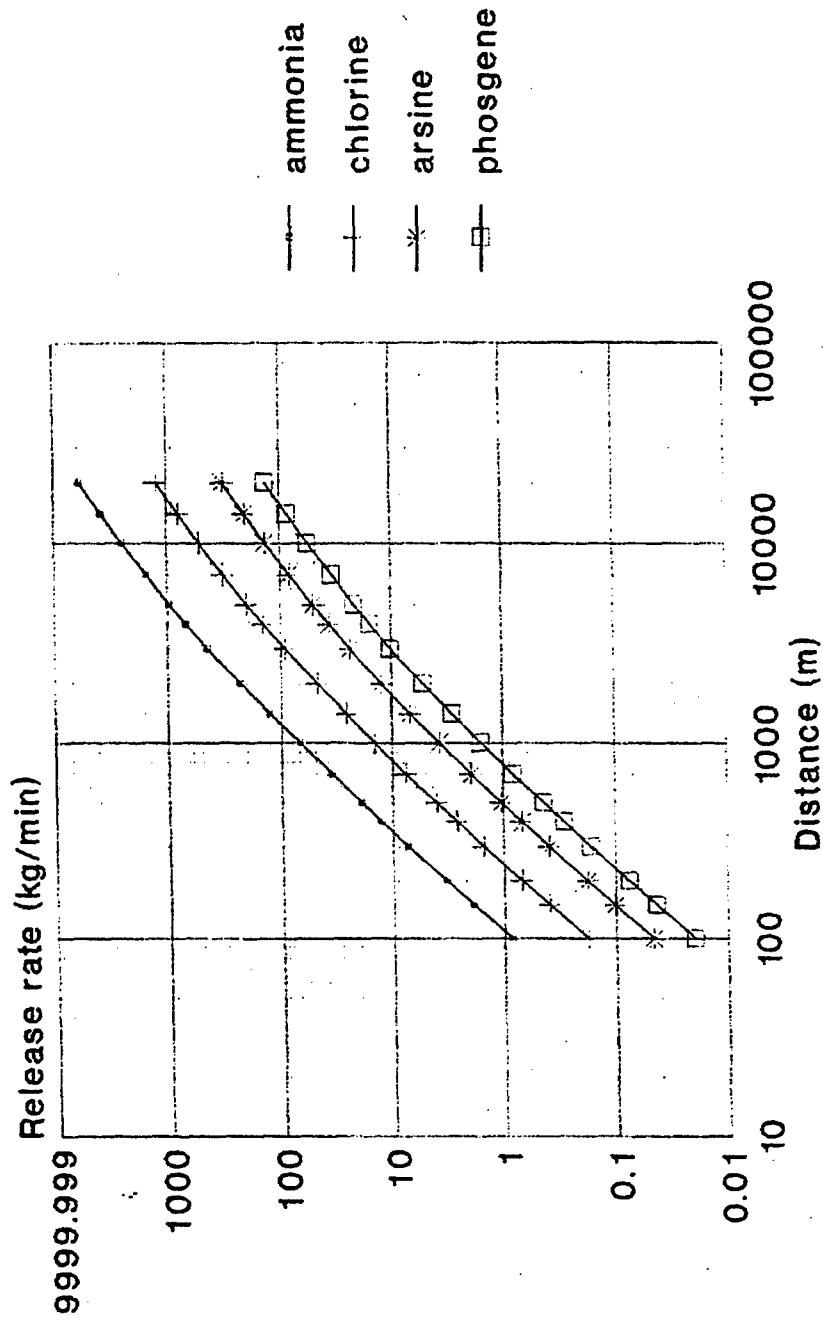
b) VULNERABLE ZONES ALONG TRANSPORTATION ROUTE



■ TRANSPORTATION ROUTE  
▨ VULNERABLE ZONE (CHEMICAL C)  
▩ VULNERABLE ZONE (CHEMICAL D)

# VULNERABLE ZONES & RELEASE RATE

chlorine, ammonia, arsine, phosgene



meteorology: F, 1.5m/s landscape: u