



# Risk Mapping in the New Member States

A Summary of General Practices for Mapping Hazards,  
Vulnerability and Risk

by

Maureen Wood and Róbert Jelínek



EUR 22899 EN - 2007





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JRC38184

EUR 22899 EN  
ISSN 1018-5593

Luxembourg: Office for Official Publications of the European Communities

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*Printed in Italy*

## **Acknowledgements**

The authors would like to thank all the participants from the New Member States who were involved in this project for their valuable contributions, fruitful discussions during JRC visits and collaboration while preparing this report. We also owe a considerable debt to Javier Hervás, Boyko Rangelov, Carmelo di Mauro, Ana Lisa Vetere Arellano, Michalis Christou and Jean-Pierre Nordvik, the JRC colleagues who developed the survey and spent significant effort in collecting and verifying results.

This research has been completed within the 5<sup>th</sup> and 6<sup>th</sup> EU Framework Programmes.



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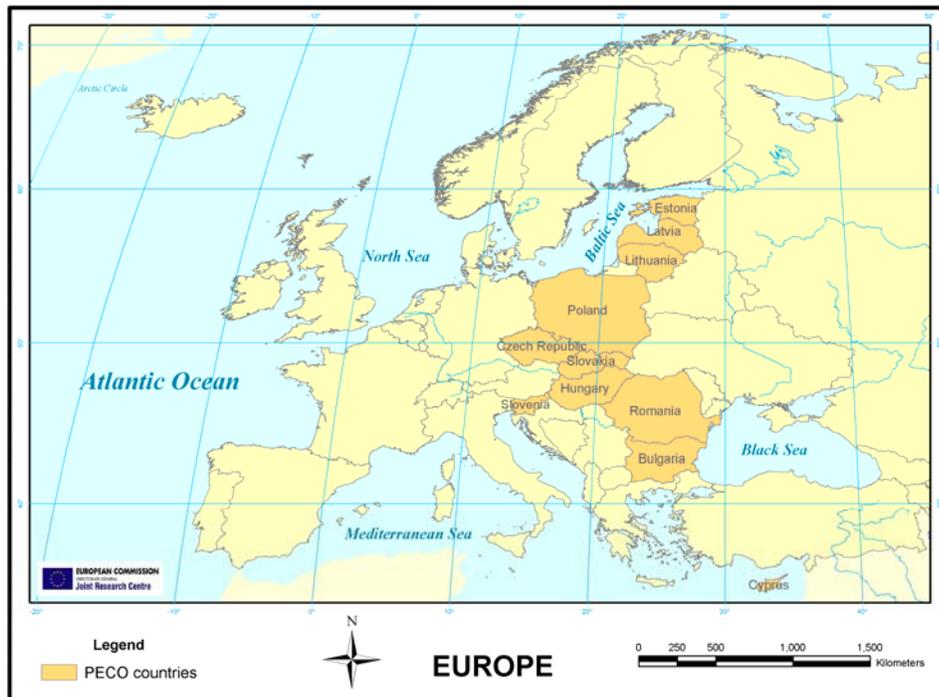
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## 1. INTRODUCTION

### 1.1 General Description of the Project

In 2003 the Joint Research Centre performed a survey of mapping practices in eleven (11) countries for eight (8) major hazards. This activity was funded as part of the project entitled “Management of Natural and Technological Risks” under the JRC Enlargement action within the Sixth Framework Programme (6FP) for Research and Technological Development (RTD). This project was a continuation of an activity supported by the JRC Enlargement action programme within the Fifth Framework Programme (5FP) RTD aimed at the ten (10) “PECO” countries<sup>1</sup> (Figure 1). The two activities were designed to support the efforts of new Member States and Candidate Countries in the creation of compatible regional and national central information systems for supporting authorities in the management of risks and emergency situations due to natural and technological hazards. The 6FP project was expanded to include Cyprus<sup>2</sup>.



**Figure 1: Surveyed countries**

<sup>1</sup> PECO countries refer to the 10 Member States in central and Eastern Europe (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia). The acronym is derived from the French translation of “Central and Eastern European Countries” (“Pays de l’Europe Centrale et Occidentale”).

<sup>2</sup> The 6FP project could also include Cyprus and Malta (although 5FP was only targeted to PECO countries). Yet for mainly practical reasons, Malta was not included in the 6FP phase of this project, although some bilateral expert exchanges on natural and technological hazards took place outside the context of this survey.

Under the 5FP project experts from the PECO countries agreed on ten priority hazards as important concerns for the region, as follows (Wood et al. 2003):

**Natural hazards**

- Floods
- Forest fires
- Storms
- Landslides
- Earthquakes

**Technological Hazards**

- Industrial installations
- Transport of dangerous goods
- Contaminated lands
- Pipelines
- Oil-shale mining

The 6FP project aimed to investigate risk mapping practices and policy for priority hazards in these countries. The aim of this activity was to:

- **Examine the existing situation, in each surveyed country** for mapping of priority natural and technological hazards
- **Compare methodologies used in the different countries** for hazard to inform guidelines for establishing compatible national mapping systems
- **Provide a basis for defining a pilot project** that would test feasibility of different approaches to harmonizing aspects of mapping practices in regard to specific hazards

Moreover, it was determined that these objectives could be best fulfilled through the administration of a questionnaire on risk mapping practices and policy for priority hazards to the target countries (Di Mauro et al., 2003).

The 6FP project selected eight of priority hazards from the 5FP project as the subject of the questionnaire, excluding oil-shale mining and pipelines for practical reasons<sup>3</sup>. As a first step of this project, an original risk relevance table (Wood et al., 2003) was reviewed according to views provided by experts during the visits to the countries. The revised table incorporating the expert views from the 6FP project is reflected in Table 1 on the next page.

Table 1 shows the risk relevance for each country starting in vertical order with the country with the highest overall risk ranking at the top and starting in horizontal order with the hazard with the highest overall risk ranking on the left (pipelines and oil-shale mining were not covered by the 6FP survey and therefore are not included). The table summarises the level of exposure and vulnerability as experienced in the surveyed countries to certain natural and technological risks and also allows comparison of experiences between countries.<sup>4</sup> Graphical illustrations of collective rankings by hazard and by country rankings hazard are also provided in Figures 2a and 2b (pp. 12). The

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<sup>3</sup> In the case of oil-shale mining, interest in this hazard was not widespread and it was determined that most respondents would not have a mapping programme aimed at this activity. On the other hand, in many countries the competent authority that manages pipelines and pipeline mapping is quite distinctly apart from those that handle other technological hazards or natural hazards. Therefore, it was considered impractical to include this hazard in the survey based on the additional extra effort that might be required to gain the support and co-operation of these authorities.

<sup>4</sup> The rankings reflect the opinion of national experts and are of a qualitative rather than a quantitative nature. Hence, they have not been (and cannot be) normalised to reflect variation in the severity and extent of consequences from actual events that have occurred within each country.

relative width of each section of each column reflects the cumulative size of the risk relevance estimate.

**Table 1: Risk relevance of the evaluated hazard in the PECO countries**

Countries	Floods	Indust. Install.	Transport of Dang. Goods	Forest Fires	Contaminated Lands	Storms	Earthquakes	Land-slides
Romania	HIGH	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Bulgaria	MEDIUM	HIGH	HIGH	HIGH	LOW	MEDIUM	HIGH	MEDIUM
Czech Republic	HIGH	MEDIUM	HIGH	MEDIUM	HIGH	MEDIUM	LOW	MEDIUM
Poland	HIGH	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM	LOW	LOW
Hungary	HIGH	MEDIUM	HIGH	MEDIUM	MEDIUM	LOW	LOW	LOW
Slovenia	HIGH	MEDIUM	LOW	MEDIUM	LOW	LOW	HIGH	MEDIUM
Slovakia	HIGH	HIGH	LOW	LOW	HIGH	LOW	LOW	MEDIUM
Latvia	MEDIUM	HIGH	HIGH	MEDIUM	LOW	LOW	n/a	n/a
Estonia	LOW	MEDIUM	HIGH	MEDIUM	LOW	MEDIUM	LOW	LOW
Lithuania	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW	MEDIUM	LOW	LOW
Cyprus	LOW	MEDIUM	LOW	MEDIUM	LOW	LOW	MEDIUM	LOW

**Legend**

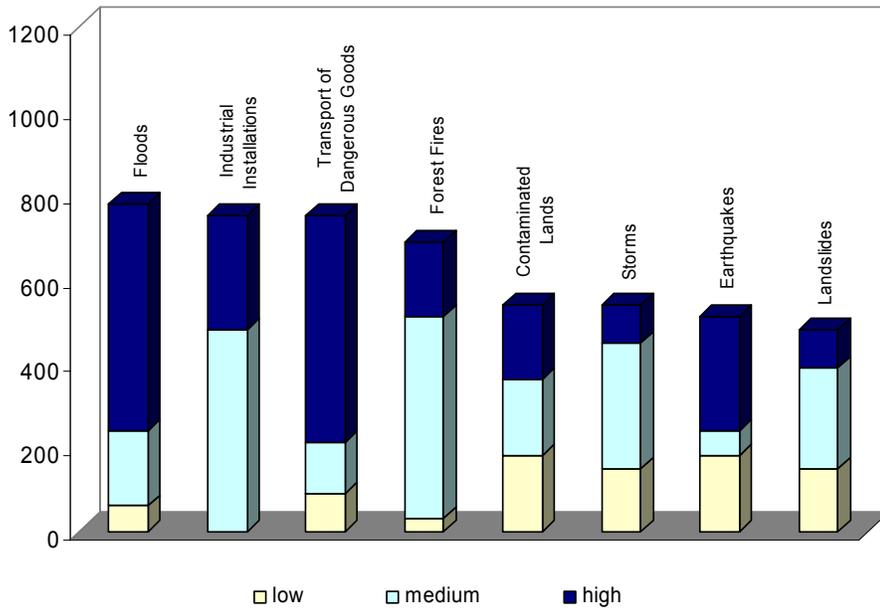
	HIGH
	MEDIUM
	LOW
n/a	NOT APPLICABLE

**Risk Relevance classes**

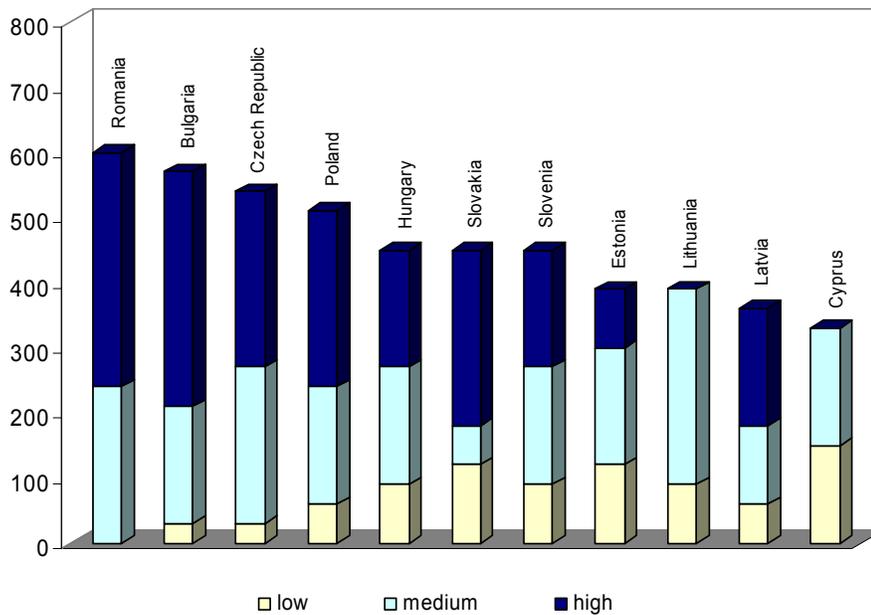
**“High”** – The hazard is present within a vast majority of the country (~>2/3) due to the infrastructure or geographic character of the country, OR the hazard is confined only to particular areas but in the event of an incident, the effect could be significant for: at least one major population center (such as a medium to large city or metropolitan area) or an important economic resource.

**“Medium”** – The hazard is present within a good portion of the country (~>1/3 and < 2/3) due to the infrastructure or geographic character of the country, OR the hazard is confined only to particular areas but in the event of an incident, the effect could be significant for: a minor population center (a large town or small to medium-size city) or minor economic resource.

**“Low”** – The hazard is present within a small portion of the country (~<1/3) due to the infrastructure or geographic character of the country, AND in the event of an incident, there is no significant effect for: minor or major population centers, or minor or major economic resources.



a)



b)

**Figure 2: Cumulative risk relevance across (a) hazards and (b) countries.** *The risk relevance categories high, medium and low have been reclassified into the corresponding raw scores of 90, 60 and 30, respectively*

The table and charts are only intended to compare priorities and identify the most predominant concerns within the region in relation to the hazards of interest. These illustrations findings can be summarized as follows:

- A certain number of risks seem to be common to nearly all of the participating countries, notably floods, industrial installations, transport of dangerous goods and forest fires, without regard to geophysical or economic differences.
- Flood and transport of dangerous goods risk was assigned “highly relevant” status by more countries (6 countries) than any other hazard, followed by industrial installations and earthquakes (3 countries).
- Forest fires were ranked as moderate or highly relevant risk by 9 out of 10 countries.
- Contaminated lands are of highest interest in the central European regions.
- Earthquakes and landslides are a common concern in Member States sharing particular geo-physical characteristics, particularly the Balkan States.
- Concern about storms seems to be concentrated in two regions, a north central corridor extending up along the Baltic Sea (Poland, Czech Republic, Lithuania and Estonia) and the southeastern countries of Bulgaria and Romania.
- Countries with highest total risk are located particularly in the Balkan states and central Europe, while on the opposite site are the Baltic countries and Cyprus.

## **1.2 Survey Methodology and Content**

This section describes the survey process including the background as well as practical and technical considerations that determined its focus and approach.

### ***Method for Soliciting and Verifying Questionnaire Responses***

Survey responses were collected over the course of a ten-month period between November 2003 and July 2004. The initial survey was sent to project focal points nominated by the countries to respond to the hazard questionnaires. Each country was requested to complete a questionnaire for only those hazards that they had identified in the previous survey as priority hazards (and as mentioned, countries were allowed to modify the previous prioritization for their country if they so desired). For this reason, there is not a complete set of questionnaire responses for any one hazard.

The JRC then organized a meeting in each participating country to discuss the answers to the questionnaires with the responding authorities. This meeting offered an opportunity to clarify questions and responses, gain more comprehensive information, and improve consistency between responses across hazards and respondents.

Following the meeting the questionnaire was revised and reviewed and through an iterative exchange between respondents and the JRC. The responses were finalized and accepted as complete. Table 2 shows the hazard questionnaires within the survey to which each country responded.

**Table 2: Summary of countries responding to each hazard questionnaire**

Country	Floods	Indust. Install.	Transp. of Dang. Goods	Forest Fires	Contam Lands	Storms	Earth-quakes	Land-slides
Bulgaria	■	■	■	■	■	■	■	■
Cyprus	■	■	■	■	■	■	■	■
Czech Republic	■	■	■	■	■	■	■	■
Estonia	■	■		■		■		
Hungary	■	■		■	■			
Latvia	■	■	■	■				
Lithuania	■	■	■			■	■	
Poland	■	■	■	■		■		
Romania	■	■	■	■	■	■	■	■
Slovakia	■	■	■		■	■		■
Slovenia		■	■	■			■	■

In comparing each country's evaluation of hazard risk relevance (Table 1) to the questionnaire responses, it can be noted that not all countries provided mapping information on hazards that they ranked moderate or high risk. For example, although Hungary and Estonia ranked transportation of dangerous goods as a highly relevant risk, no mapping information is provided. A few other countries also chose not to complete information for what they had indicated were more or less important risks. The probable reason for these discrepancies lies in the different experts responding to the different surveys. Although respondents to the questionnaire might have had a general knowledge about which risks remain fairly important in their country, they may have represented some but not all hazard specialities. For this reason, they may have not had familiarity with some types of hazard maps and therefore, chose not to fill out this portion of the questionnaire.

Also, respondents were allowed to choose the hazards for which they would provide information and for the sake of time, some experts limited their responses to a subset of the hazards in consideration.

### ***Content of the Full Questionnaire***

The questionnaire encompassed nine separate sections: eight sections devoted to a particular section and one section on general hazard and risk mapping practices. Each of the eight sections focusing on a particular hazard, was constructed in a similar manner. In essence, the questionnaire aimed to identify state-of-the-art mapping practices, priorities, and similarities and differences in mapping practices for each hazard. The data identity and availability based on the questionnaire encompassing more than 35 questions grouped into six categories: hazard maps, hazard data, elements at risk to the hazard, vulnerability maps and risk maps. Each questionnaire was divided into six sections:

1. General description of hazard maps
2. Data and data collection
3. Identification of elements at risk
4. Vulnerability mapping and classification
5. Risk mapping
6. Final considerations (use and accessibility)

Questions within sections were then individualized for each type of hazard.

## 2. SUMMARY OF THE STATE OF THE ART OF HAZARD, VULNERABILITY AND RISK MAPS

### 2.1 Definitions

Recognizing that there are often several interpretations for common terms associated with hazards, risks and mapping practices, the following definitions were included to facilitate a common understanding of these terms by all questionnaire respondents.

#### HAZARD

1. *A situation with the potential to result in harm. A hazard does not necessarily lead to harm.*

2. *Potential source of harm. [ISO/IEC 51]*

Note: For natural hazards, HAZARD is commonly referred to as the probability that a natural event (of a certain magnitude) occurs in a certain place/area at a certain time. Consideration of the time dimension thus differentiates HAZARD from SUSCEPTIBILITY, which only considers the event and the place/area.

#### HAZARD MAP

*This type of a map that portrays levels of a particular hazard (or hazards).*

#### VULNERABILITY

1. *Degree of loss (from 0% to 100%) resulting from a potentially damaging phenomenon. [UN IDNDR]*

2. *The degree to which a systems is susceptible to, and unable to cope with, injury damage or harm. [EEA Glossary]*

#### VULNERABILITY MAP

*This is a map that portrays levels of vulnerability It may include one or more than one type of vulnerability (e.g., death, injury, property damage).*

#### RISK

1. *Combination of the frequency, or probability, of occurrence and the consequence of a specified hazardous event. [Ref.: ISO/IEC 51]*

*The concept of risk always has two elements: the frequency or probability with which a hazardous event occurs and the consequence of the hazardous event.*

2. *Expected losses (of lives, persons injured, property damaged, and economic activity disrupted) due to a particular hazard for a given area and reference period. Based on mathematical calculations, risk is the product of hazard and vulnerability:*

*Risk = Hazard x Vulnerability [UN IDNDR]*

## **RISK MAP**

*This is a map that portrays levels of risk across a geographic area. Such maps can focus on one risk only or include different types of risk (e.g., integrated risk map, maps of multiple risks).*

## **2.2 Analyses**

To obtain knowledge about the situation in each surveyed country on hazard mapping practices, the questionnaires focused on the availability of existing hazard, vulnerability and risk maps. Questions to ascertain the detail and quality of the data were also included.

Table 3 (pp. 18-19) summarizes and compares spatial mapping information of different hazards investigated in the project. The table compares each country's situation in terms of four different characteristics: hazards maps, vulnerability, risk maps and availability of other data. A numerical score representing "total risk relevance" has also been included for comparison.

### ***Total risk relevance***

The total risk relevance quantifies responses on risk relevance across each hazard. The numerical value equals the sum of the risk category. This number was derived by applying mathematical scores to the different risk categories assigned to each hazard by the experts as shown in Table 1 (p. 11). The risk relevance categories high, medium and low have been reclassified into the corresponding raw scores of 90, 60 and 30, respectively.

In general, the table shows that floods, transportation of dangerous goods, industrial installations and forest fires have the highest total risk relevance for all the surveyed countries combined, while landslides and earthquakes rank the lowest.

### ***Hazard maps***

The distribution of hazards in a particular country or region can be measured and expressed in a map in a number of different ways and using different representation techniques. Information summarized in Table 3 indicates that a variety of hazard maps exist in all of the surveyed countries:

- Flood hazard maps in the surveyed countries usually portray potentially or frequently inundated areas. The existing flood hazard data can be generally considered adequate and most of the countries have the ability to produce risk maps.
- The state-of-the-art of maps for transportation of dangerous goods hazards and risks is clearly very poor. Only two (2) countries indicated having sufficient information to define a national map locating the presence of hazards associated with transportation of dangerous goods.
- A majority of the countries have official hazard maps that cover industrial installations, or at least have inventory maps of hazardous installations in the SPIRS database.

**Table 3: Comparison of availability and basic characteristics of hazard maps between countries and across hazards (p. 1 of 2)**

<b>Hazards Ranking by the Risk Relevance (# of Countries Responding)</b>	<b>Total Risk Relevance</b>	<b>Hazard Maps</b>	<b>Vulnerability and Elements at Risk</b>	<b>Risk Maps</b>	<b>Availability of Other Data</b>
<b>Floods (10 countries)</b>	780	<p>4 countries have official flood hazard maps</p> <p>1 country has maps of the flood plain areas, which play the role of flood hazard maps</p> <p>2 countries have flood maps connected with dams</p>	<p>1 country has official flood vulnerability maps</p> <p>Humans as individuals and humans as social targets were cited as the most vulnerable elements to flooding</p>	<p>None of the surveyed countries have flood risk maps</p>	<p>2 countries have their own flood warning and forecasting systems</p> <p>All countries are collecting data on surface and ground water hydrometry, climatology and meteorology</p> <p>Majority of the countries are collecting data on soil</p>
<b>Transport of Dangerous Goods (9 countries)</b>	750	<p>2 countries claim to have official hazard maps for transportation of dangerous goods</p> <p>2 other countries reporting having some hazard maps, but not at an official level</p>	<p>2 countries have an official classification system for vulnerability</p> <p>Ecology, humans as social targets, humans as individuals, and natural resources were cited as the most vulnerable elements</p>	<p>There are no risk maps for transportation of dangerous goods in any of the surveyed countries</p>	<p>In general, hazard events are registered in all the countries</p>
<b>Industrial Installations (11 countries)</b>	750	<p>7 countries have maps that cover industrial hazards</p>	<p>Vulnerability maps are not available, even though elements at risk and the extension of possible effects can be identified in most countries.</p> <p>Humans as individuals, as well as humans as social targets, and infrastructures were cited as the most vulnerable elements to industrial accidents</p>	<p>4 countries have industrial risk maps</p>	<p>The most frequently collected information includes chemical substances, accidents and chemical concentration and dispersion zones (for potential accident scenarios)</p>
<b>Forest Fires (9 countries)</b>	690	<p>There are many hazard maps in the PECO countries related to forest fires. Almost all of them contain the typical parameters for describing forest fire hazards</p>	<p>No country has developed any kind of vulnerability map for forest fires</p> <p>Ecology, natural resources, and infrastructures were cited as the most vulnerable elements</p>	<p>No country reported having any risk maps for forest fires</p>	<p>Precipitation, temperature, wind speed, wind direction, and vegetation type are the main data elements collected</p> <p>Forest fire events are recorded in 6 countries</p>

**Table 3: Comparison of availability and basic characteristics of hazard maps between countries and across hazards (p. 2 of 2)**

<b>Hazards Ranking by the Risk Relevance</b>	<b>Total Risk Relevance<sup>5</sup></b>	<b>Hazards Maps</b>	<b>Vulnerability</b>	<b>Risk Maps</b>	<b>Availability of Other Data</b>
<b>Contaminated Lands (6 countries)</b>	540	2 countries have official contaminated lands hazard maps  2 countries have national databases of contaminated sites	2 countries have an official vulnerability classification for assessing risk from contaminated lands  Humans as individuals, as well as humans as social targets, infrastructure, natural resources, and ecology were cited as the most vulnerable elements to contaminated lands hazards	None of the surveyed countries have risk maps of contaminated lands	Type of activity, surface soil, the extent of the contaminated area, and groundwater flow velocity are the most frequently collected data related to t contaminated lands hazards  Events involving contaminated lands are recorded in 5 countries
<b>Storms (8 countries)</b>	540	No storm hazard maps, neither official nor unofficial, are available in the majority of the surveyed countries	None of the surveyed countries have official storm vulnerability maps  Humans and infrastructure are the elements with the highest potential risk of storm hazard	None of the surveyed countries have storm risk maps but most of them are planning to prepare such maps in future	Storm hazard data information such as wind-related data, climatological and meteorological conditions are available in all the surveyed countries  Storm events are recorded in two countries
<b>Earthquakes (6 countries)</b>	510	5 countries have their own national hazard maps usually used for applying seismic design codes and rules in appropriate areas.	As a rule, no seismic vulnerability maps are currently being developed,. There are some minor exceptions  Infrastructures and humans as individuals are cited as the elements with the highest potential vulnerability to earthquakes	No seismic risk maps are prepared (with some minor exceptions)	Intensity, magnitude, ground acceleration, lithology, stratigraphy and seismic events are the most frequently collected data related to earthquake hazards  Seismic events are recorded in 5 countries
<b>Landslides (6 countries)</b>	480	4 countries have official landslide hazards maps  5 countries have landslide inventory maps of various scales	2 countries have official landslide vulnerability maps  Infrastructure and ecology are cited as having the highest potential vulnerability to landslides	None of the surveyed countries have official landslide risk maps	The majority of the countries are collecting data on climatology, meteorology, geological setting and terrain configuration  Landslide events are recorded in 4 countries  Some countries have landslide susceptibility maps, or maps of stability conditions

- Seven (7) countries noted having sufficient information for defining a national forest fire hazard map.
- Two (2) countries indicated having sufficient information for defining a national contaminated land hazard map.
- Storm hazard maps are currently not available in any of the surveyed countries. However, six (6) of the countries stated that the information available on storm hazards is sufficient for defining a national storm hazards map.
- Two types of earthquake hazard maps, intensity maps and acceleration maps, are available in the surveyed countries. All of the surveyed countries stated that the information available is sufficient to define a national earthquake hazards map.
- Landslide hazards maps are usually represented by landslide inventory maps. Four (4) of the surveyed countries stated that the information available is sufficient to define a national landslide hazards map.

### ***Vulnerability and elements at risk***

The questionnaire results indicate that only a few countries have begun significant work in this area and that, by and large, most remain open to looking at different approaches and methodologies. Most notably, vulnerability maps are not common in the surveyed countries. Moreover, there are only a few examples of vulnerability assessments available, specifically for floods (in one country only) and landslides (in two countries). However, three (3) countries indicated that they have an official classification system identifying types of objects considered potentially vulnerable to transport of dangerous goods and contaminated lands. As part of this question, respondents were also asked to indicate how various categories of typically vulnerable objects are prioritized for risk management in their countries. Humans as individuals, humans as social targets and infrastructures are generally the most vulnerable elements at risk related to all surveyed natural and technological hazards. The other elements are ecology and natural resources.

### ***Risk maps***

Similar to vulnerability, the questionnaire also sought to understand how countries were approaching risk mapping, and whether in fact, it was of interest to them. The current situation indicates that risk maps are currently available only for industrial installations (four countries). However, the majority of the respondents expressed their intention to create risk maps within the next few years for various hazards. Even so, there are limited numbers of methodologies developed for natural hazard and risk mapping at European level. Therefore, not surprisingly, responses indicated that any assistance or collaborative work in this area would be helpful.

### ***Other data availability***

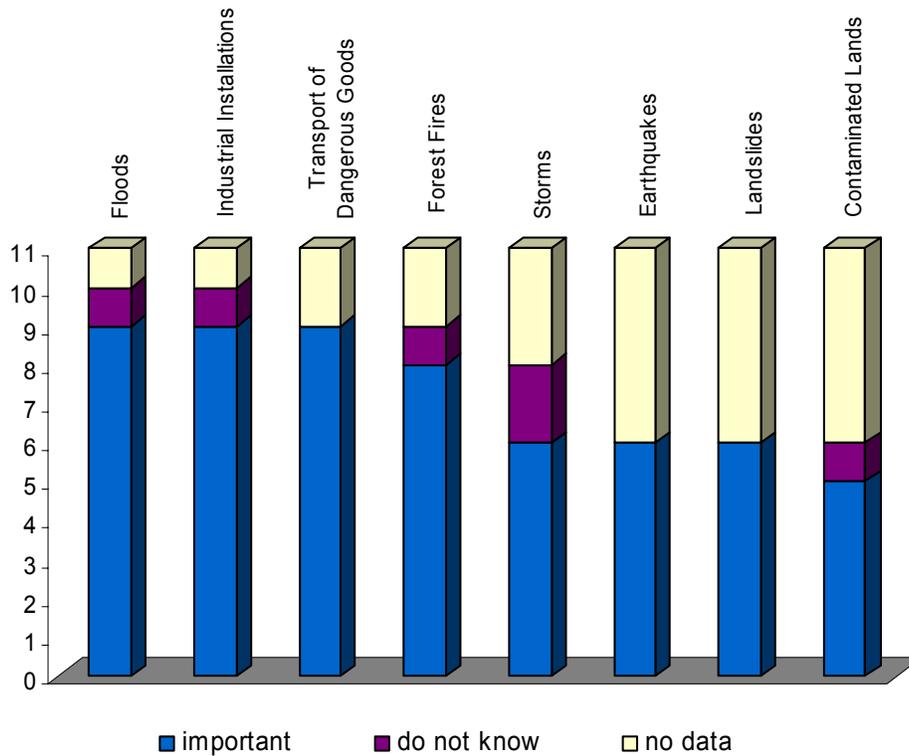
From the responses received, it can be concluded that all the countries are collecting specific data related to different hazards. Events associated with each hazard are recorded in the majority of the countries.

### ***Views on harmonization of hazard mapping practices in the EU***

The current situation regarding overall risk mapping indicates that in the new Member States there is significant diversity and incompatibility between different mapping practices across hazards and countries, and sometimes even between regions within countries. Therefore the opinion of national experts regarding the potential value of establishing common standards for hazards and risk mapping in the EU was investigated.

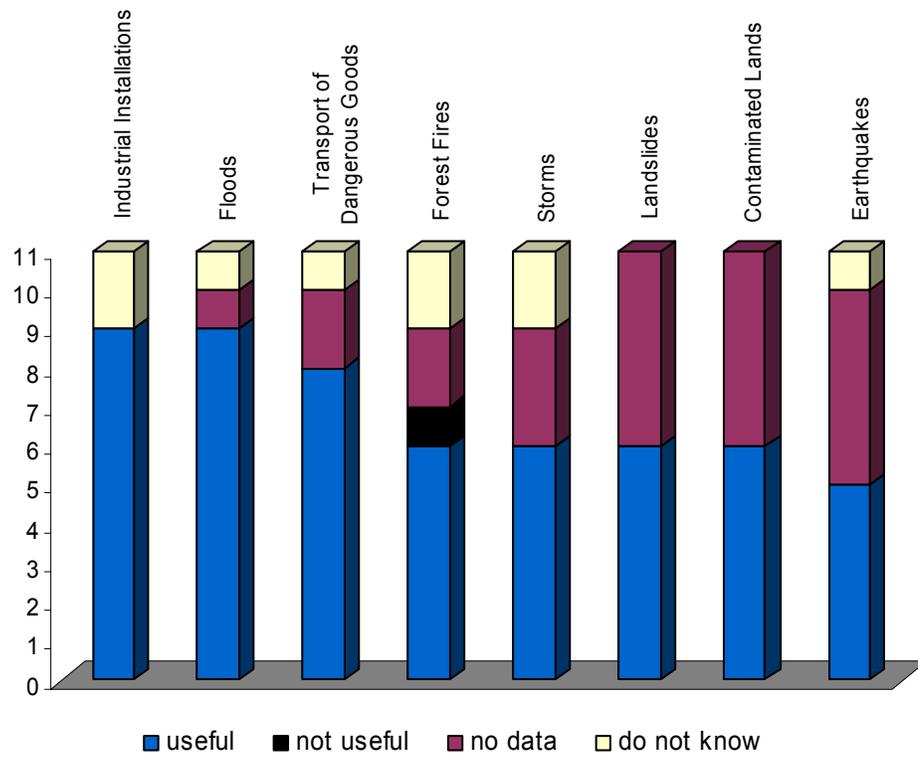
For this reason, each hazard survey asked whether it would be desirable to have 1) a harmonized approach to risk mapping of that hazard within the EU and 2) a mapping approach allowing integration of different kinds of risks for one geographic area.

Figure 3 summarizes the responses to the question about harmonized approaches on a hazard-by-hazard basis (according to the responses of national experts to the individual hazards surveys). As noted in this figure, national experts indicated a strong interest in moving towards harmonized approaches.



**Figure 3: Experts opinion on importance of harmonization of risk mapping**

Figure 4 summarises responses concerning the potential usefulness of integrated risk mapping. According to the survey, integrated risk maps were viewed as highly desirable, particularly for locating and analysing the potential relationship between industrial hazards, floods and transport of dangerous goods in the same geographic region.



**Figure 4: Experts opinion on the value/utility of integrated risk maps**

### 3. CONCLUSIONS AND RECOMMENDATIONS

These findings have some important implications for efforts to encourage common mapping practices and develop some minimum standards for mapping of these hazards.

- **These hazards have been pre-selected as important hazards by the participating countries, so therefore it is not surprising to find that each hazard has some importance in at least half the countries if not a majority of them.** Every country responded to the section of the survey on industrial hazards. The sections on floods, forest fires and transport of dangerous goods also had relatively high response rates.
- **According to the survey responses, minimum common practices that aim at increasing interoperability and exchange of information would be considered particularly beneficial for mapping of floods, industrial hazards, transport of dangerous goods and forest fires.** These hazards are not only of concern across a majority of countries but also have transboundary implications.
- **In terms of the other types of hazards, there are also broader regional, even European-level, benefits to establishing common practices** even though in principal they are only of interest to a minority subset of countries.
- **Earthquake, floods and storm hazards clearly have cross-border implications** and interoperability/exchange of mapping could greatly enhance land-use planning and co-ordination, prevention, preparedness and emergency response in vulnerable transboundary areas.
- **For some hazards, landslides and contaminated lands, direct exposure is essentially local and does not often cross boundaries, but the potential for disaster may actually be linked to the presence of other hazards, such as earthquakes or flooding.** Such a possibility actually magnifies the importance of these disasters inasmuch as they may be the source of important secondary consequences of disasters.
- **In addition, the results of the risk relevance survey are not normalized to control for the social and economic importance of the risks across the countries or within a European perspective.** Therefore, consequences of certain types of disasters, such as earthquakes, while occurring only in certain regions, may have enormous economic implications for a much larger region or Europe as a whole.
- **In general, the sufficient data is available for defining national hazard maps for almost all the surveyed hazards in a majority of the countries, the exception being the transport of dangerous goods.** According to the survey responses, only two countries claim to have sufficient information for creating detailed maps of the presence of this hazard.
- **The majority of the countries favored defining a harmonized approach to risk mapping, particularly for the purposes of inter-compatibility of maps among EU Member States, as well as to allow commonality in the way maps are used for the purposes of emergency and land-use planning.** In fact many countries find that their internal systems and methods are suffering from a lack of harmonization such that mapping practices within the country across hazards and regions are also not always compatible. According to the experts, harmonization priorities should be aimed at conceptual approach, methodology, symbology, data collection and typology. Harmonization of the terminology and definition of risk categories and hazard zones is also very much needed.
- **The survey responses also indicated a high interest in risk mapping, and most probably multi-hazard risk mapping,** although such new techniques are generally

not yet being implemented in these countries. Integrated risk maps, particularly combination of earthquakes, landslides, floods and industrial installations could be most useful to facilitate creation of an overall risk assessment and indicate possible domino effects.

- **These findings imply an opportunity for collaboration on methodology development and potentially harmonized implementation,** provided that the differences in basic inputs are taken into consideration in any such efforts. In conclusion, it was suggested that possible strategies for addressing these challenges could be the focus of a European collaborative project.
- **The overall survey response rate was 73.86 % based on the number of countries responding to each hazard questionnaire.** (A 100% response rate would indicate that every country completed every hazard questionnaire.) This percentage indicates that generally the data are relatively comprehensive of the situation in the new Member States in regard to mapping of the priority hazards and the responses are strongly representative of their relevant views and practices.

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## APPENDIX: Focal Points for the JRC Risk Mapping Survey

Country	Address
<b>Bulgaria</b>	Ministry of Environment and Water 67, Gladstone street, 1000 Sofia Bulgaria <a href="http://www.moew.government.bg">www.moew.government.bg</a>
<b>Czech Republic</b>	Ministry of Interior, General Directorate of Fire Rescue Service of the Czech Republic Kloknerova 26, P.O. Box 69, 148 01 Praha 414 Czech Republic <a href="http://www.mvcr.cz/hasici/index.html">www.mvcr.cz/hasici/index.html</a>
<b>Cyprus</b>	Ministry of Interior, Department of Lands and Surveys 17 Alasia Str., 1075 Nicosia Cyprus <a href="http://www.moi.gov.cy">www.moi.gov.cy</a>
<b>Estonia</b>	Estonian Meteorological and Hydrological Institute Toompuiestee 24, EST-10149 Tallinn Estonia <a href="http://www.emhi.ee">www.emhi.ee</a>
<b>Hungary</b>	Ministry of the Interior Mogyoródi út 43, h-1149 Budapest Hungary <a href="http://www.bm.hu">www.bm.hu</a>
<b>Latvia</b>	State Fire and Rescue Service, Ministry of the Interior Maskavas 5, LV-1050 Riga Latvia <a href="http://www2.112.lv">www2.112.lv</a>
<b>Lithuania</b>	Civil Protection Department Pamenkalnio str. 30, Vilnius It-2600 Lithuania <a href="http://www.csd.lt">www.csd.lt</a>
<b>Poland</b>	Ministry of Economy, Labour and Social Policy Centre of Excellence for Management of Health and Environmental Hazards - MANHAZ Institute of Atomic Energy, 05 400 Swierk – Otwock, Poland <a href="http://manhaz.cyf.gov.pl/">http://manhaz.cyf.gov.pl/</a>
<b>Romania</b>	Ministry of Agriculture and Rural Development B-dul Carol I, nr. 24, sector 3, codul postal 020921, oficiul postal 37 Bucharest Romania <a href="http://mapam.ro/">http://mapam.ro/</a>
<b>Slovakia</b>	Ministry of the Environment of the Slovak Republic Námestie Ľ. Štúra 1, 812 35 Bratislava Slovak Republic <a href="http://www.enviro.gov.sk">www.enviro.gov.sk</a>
<b>Slovenia</b>	Ministry of Defence, Administration for Civil Protection and Disaster Relief Kardeljeva ploščad 21, Ljubljana 1000 Slovenia <a href="http://www.mors.si">www.mors.si</a>

European Commission

**EUR 22899 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen**

Title: Risk Mapping in the New Member States, A Summary of General Practices for Mapping Hazards, Vulnerability and Risk

Author(s): Maureen Wood and Róbert Jelínek

Luxembourg: Office for Official Publications of the European Communities

2007 – 26 pp. – 21 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1018-5593

**Abstract**

In 2003 the Joint Research Centre conducted a survey of mapping practices in eleven (11) new Member States (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) for eight (8) major natural and technological hazards such as floods, forest fires, storms, landslides, earthquakes, industrial installations, transport of dangerous goods and contaminated lands. This activity was funded as part of the project entitled “Management of Natural and Technological Risks”.

One fundamental project objective was to examine the existing situation in each of the surveyed countries, and compare different mapping methodologies in order to define guidelines for establishing compatible risk mapping systems, in particular multi-hazard risk mapping. Therefore, a portion of this survey was targeted to improve general understanding of mapping practices in the different countries for identifying types and locations of relevant natural and technological hazards. This report summarises the findings from this survey on general practices for mapping of selected hazards, vulnerability and risk in PECO countries.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

