Risk Assessment in Europe

Part 2

Lectures presented at the
EU workshop
on
Risk Assessment
arranged in Oslo
25-26 November
1999

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Summary: This report contains lectures presented on the workshop on «Risk Assessment» held in Oslo, November 1999. The results and conclusions from the workshop is presented in a separate report.

Subjects: Risk assessment, follow up procedures, risk communication, risk acceptance, geographical information systems, risk mapping, dimensional planning of fire brigades, safety, security, flood warning, dam risk management, quality management, earthquake emergency discussion results,

Preface

This report is the result of the workshop on Risk Assessment arranged in Oslo 25-26 November 1999. Most of the lectures presented at the workshop are enclosed in this report. Regrettably, only the lectures we had access to on floppy disk are presented here.

The main conclusions from the workshop «Risk Assessment in Europe - A summary from a EU Workshop on Risk Assessment arranged in Oslo 25-26 November 1999» is available on DCDEPs Internet site (www.dsb.no) as Acrobat Reader (.pdf document), or can for a period be ordered directly from DCDEP (send a request via fax + 47 22 38 26 75).

The Directorate for Civil Defence and Emergency Planning (DCDEP) wish to thank the European Commission Civil Protection Unit for their decision to co-finance this workshop together with us.

On behalf of the DCDEP I would also like to thank the participants in the organising committee: Ms. Harriet Lonka, Finland, Dr. Horst Siegmund, Germany, Ms. Janet Edwards, Sweden, Ms. Fernanda Aires Rodrigues, Portugal, Mr. Arne-Jarl Ringstad representing Rogaland Research in Norway and DCDEP colleagues. A special thanks goes to all the speakers and chairmen in the working groups for their help in bringing this arrangement about.

DCDEP
Oslo - Norway, May 2000

Nils Ivar Larsen
Assistant Director

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1. Introduction

The intention with this workshop on Risk Assessment was to create a forum for sharing information about the different risk assessment procedures and methods used in the EU/EEA countries, and experiences with the use of risk analysis. An additional purpose was to give the participants information, and the possibility of exchanging experiences, about follow-up measures of risk analysis in planning procedures and plans, including the use of risk visualising in digital maps (GIS)

One objective with the workshop was to be an effective mean of enhancing compatibility in risk assessment methods, and contribute to more effective cross-border response co-operation within EU/EEA countries.

Is safe - safe enough? Whom shall define what acceptable risk is - media, the public, true legislation or the politicians? Questions which always give an interesting discussion. These were some of the approaches to challenges this workshop wanted to focus on.

Lectures presented

In the following pages lectures presented during the workshop, by specialists in different aspects of Risk Assessment are sharing their experience with different tools and approaches. All the lectures are such they were presented and have not been edited.

Part 1 Lectures and/or slides presented on the workshop

2. «The risk assessment procedures used in the field of civil protection and rescue services in European Union countries and in Norway» by Ms. Harriet Lonka, Reasearch Officer, FEI, Finland

Abstract
Ms. Harriet Lonka, Reasearch Officer, FEI, Finland

The scope of the study was to get an extensive view of the use of risk assessment procedures in civil protection and the rescue services in the EU-area. A basic questionnaire was sent out in spring 1998 to all European Union countries and Norway. After that a closer look was taken to five EU-states: Denmark, Finland, Germany, the Netherlands and Sweden trough collecting more background information and making interviews.

The study focused especially on the use of risk assessment procedures at local level and as a tool of preparedness planning of fire brigades.

The need to use risk assessment procedures in the rescue services in general was clearly recognised by all the countries studied, but the way in which risk assessments were carried out - if at all varied considerably. Most of the countries clearly stressed the responsibility of industry in risk assessment work in accordance with the Seveso I directive and other legal obligations.

The differences between the countries in the use of risk assessment in fire brigades strongly reflect the different administrational systems in these countries. One significant difference regards the strength of central co-ordination of the rescue services in each country. To what extent the rescue services in each country use their resources to develop risk assessment as a tool in preparedness planning depends strongly also on the internal prioritisation of the rescue services system.

In every country, risk assessment methods are used in industry as a basis for emergency planning required e.g. by Seveso I directive. These risk assessments are usually carried out by private consultants and they are not the primary scope of this study. The results of such risk assessments can nevertheless serve also the needs of the local rescue services and can be considered in their preparedness planning.

In the field of rescue services in general, the risk assessment methods in use are mostly of qualitative nature. The minimum standard of risk assessment procedures used in the rescue services in each country is the use of risk identification and consequence assessment. The sophistication of the system is actually based on how far and by what methods the identified risks and their consequences are analysed and what conclusions are drawn from these analyses and estimations.

Many European countries use risk assessment methods of different forms to assist the dimensioning and allocation of rescue services. In most of the countries, only a rough basis for local risk estimation and preparedness planning is provided by legislation or the state authorities. Such a basis can be e.g. the number of inhabitants in the municipality according to which the requirements on the preparedness level are set. Risk assessment methods used at local level are most often based on the estimation of risks in a certain area or on structural risk estimation.

3. «Dimensional Planning and the use of Fire Brigades» by Mr. Anders Arnhus, Adviser, Directorate For Fire and Explosion Prevention, Norway

Introduction

The Directorate for Fire and Explosion Prevention (DBE) is the national public authority within the field of fire and explosion prevention and preparedness in Norway.

The directorate reports to the Ministry of Local Government and Regional Development. Activities are financed over the State Budget.

Trends in damages and losses

The 1998 statistics show that 52 persons died as a result of fire. This is a 20% reduction on the average for the last five years, and this is the lowest number of deaths caused by fire since 1983. Material losses were also considerably lower than in the previous 2 years. The number of large-scale fires shows a decreasing trend.

Goals, Strategy and means

The Norwegian national goals for fire prevention work in the present decade are a 30% reduction in both loss of life and material damage resulting from fires and explosions and a 50% reduction in large-scale damages. This goals are to be fulfiled within the year 2000, measured comparatively with the average for the period 1985 – 89.These goals are moderate and will bring Norway in line with the average for the rest of Europe. The directorate gives priority to work directed towards:

- The general public
- Private and public enterprises
- Large-scale industrial enterprises of national importance
- Municipal fire services

Fire prevention work

The directorate closely follows up the local adaptation to new requirements for municipal fireordinances. The fire ordinance is a binding document which describes how and with which resources the statutory requirements for the fire services shall be complied with by the municipality. The majority of the municipalities have now introduced new, updated fire ordinances. A number of these municipalities employ various forms of mutual cooperation and coordination.

Goals

The aim with dimensional planning is to ensure that Municipal fire brigades are organized and equipped satisfactory and that they have personnel with sufficient skills and competence. The regulation specifies the minimum accepted emergency preparedness for the municipal fire department, with specified minimum requirements for the task forces size (personnel), equipment and response time.

Fire brigades in Norway

The Act relating to Fire Prevention etc. is the legal authorisation for he regulations of the municipal fire brigades capacity. Each Municipal Council shall ensure that the municipality has established a Fire Ordinance. The Fire Ordinance shall contain all necessary documentation, and shall be adopted by the Municipal Council. The adopted Fire Ordinance shall be submitted to the Directorate for Fire and Explosion Prevention, which may order any changes in the ordinance considered necessary. Norway consists of 435 municipalities, about 25 of this municipalities have a joint fire brigade. The rest are independent municipal fire services that are «living their own lives» within the boundary of the actual legislation. Co-operation and collaboration of specific areas of the fire services duties have not been common.

One challenge has been to make the Chief Fire Officer (CFO) and his staff able to work out a reliable and trustworthy risk analysis and a following dimensioning. The majority of Norwgian fire services are on a part time basis. The CFO and his staff are engaged also with other duties, often as technical managers in the municipality.

To help on this situation, the directorate decided to work out comprehensive guidelines to the regulation, we worked out a matching handbook in risk mapping and risk analysis, and we gave several courses for the CFOs and the fire services staff.
This effort was a success. Our written material and the direct dialogue at the courses gave the CFOs inspiration and self confidence to start the work with the new dimensjoning planning for their fire services. Afterwards, after finishing the dimensioning planning some CFOs have told me that they were glad they didn't know how much work it was to carry out the risk mapping and risk analysis in their own community. They also said, and this is an important learning: they would not have been without it!
I have got a lot of comments from those who have worked out the analysis that they have learned a lot out of it. Many were surprised over risks they detected in their own community, they thought they knew their own «neighbourhood» better than they really knew. Another experience was that many fire services have been more humble related to their actual striking power against fires. What they earlier, before the analysis took place, looked at as a risk they were capable to handle, many now have a revised their point of view according to their extinguishing capability.
For the directorate it has been important to pinpoint just the fact that any fire department and any preparedness efforts will meet their individual limits. This limits have to be found, and adequate action must take place to cope with risks that exceeds the fire services capacity.

Risk

Risk analysis is central in the dimensional planning of fire brigades in Norway. The minimum design rules for municipal fire departments are given as standard measure. Herein the individual risks in the municipalities are not taken into account. Risks vary a lot form place to place. It would not be practical to be even more prescriptive in the regulation, giving exact provisions for the fire brigades size and preparedness for all kinds of risk settings.

We could have one standard for all municipalities. This would not have been socio-economic favourable, and far from the optimal cost-effectiveness that we as a directorate want to achive.

In this considerations we landed on a semi-functionally descriptive regulation, giving minimum standards of the fire brigades size, personnel and preparedness. Further the regulation instructs all municipalities to carry out a risk analysis to ensure that their fire brigade can cope with their own risks in their municipality.

This kind of risk analysis has not been carried out earlier, and we did not have the means or the necessary competence in the Norwegian fire brigades to do this work. We were a little concerned about it, this was something new. As it is to things that's new, it have not been done before! So there was no lack of warnings; «-this would be difficult to carry out» was a common view.

So we had to work out a method that both was a textbook in risk mapping and risk analysis, and was a template for the standard that we wanted for the analysis.

Further, we had a challenge in the critical transformation process in this work: How to transform a risk level to preparedness means? (That is personnel, trucks, water supply/tankers and so on).

Response time

The maximum allowed response time is dependent on type of risk. The response time is maximum 10 minutes for Hospitals, nursing homes, malls and areas with a high density of wooden buildings with risk of severe all-including fires.
The response time in other parts of towns and dense built areas is 20 minutes maximum. In the countryside a 30 minutes maximum response time is recommended.

The risk mapping and risk analysis

It is sometimes hard to get started on a work like this. Working with risks and dimensional planning in a academic way can be frightening on personnel who haven't done something like this before. We tried to take this in consideration when we were working with the guidelines, the handbook and the method.

How many fires can be expected in Your Municipality?

Thanks to our god statistics we were able to estimate the actual frequencies of fires in buildings in Norway. This frequencies are divided into different groups of dwellings and different groups of business activities.
Thanks to easy access of official statistics it is an easy matter to find the actual number of dwellings and businesses in the municipality. Having the number of and frequency, the number of expected fires will be the product of these two numbers.
It is an important learning in this, now the CFO can see what to expect rather to regard fires as random or accidental happenings. It is extremely important to base the risk analysis on fires that have happened in Norway as whole, and not base it on the rather few fires that each CFO have experienced. If a municipality once had a serious fire in a nursing home, it doesn't necessarily mean that nursing homes are the most serious risks in this community. It is human to cling to your own experiences when determing risks, and it is easy to forget or not even think about other risks that may be even worse. If you calculate how likely it is to expect a fire in the different objects in the municipality, you can be more certain to do a objectively right risk assessment.

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As a part of the risk mapping process, there was produced risk maps for each municipality. This was based on GIS-data. The objects was given a colour coding according to type of risk. Roads, railways, waterfronts, rivers, lakes and ponds are also plotted in the risk-maps. This is giving both the CFO and the Directorate a clearly set out view of the distribution of the risks.

The dimensional planning is further based on scenarios. We found that conducting fire-scenarios in some chosen risk objects would show how capable the fire service is to handle with fires.
The question was then, how to find the largest risks in the municipality?
For this use we made a graphical representation of some risk levels, and put them in a diagram. We called this graphs «iso-risks» because they represent the same risk level at any point of the graph.

To use this diagram you have to pick out the assumed largest risks in your municipality, their fire frequency is known, you must determine the consequence in case of fire. When this in known, you can plot the risk into the diagram. The definition of risk used is that risk is the product of frequency and consequence.

When you have plotted some of this risks you will find the largest risks in the upper right of the diagram.

Now you have found the objectively largest risks in your area, and you are ready for the final step in dimensioning your fire services, the fire scenarios.

Fire scenarios
Having found the largest risks it is time to test the fire services capability on these objects.
To carry out the scenarios we have composed a questionnaire that is called a «3T-form», the «T's» are a Norwegian abbreviation for «Condition – Threat – Action».

Using this form has proved to be effective. The scenario starts with a description of the technical standard and eventual preparedness in the building. Using this data «a fire is let» in a part of the building where a fire can do most harm, and in places where fire is most likely to break out.
Dependent on the fires growth and the response time for fire services, the strike forces capability, smoke divers or not available, and with the preventional measures in the building expected to function normally, the fire scenario is built.
If the water supply is inadequate, few fire hoses can be used and the fire will expand, then it is vital to have access to water tankers etc.

Conducting this scenarios to the end, success or failure is exposed. If the failure is depending on insufficient preventive measures in the building or if the fire services is to blame will be shown in the scenarios.

If the fire ended in failure, some preventive measures or some increase in the fire services capability can be tested doing this scenario with this increased measures activated. If this is successful they should be put into action through the Fire Ordinance.

What to do with risks that exceeds the fire services capability?

The regulation gives standard minimum requirements for the services «strike forces». If the CFO through the work with risk mapping and risk analysis finds that this minimum striking power is too weak, appropriate action must take place in the dimensioning of the fire brigades power (that is number of personnel, number of trucks etc), or he can do something with the risk itself.

Alternative 1

In the Act relating to Fire Prevention etc., and regulations of Fire-Preventive measures and Fire Inspection, the Municipal Council is given the power to order the measures found necessary to protect against fire in every building, group of buildings, area etc.
This is a very powerful provision given in the Act, and the owner of the object have to pay the costs. So, if there is one or a few risks in a community that overwhelms the striking power of the fire services, reducing this risks can be the right way to go. There is of course some legal aspects here that must be addressed, but this principle has shown practicable.

Alternative 2

If there is a lot of risks of the category that overwhelms the capability of the fire services, the right thing to do is to increase the fire services power.
We have stressed the possibility to co-operate and collaborate with other parties in this matter.
Neighbouring communities fire services are the most obvious party to co-operate with.

Experience from many fires have shown that lots of CFOs are slow to ask for help from his neighbours. The directorate have addressed this problem widely, and it gives results. More municipalities have began to collaborate about many of the fire services duties.

Another important co-operation party is the Civil Defence Rapid Task Forces (FIG). The Norwegian fire departments are municipal, they are not a part of the Civil Defence Forces. This is not an appropriate way of spending limited resources, holding two different preparedness organisations with common goals. The fire services have of course a very short response time compared with the Civil Defence. It is in the field of planning, of education and training of personnel, joint equipment and standards, a huge personnel resource etc. there is something to gain in co-operation with the Civil Defence Forces.

We believe that the work with risk mapping, risk analysis, dimensioning planning and the increased requirements for knowledge in fire prevention have made many of the municipalities aware of the new trend in this field of work. It has been a more professional field of work and even a engineering discipline that requires full time focusing. As mentioned earlier, the majority of our municipal CFOs are only part timers. This makes it difficult to have full attention at all fields of the fire engineering disciplines, fire services operations etc. Collaboration with other municipalities will make the CFO's more comfortable and self-confident.

Alternative 3
A third possibility, if reducing the risks is not possible, too costly or if it is impossible to increase the preparedness or too costly to do so, there is a third alternative:
- To chose to live with the risk after all cost effective risk reducing measures have been carried out.

To chose to live with the risk is a serious matter, and it has to be mentioned as a part of the Municipalities Fire Ordinance, which is submitted to the Directorate for Fire and Explosion Prevention. The Fire Ordinance is approved by the Municipal Council. To chose this third solution shall be an deliberate action and the consequences shall be acknowledged.

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4. «Risk Mapping for Swedish Communities: A Geographic Perspective for Planning and Decision Making for Risk Management» by *Ms. Janet Edwards, Project Leader, and Mr. Mattias Strömgren, City Planner, Swedish Rescue Services Agency*

Risk Mapping for Swedish communities:
A Geographic Perspective for Planning and Decision-Making for Risk Management.
By Janet Edwards and Mattias Strömgren, The Swedish Rescue Services Agency

Presented at the EU-Regio Risk Management Conference in Oslo, Norway, on the 25-26 November 1999.

Swedish Rescue Service Agency's role and area of responsibility

My colleague Mattias and I would like to discuss selected risk mapping applications developed by the Swedish Rescue Services Agency. We will begin with information about our agency, its mission and goals. The Swedish Rescue Services Agency is a national agency authorized by the Swedish government in 1986. It is administered by the Ministry of Defense. There are 800 employees at the Rescue Services Agency, 300 of these people work in the national headquarters in Karlstad. The other employees are educators in one of four fire and rescue schools within the country.

Those of us who work for the agency have one primary mission. That is to promote a safer society by preventing, limiting and mitigating damage to life, property and the environment. In order to accomplish this mission, the Agency coordinates risk management and rescue activities for the country's 288 communities and 830 fire stations. The Agency provides training, advice, and information in the form of reports, newspapers, and brochures. The Agency finances research and development of new techniques.

The Swedish Rescue Services Agency's activities stretch beyond the national boundary. A large portion of the Agency's yearly budget is allocated to service abroad. Personnel with specialized skills are often sent to foreign countries to assist with complicated accident situations.

GIS-development is currently supervised bythe agency's information bank, RIB. Beginning in 1995 a different unit, the risk management unit, introduced geographic information systems as a method for inventory and evaluation of risks. This has revolutionized the way communities access information about risks.

I will discuss three different models today. One is called **RiskArvika** and was designed for use in fire and rescue schools. Students using RiskArvika can perform an easy inventory and classification of risks within a city's center. Users can also see the results of selected analyses of risks.

Riskplan also uses Arvikas city data. The application was created for city planners**.** It walks the user through several steps in the risk management process. The third

model is called **Risk-GIS** and was intended to spread information about how one large community designed its computer system for accident prevention.

Before we begin our discussion of these GIS-applications, we would like to present some background information about, first, how our unit has helped communities to think «accident prevention» and, secondly, the risk management process that is promoted within the communities.

The final part of our presentation revolves around the latest risk mapping application which is called **RISK-ERA**. This new computer tool will be developed in cooperation with representatives from nine communities. Its purpose is to allow risk managers to use a standard system which accompanies their community's digital maps.

Encouraging rescue personnel to think «accident prevention »
Paving the way
Let's start from the fireman's point of view. He or she has been trained to respond immediately and professionally when fires and other accidents are reported. The fireman does his job and then returns to the fire station to document the incident and prepare his equipment for a new accident. However, his world is changing. Now a large part of his job or his boss' job involves preventing these types of accidents from occurring. Here is where the Agency's work begins, educating and then allowing the «students» to implement what they have learned.

Most often information about accident prevention is dispersed through printed material.
In recent years the Swedish Rescue Services Agency has published 20-30 reports or training materials per year dealing with prevention of specific types of accidents. This is not surprising if you consider all the types of accidents that the Agency works to prevent. These include fires in buildings, forest fires, landslides, avalanches, slope failures, flooding, drowning, explosions, and chemical spills (both industry and transport).

In an attempt to pave the way for communities and counties to inventory and assess their risks, the Swedish Rescue Services Agency has published a number of reports and handbooks. The first book that presented a comprehensive look at risk management was called **The Risk Handbook: To protect and save life, property and the environment**. The report was published and distributed to all Swedish communities in 1989. Before the publication of this book, there was no Swedish guidebook for inventory and analysis of risks.

The handbook is easy to read and use with text, charts, tables, photographs, drawings and site maps. It gives the user a step-by-step method for finding and assessing risks in one's own community. There is a chapter for each type of accident that is likely to occur in Sweden. They are traffic accidents, natural accidents, fires, explosions, chemical spills and accidents at nuclear power plants. For each of these types the source of risk is identified. An example of an accident of this type has been selected. For this case study consequences have been summarized. Risk analysis methods are thereafter described. There is also a chapter about industry and technical development.

This work was published three years later by the United Nations Emergency Programme (UNEP), Industry and Environment. It is called **Hazard Identification and Evaluation in a Local Community.** This technical report is number 12 in UNEPs APELL (Awareness and Preparedness for Emergencies at the Local Level) series.

In addition to the handbook, there is also a collection of case studies which provide information on risk analysis methods, that is to say: identification of the risk object, what damages can be expected, an assessment of both the probability of such an accident occurring and the expected consequences. The accident types selected for this 1992 publication are the following: iron and paint store, ice hockey stadium, petrol station, plastics factory, oil depository at a harbor, and a train yard. These cases give detailed information about what can be expected in other communities that have similar risk sources.

Personal contact with local community personnel is done quite often. This is a second important way to assure that information reaches all parties involved in risk management. Most of the employees in Karlstad travel on a regular basis in order to inform other agency members or fire and rescue personnel about new policies, new management tools or the most current research findings. Mattias has traveled to different universities and colleges as well as to local communities in order to present risk management strategies.
Personnel are also involved in committee work. Employees sit with members of other agencies to discuss new issues and new methods regarding risk management. In several cases new task groups have been established under our agencies leadership. These groups focus on one clear objective related to accident prevention. The latest method of information spreading is the initiation of a seminar series. At least four times a year different risk specialists are invited to Karlstad to present their research. These seminars are announced on the agency's home page and special invitations are sent to strategic groups in risk management. Agency personnel, students, and other interested members of the public are invited. Discussions are always an important part of these meetings.
Research
Many of the research reports published by the Swedish Rescue Services Agency in the recent years have a baring on risk mapping. Even if the new information does not include maps and tables, there is often information about risk sources, methods of analysis, accident statistics, area of risk, fire dynamics, chemical information, etc. All of this can be relevant for a risk mapping project. The goal is to provide enough information for communities to have a bird's-eye view of the risks in their community. The County Administrative Board in Kronoberg and the Swedish Rescue Services Agency worked together to produce the first regional risk management report. The County has an area of almost 10,000 square kilometers. Approximately 180,000 people inhabit the area. There are eight communities within the County boundary. Two-thirds of the County is forested with a relatively high percentage of water (8 percent) and a nearly equal amount of cultivated land (9 percent).
Anders Johansson, author of the final report, **Risk Management with the Help of GIS,** describes the project goals as follows: to develop new methods for risk analysis, to use GIS to a larger extent, and to describe the risk profile for the county. As with most of the computer applications, a consultant was commissioned to develop the geographic information system. An affairs unit of the Swedish Land Survey Office

developed the applications in ArcView, which is currently used by county employees. Different types of risks were studied to obtain an overview.
While mapping the risk profile for Kronoberg, the researchers looked at these important matters. Where are dangerous chemicals transported? What chemicals are used in industry and what impacts would a spill have? Where are the dams located? Where is the slope likely to fail? Where could avalanches occur? What areas are sensitive to flooding? Where is the greatest danger for forest fires? How is electricity distributed? Where are the telephone connections? What areas are environmentally sensitive? Where are the fire and rescue stations located? How fast can they respond? As a conclusion the industries, roads most likely to be subject to an accident are listed and will continue to be monitored.
What is unique about this project is that data was collected from several different offices and combined in the same project. That means several suppliers and several users. This is the direction which the Swedish Rescue Services Agency would like to go.
Although establishing a risk database is a major step for local authorities, it is only the beginning. There is now a need for encouraging a process of continual improvement of risk management activities. The goal is that accidents of all kinds will be reduced with time and effort.
Nine years after the publication of the Risk Handbook, Dr. Tommy Rosenberg published a new book for risk management. His dissertation **Risk and Quality Management for Safety at a Local Level** offers methods and tools for continuous quality improvement (CQI) of accident prevention. Step one of the process is the definition of the local risk topography including hazard identification and risk assessment in a geographic perspective. It also involves collecting accident data and analysis. Step two is the definition of targets, objectives and strategies for prevention. The third step involves actions towards improved management, identification of preventive measures and the use of tools for decision support. Step four is follow-up, checking the results of the actions taken. The final step improves the process. This five-step loop is never ending. It is intended to be engaged continuously, gradually selecting risk after risk and improving methods for reducing the number and severity of accidents.
In order for this CQI process to be implemented, communities must emerge from an «old paradigm» and be submerged in the new one. The old paradigm focuses on emergency response and the new paradigm emphasizes accident prevent.

Cultivating the risk management process

Risk management at different levels

Risk management is important at every level of the society. «Safety thinking» should occur from the individual person to the entire society in a hierarchy of responsibility. On the society level the government, authorities etc. make laws and decisions in order to create a safer society. On the organization or company level risk management should be a part of daily work. On the group level and the individual level one must be aware of risks, develop competence, follow safety instructions,

and use safety equipment. In Sweden our agency believes that the local community should coordinate and inspire risk management and safety activities.

Risk spectrum

There are several kinds of accident risks. One can put these different kinds of accident risks in a risk spectrum. We have divided accident risks into «everyday accidents», «large accidents» and «catastrophies». Everyday accidents will occur every day in our country and will affect only a few peoples. Examples can be fires, traffic accidents and drowning. Large accidents are unusual but can affect groups of people. Examples can be air and train crashes and accidents with dangerous gods. Catastrophies are rare in our country but can affect many aspects of society.

Teamwork

Risk management demands teamwork. There is no specific actor that can do this alone. Risk management needs different kinds of knowledge, different kinds of techniques (for example risk analysis, statistics, GIS, cost-benefit analysis), different kinds of preventive measures and different kinds of channels for risk communications.

Examples of actors at the local level can be rescue and fire fighting personnel, environmental protection specialists, land use planners, technical support staff, traffic planners, social welfare administrators, school directors, business managers and politicians. These can form a working team for risk management. Police, the road and rail administration, the county board of administration, the national defence and private organizations can also play an important role increasing safety.

The risk management process

It is important that risk management becomes a process, that it is structured and long living. Risks in society change over time, therefore knowledge, techniques and attitudes need to follow these trends.

The risk management process could include the following steps:

1. Goal and delimitation

The process should start with goals and policies for risk management work.

2 .Inventory

The risk inventory describes the risk situation in a local community or in an industry etc. The inventory can answer: What can happen? Where can it happen? How can it happen?

The inventory becomes easy to understand if used put on a map. Risk inventory can be used as support for general plans (land use planning), rescue plans, traffic plans, and environmental protection.

3. Analysis

The next step is to analyze the risks with respect to probability and consequence. There are many different risk analysis methods that can be used. The result of analysis can be expressed as a risk level (for example low probability, high consequences. The exact location of these risk objects or areas can be presented

on maps. Risk analysis can be useful to evaluate the risk level in an industry or in a technical system, and for planning, projecting and drafting of such documents as Environmental Impact Assessments.

4. Assessment

Risk levels can be compared with risk criteria, legislation and other conditions. A decision must be made: Is the risk too high or is it tolerable?

5. Risk reduction measures

Risk reduction measures may be necessary. Measures to prevent accidents and/or mitigate consequences can be taken. Cost-benefit analysis may be done to find the best approach.

6. Follow-up and risk communications

It is important to follow-up the risk assessment with statistics, accident investigations etc. It is also urgent to communicate risks to the public and decision-makers.

Creating digital mapping applications for community risk management

Räddningsverkets Information Bank

Developing digital training packages has been a goal since the establishment of the Agency's Information Bank. Called **RIB**, a yearly subsription costs 900 Swedish crowns or about 100 US dollars. RIB has been designed for use by fire and rescue personnel. It is user-friendly and information can be accessed at a time of emergency.

Several buttons provide easy guidance into one of the major files. Here are a few of the programs featured. There is a button for the library which has the complete text of most reports published by the Agency. There is a button for a chemical database. Here information about the properties of thousands of chemicals are found. Information about how to clean up chemical spill without injury to personnel or the environment is also available.

There are a few dispersion models in RIB including chemical dispersion in water, air and on the ground. The model for dispersion in air has a button that starts MapInfo. If the user has installed this desktop mapping program, then the result of the dispersion plume will be shown on a city map with a scale of 1:20,000.

Training with Risk Mapping

The Information Bank has recently added a training application called **RiskArvika**. It shows how mapping can add a new dimension of understanding risks at a local level. Map data was acquired from the community of Arvika for this application. When you open the program the city map can be seen on the left side of the screen. To the right are two file folders, one for risk inventory and the other for risk analysis. When the user begins he or she chooses which map themes to look at. There is one for streets, one for buildings, one for lakes and rivers and one for the local fire station. Risks are classified and objects in each class can be easily shown on the map. Objects to be protected also have their own classification system. Any combination of risks and protection objects can be shown simultaneously.

Twenty questions have been included in a short manual which allows the user to become acquainted with the information. As with all modules in RIB, users can call the support-line if they encounter difficulties.

RiskArvika was one of the simplest applications to create for two reasons. One reason is the availability of a new mapping package from ESRI (Environmental Systems Research Institute) for programmers called MapObjects. This allows map data to be combined with simple GIS-tools that did not require the purchase of a GIS-desktop mapping product. Nor did it require knowledge of GIS: The second reason that Risk-Arvika could be produced without much time or costs, was because the data was compiled during an earlier project.

In 1998 I met with members Arvika's risk management group as Mattias had done a year early. After several meetings we agreed about the focus of a new training application that could be distributed to city planners. It was the Agency's wish to develop an example that would allow the user to follow the risk management process described above. The application revolves around a planning proposal to build a heating plant for heating homes in central Arvika. The application illustrates the risks facing employees working at the plant (should it be built) and risks caused by the new industry.

Riskplan is divided into three map views, the first is an overall plan of the city, the second is a risk inventory and analysis (risks to the factory) and the third, environmental consequences (risks from the factory). The first view is used primarily to orient the user to the various planning zones. In the second view, users may click on various objects to obtain site-specific data.

Users also perform several analyses. First, one searches for other industrial sites in the area to find out where chemical explosions or spills could occur. Secondarily, one views the results of an analysis to determine how large the risk area is and which buildings are found within the zone. In the third view the user learns which houses would be adversely affected by noise or sulfur dioxide emissions.

Riskplan was developed originally for ArcView because that is the GIS-program that Arvika used. They purchased 10 licenses for employees. However, only half of the Sweden's communities using GIS-technology use ArcView. The other half use MapInfo. The Agency specified in the consultant's contract that both versions were necessary. Therefore, data conversion and the writing of a new manual were done easily without unnecessary delays or further negotiation.

When the two applications were finished, several employees met internally to discuss how Riskplan could be publicized and distributed on the Internet. Several introductory statements about risk management with GIS and how Riskplan was created are found on the Agency's home pages (www.srv.se). The data for either ArcView or MapInfo (about 3 mb) can be downloaded.

The third mapping application for risk to be discussed is **Risk-GIS.** Although it was one of the Agency's first GIS-applications, it is the hardest to use and has the largest database. It was also the most expensive to create. This was due to two factors. The test community was Jönköping with a population of 115, 000. The fire stations reported over 8,000 accidents during six years (1989-1995). A version of ArcView (ArcView 2.1 Data Publisher) accompanies Risk-GIS. Training in ArcView is suggested or at least a sufficient amount of practice with Risk-GIS before

understanding Jönköpings risk zones. There is a very detailed manual for Risk-GIS. Despite its 65 pages, there might not be an example of the exact analysis you wish to perform. The amount of new information acquired by using the application depends largely on the amount of self-study.

There are many types of geographical analyses that can be performed. Here is an example. If you want to know where the most fires have occurred, you first decide if you are interested in all fires or a certain type of fire. If you choose fires in dwellings, you can ask the program to count the number of fires in houses or in houses and apartments. Perhaps you want to know the total number for all years in the data bank (six years). On the other hand, you might be interested in knowing only the total fires for 1995.

It is a challenging program that has been used in advanced risk management courses and at a couple of Swedish universities. Five hundred copies of the CD were made.

Planning for a locally based risk management system- Risk-Era

The Swedish Rescue Services Agency would like to enter a new era in risk mapping and therefore the current application under development is called **Risk-Era**. Risk-Era is intended to compliment the Risk Handbook. This new digital version will assist the user in entering and updating risk information. Text from the handbook, updated if necessary, can be accessed digitally by users of Risk-Era. The application will also allow local risk managers to follow the «continuous safety improvement process» mentioned above.

Risk-Era will be developed over a period of three years. Several work groups have been established to gain consensus about which data the application should process, how a standard risk inventory should look in a GIS-environment. Risk-Era is different from the other applications mentioned because each community will work with the same program but with different data, including a unique digital map of the city's roads, building, industries, parks, lakes, rivers, protected areas. City planners are responsible for digitizing such a map. Risk objects will be mapped. This will include industrial locations as well as transport routes for trucks loaded with dangerous chemicals. Objects, which need to be protected, are considered equally important as the objects of risk. Objects deserving special protection include schools, public buildings, hospitals, environmentally sensitive areas etc. Some analytical tools will be added. It is left to the user to decide which tools will be used in the various phases of the risk management process.

Since Risk-Era will be distributed with the Agency's Information Bank (RIB) it can be evaluated regularly. Comments from users are essential to assure that the program is effectively used for risk management.

Conclusion

The Swedish Rescue Services Agency attempt to lead the way for Swedish communities in their risk management efforts. The Agency finances research which lead to new information and the development of products which use new techniques. In some cases communities use their own resources to develop risk mapping

applications. These models are equally valuable and the Agency. Therefore, this information is spread to other communities.

There are several reasons why GIS has been used. It gives the decision-maker better, more accurate, and timely data. The information is easy to read and interpret. Consequences of various accidents can be assessed and evaluated. What will be the consequences if no preventative actions are taken? What will be the environmental consequence of rescue and clean-up work?

Modern methods are also needed to determine which risks should be given immediate attention. Is a chemical spill from a truck transporting dangerous chemicals more likely to occur than an explosion at an industrial plant? In order to answer these questions, an analysis is needed for all major risk sources. Those analyses should be geographically based. This will show where the risk objects are and how large the risk zone is for a specified accident type. The results of each analysis need to be compared with each other to determine where and what type of facilities, homes, roadways etc need attention first. These analyses will also tell us where improvements should be made.

Several foreign visitors have come to Karlstad to talk with our risk management experts and to see a few of our risk mapping applications. This exchange has been valuable for both parties. Those of you who are interested in seeing one or more of these applications are welcome to Karlstad for a more informal encounter.

The Agency is also involved in several international groups. This allows us to stay informed about the work done by other countries. In some cases our work had been modified or patterned after state-of-the-art methods from other parts of the world.

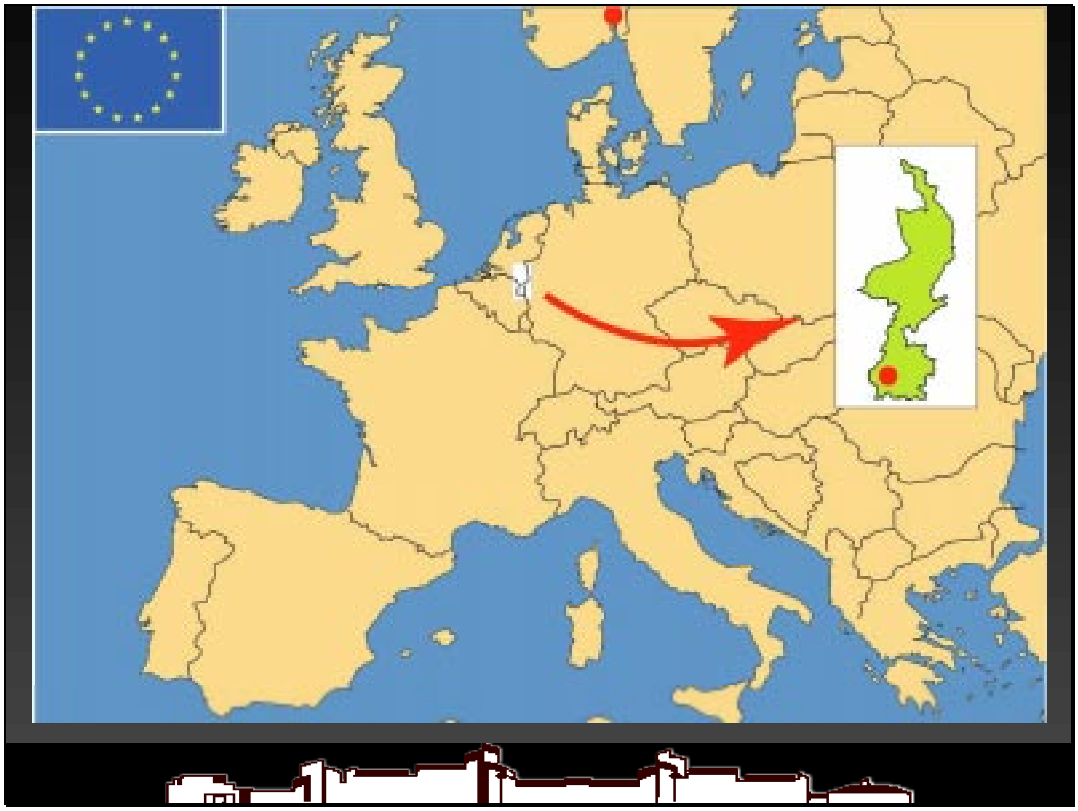
Janet Edwards is a GIS project leader and currently works for the Swedish Rescue Service Agency's Information Bank. She has a bachelor's degree in geography from the University of California at Los Angeles and a master's from California State University at Northridge. Janet began her work with GIS in 1985 starting with a course at the Earth Resources Observation Station in South Dakota. She has also taken courses at the Swedish Institute for Geographic Information Technology (SIGIT) and taught GIS at Karlstad University. Janet has worked for the Swedish Rescue Services Board since 1995.

Mattias Strömgren is a city planner and currently works for the Swedish Rescue Services Agency's Risk Management Division. He works specially with land use planning and risk management. He has a bachelor's degree in spatial planning (180 credit-points, 4,5 years) from The Department of Spatial Planning at University of Karlskrona/Ronneby. Mattias has worked for the Swedish Rescue Services Board since 1996.

5. «Risk Mapping and the Cross Border Nature of Risk» by Mr. Nic M.J. Herzig, Chairman of the Commission for Public Safety of the EUREGIO Maas-Rhine project, the Netherlands

Slide 1

Slide 2



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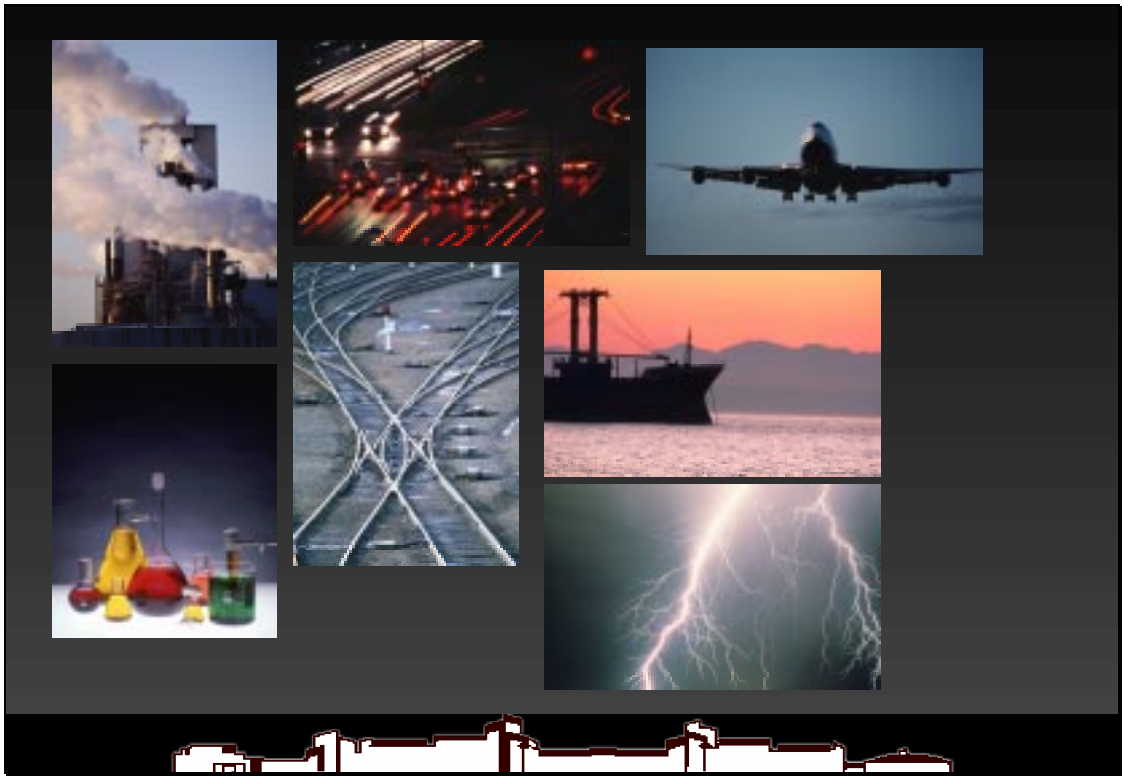


Slide 5

BASIC DATA

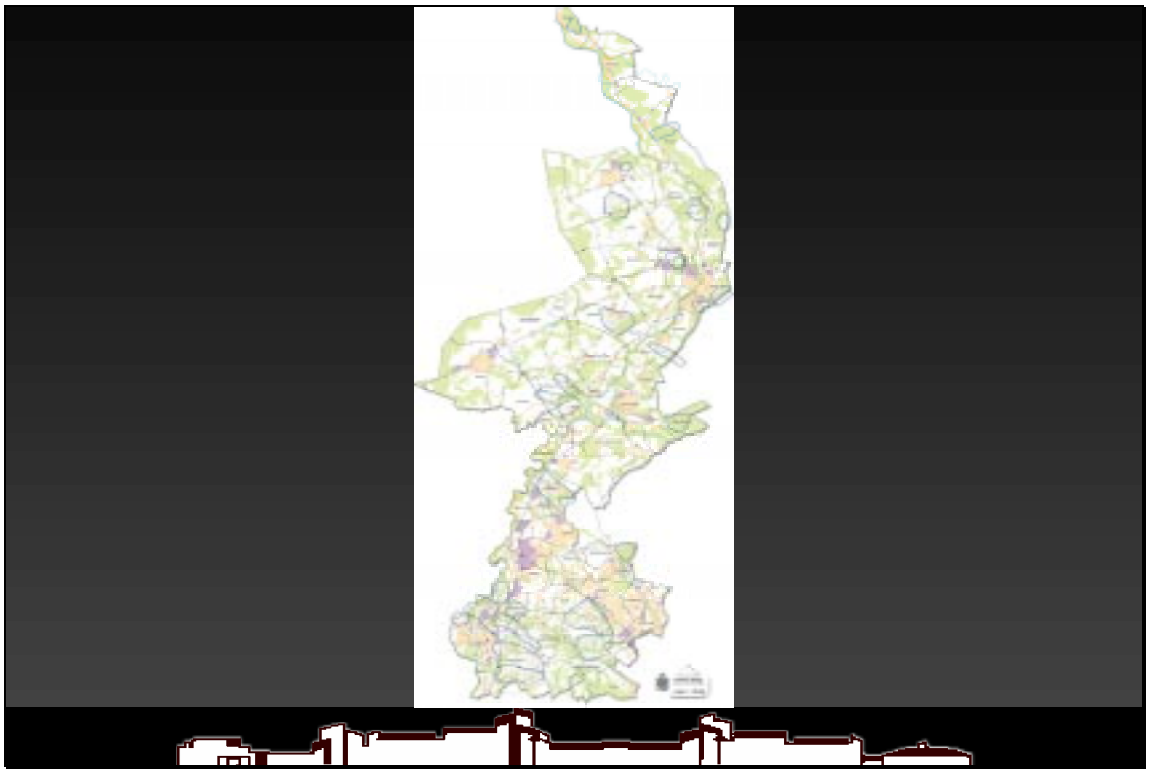
- The border of the province of Limburg
- Rivers and canals
- Borders of municipalities and their names
- Residential and industrial areas
- Forest and other reserves
-

Slide 6

BASIC DATA (2)

- Roads
- Groundwater protection areas
- Dikes along the river Maas
-

Slide 7



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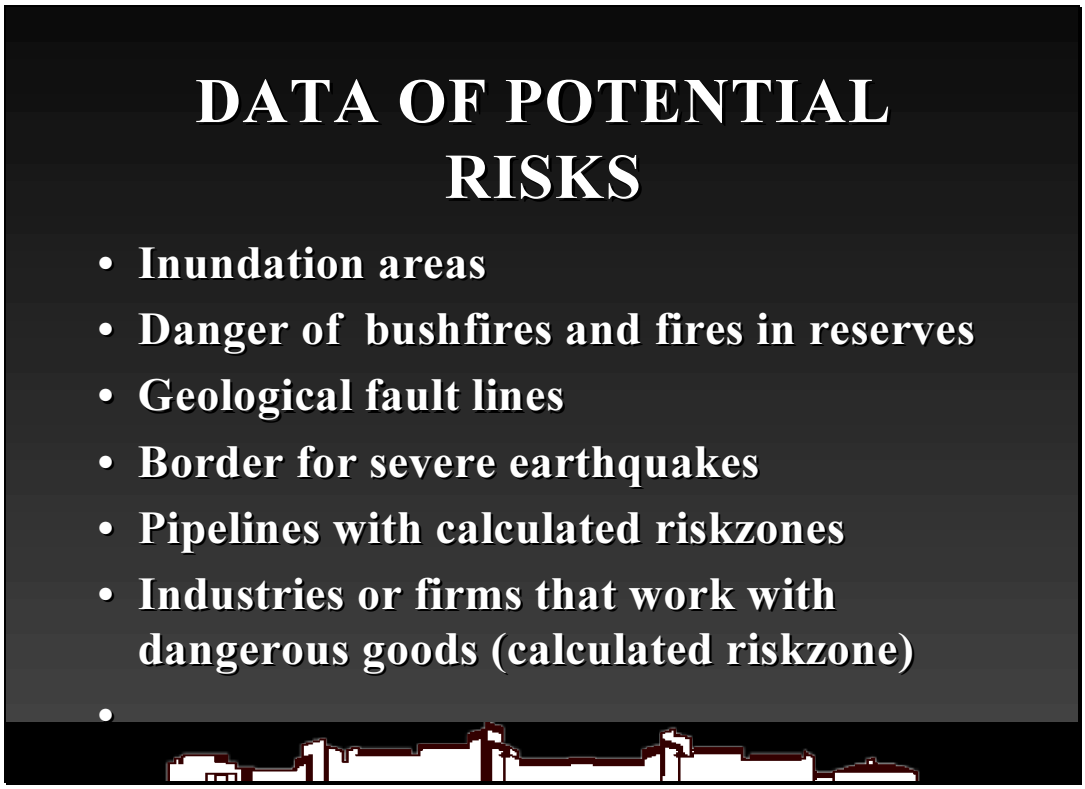

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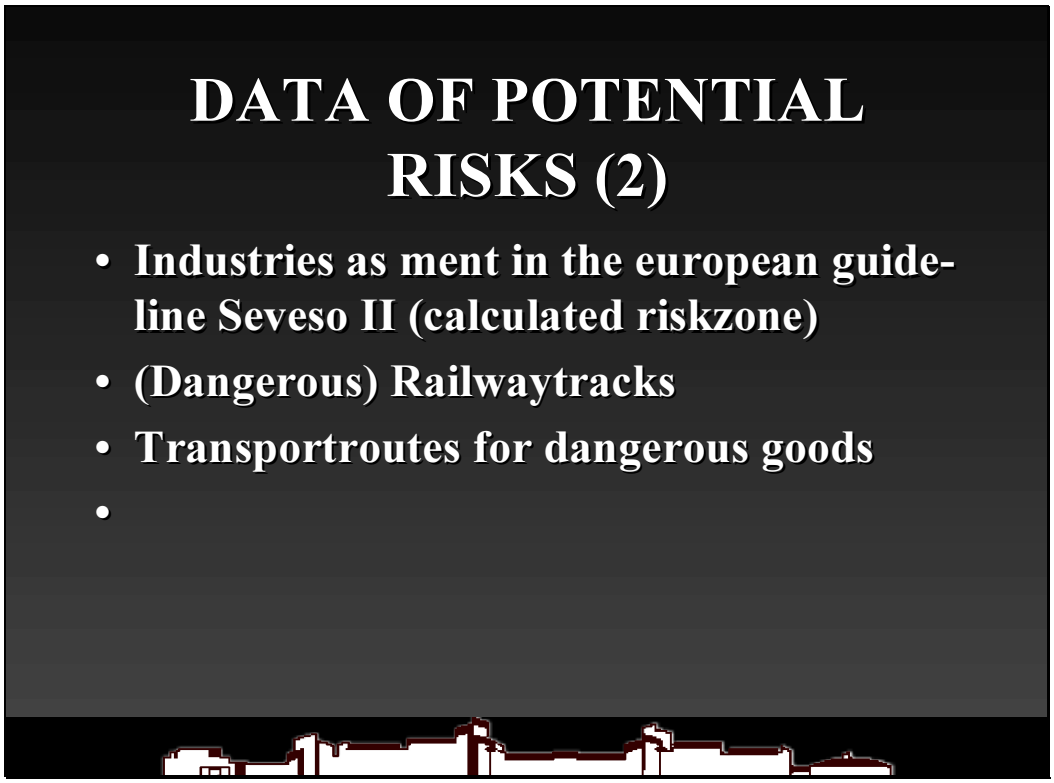


Slide 10

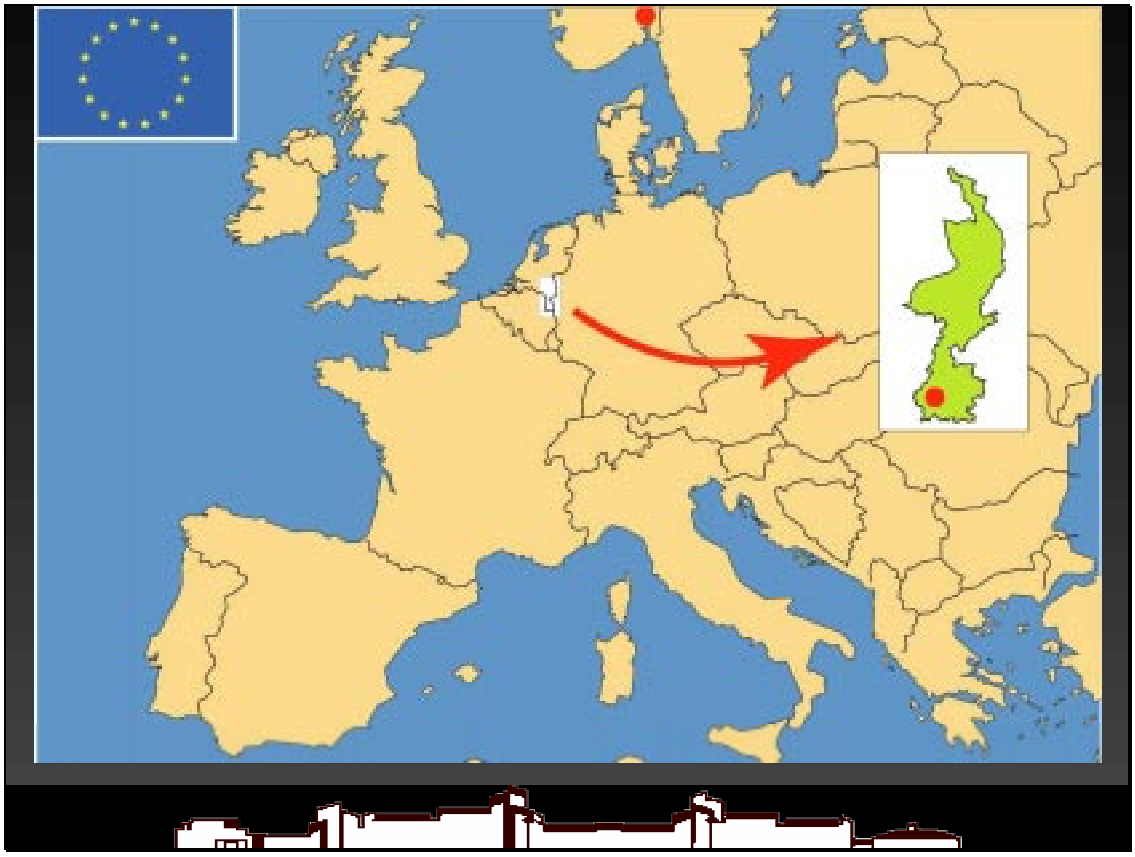
Slide 11

Slide 12

USAGE OF THE RISKMAP(2)

- Avoid (more) cumulation of risks
- Safer planning of new riskfull activities
- Better preparation on potential risks
- Create more riskawareness
-

Slide 13



Slide 14

THE EURISKMAP PROJECT

- Cooperation with the adjacent German and Belgian regions (Euregion Maas-Rijn) and EC-subsidy
- Datacollection is difficult
- Definition of risks and riskzones
- Usage of GIS-software
- Arrangements about updating the map
- Pilotmap and workshop in december
-

Slide 15

QUESTIONS ?

6. «The Safety Chain Project» by Mr. Peter Dekker, Senior Policy Adviser, Ministry of the Interior, the Netherlands

International Workshop on Risk Assessment, Oslo, 25th – 26th November 1999

(1)

Integration of Risk Assessment in the Decision-Making Process

Preliminary results of the Safety Chain Project in The Netherlands

Peter A. Dekker
Senior adviser Safety Policy Division
Crisis Management and Fire Services Department
Ministry of the Interior and Kingdom Relations, The Netherlands

Ladies and gentlemen,

Think before you act! That's a well-known saying. In my presentation I change this in: Think before you plan, construct.

I'm sure that many of you will get this in mind while hearing the following situations:

(2)

1. In a small town in the country side a large international company has a major distribution-centre, with very large uncompartimented areas, with no sprinklers. When a fire starts and the - also small - fire brigade of this town must suppress this fire, there is of course no possibility to do so.

2. The recent floods of the Maas River in Belgium and the Netherlands. Houses and premises built in the beds of the river were flooded.

3. A new chemical plant is built at the westside near a densely populated area. The major direction of the wind is North-West. A large emission of a toxic substance occurs. The toxic cloud drifts across the city with serious consequences.

Examples of what you can call **unsafe situations**. Everybody knows that these situations may be prevented if - in an early stage of the decision making process about these objects and activities - the issue of safety has a high priority.

(3)

So, the important question is: **How can we make the right decisions on safety at the appropriate moments in decision-making processes for new constructions and works (e.g. a production site of chemicals or a tunnel) to guarantee a adequate level of safety in society?**

And: **How can Risk Assessment be useful in this process?**

(4)

Recently - in the beginning of November 1999 - an **EU-workshop** was held in Rotterdam. In this workshop it was discussed whether the **Safety Chain concept**, used in the Netherlands, is a useful instrument to give safety the required position in decision-making processes.

The aim of this workshop was to study the concept and compare it with safety policies of other European countries.

I will present to you the preliminary results of the workshop.
But first of all I will introduce to you the Safety-Chain concept itself.

(5)

The Safety-Chain is a **conceptual model** which describes on one hand the process of decision-making, and on the other hand the contents of the safety decisions that have to be made in the different stages of a construction or work: initiative, planning, design, construction, exploitation.

Aim of the Safety-Chain is to bring in the relevant safety issues at the appropriate time. Furthermore, it can help the user to pay attention to all the steps of a chain and to the interconnections and interdependencies of those steps. E.g.: there must be a good balance between Prevention and Preparation.

The Safety-Chain consists of **five steps**, which I now will deal with in detail.
At each step I will formulate an important safety question on which decisions have to be made.

1. **Pro-action**
def.: Elimination of structural causes of danger.

Safety question in this step:
- is this the right mode of production, transport, storage, etc. with respect to safety? Are there alternatives?
(- do all persons / organizations who should have influence on the decision on safety (participate in the discussion?)

2. **Prevention**
def.: Elimination of direct causes of danger (reduction of chance) *and* maximum possible limitation of the consequences of infringements of safety if these occur (reduction of consequences).

Safety question in this step:
- when is the activity / situation / object etc. safe enough? what's the safety level?
- which safety measures provide a good level of safety with respect to both the reduction of chance and the reduction of consequences? In other words: when a

building permit is given, are you then sure that in case of a fire in that object this fire is manageble for the fire brigades and for the other rescue services?

3. **Preparation**
def.: Actual preparations for action to be taken in the event of infringements of safety.

Safety question in this step:
- what are the scenario's to prepare your rescue services on?
(- in which situations we do not suppress a fire, but let it burn out under controlled conditions?
(- which safety plans are needed to prepare for possible accidents?)

4. **Suppression**
def.: Actual suppression of infringements and the provision or help in critical emergency situations.

Safety question in this step:
- what is the most adequate strategy in case of a fire?
(- tactics)

5. **Follow-up**
def.: Everything necessary to restore the 'normal' condition as soon as possible *and* lessons learned or evaluation.

Safety question in this step:
- when can you say a normal situation has been restored?
(- what can you learn from the accident (evaluation)?)

(6)

One of the discussions at the workshop was: What's the best model for the Safety Chain concept? **A Chain or a Wheel**? The chain is more static, the wheel is a more dynamic model. A model I like to add to these models is the **Spiral**: it's dynamic and progressive.
It's nice to philosophize this question, though no conclusion has been formulated on it. But it's sensible to think about it.

(7)

Now I will present to you the **preliminary results** of the Safety-Chain workshop. The first day three plenary lectures were given on the national safety policies of Norway, Italy and the Netherlands. In workshops those policies were applied to specific cases or situations and discussed with the other participants:
- the underground building to cross waterways,
- the planning in flood prone river areas,
- the planning of the transport of hazardous goods through residential areas.

The second day the Safety-Chain concept was applied in three parallel workshops, all dealing with the same case: an underground shopping centre 'Koopgoot' in the city center of Rotterdam.

The following conclusions can be drawn:
1. It proved to be very useful to discuss the safety policies of different EU-countries.
2. In most of the countries a lot of attention is paid to **Preparation and Suppression**. The organization of rescue services is not the problem. Also sufficient attention is paid to the making of plans, based on a assessment of the existing risk of all objects and activities in the vicinity of municipalities.
3. Another conclusion is that all countries stress the importance of more attention for **the left side of Safety-Chain** - **Pro-action and Prevention** - and it is agreed these two items need to be improved.
(in the Spiral model of course I should say the first steps of the Chain).

For reason of time I will focus in this presentation on Pro-action.
In most of the EU-countries **Prevention** gets a lot of attention and there are instruments to deal with it: legislation, guidelines, etc. But the question is: are these regulations flexible enough to deal with new and complex objects?

Main **problem of Pro-action** is that it turns out to be very difficult for policy-makers and rescue services to influence in the early stages of decision-making on objects and activities. Many countries agree that it is important to have this influence, because in these stages a reasonable reduction of risks can be achieved. It can also reduce costs of safety: in most cases the costs to implement safety measures in the planning or design phase are much lower than in the construction phase or the exploitation phase.

Furthermore, most of the EU countries are wrestling with the question how to obtain influence in these very first steps of the chain.

(8)

In the **Pro-action** step the **main questions** are:

How can you make safety an issue in this early stage of the decision making process? If the major players in this process do not see safety as an issue, there's no reason for them to have you involved.
How to get involved? How do you get the opportunity to bring in your safety issues? How to do it? When you have the opportunity, what is your message? And is this message important enough to all participants to have you involved?

(9)

How to get involved?

How can policy-makers and rescue services become accepted partners in early stages of discussion on new activities?

At least two items are important:

1. **Process**.
It is very important to find the right persons, the initiators, in the decision-making process and that they find you because they consider you an important party. And also at the relevant level of influence. Problem is that administrators and rescue services don't speak one and the same language.

(Example: High Speed Train South Link in The Netherlands: in an early stage there has been a discussion between the Ministry of Transport and the Ministry of the Interior and Kingdom Relations. This has resulted in an influence in all major documents in the decision-making process: the policy-document which describes the initiative, the safety philosophy document, the risk analysis models, the building permit)

2. **Legitimacy**.
In the Safety-Chain workshop one of the urgent problems was that most participants said to find it very difficult to become a structural partner in decision-making processes and to be accepted as such.
On this point at least two suggestions were made:
Try to fix it in regulations, e.g. on EU-level.
Try to make safety a 'selling point'. In other words: the marketing of safety.
There is a lot more to say about this point. But now I will focus on the next question: how to do it?

(10)

How to do it?

When you get the possibility, when you are allowed to 'sit at the table', what is your message?

In my opinion two aspects are important in decision-making matters:
Content: you must have at least the same capabilities as your sparring partners to bring the message. Futhermore, you must have the relevant level of knowledge to be able to understand the discussion and to participate in it.
Message: what you bring in must be clear for your partners. Is your message consistent and coherent?
(11)

Now I will pay more attention to the decision to be made in the pro-action step. I will illustrate these questions with an example: a new production site of a chemical plant.

Why? Is it possible to buy the chemicals, instead of producing it ourselves? In other words: do we need to build this factory?

What? Are there alternatives for the chemical substance; for the process?

Where? Is another location possible? What is the right position with respect to residential areas?

How? Why this production method? Can it be produced in an other way? With other chemical substances / materials?

When? Can it be produced on another time-schedule?

(12)

To give the correct answers to these questions, you need instruments: to identify, quantify, prioritize and compare the risks. These instruments we call Risk Assessment tools. They give you the ability to make others aware of the risks and to make a responsible decision in a certain situation.

I will shortly present some examples of Risk Assessment instruments in the Pro-action phase, most of them developed in The Netherlands:
Effect Indicator: an instrument which shows to public administrators in a very simple way what the risks are of a new object or activity and their consequences.
Quantitative Risk Analysis: a well-known method to calculate and present risk. Important is how to use it. In my opinion it's only feasible to compare different designs or alternatives in a relative way.
Safety Effect Report: instrument that consist of two parts: 1. a quick scan method to roughly analyse the risks of a new initiative and 2. An instrument to make arrangements between the players in the decision-making process how to deal with safety and which instrument / method must be used.
Decisive Scenario Analysis: method to select scenario's that are decisive for the design with respect to safe evacuation of the public and the possibilities of the rescue services. In other words: is the design adequate for a certain scenario, e.g. a fire in a train in a tunnel?

Conclusion: it's very important to have simple, useful and powerful instruments to assess the risks of new initiatives to support the decision-making process. The decision makers need to know all the risks and their consequences to take the right decision.

Besides, I want to emphasize that there are various / different Risk Assessment instruments for the next steps of the Safety-Chain.
Prevention: the (Fire) Safety Concept: provides a framework of measures based on the safety-chain philosophy.
Preparation: at the Safety-Chain workshop Norway presented a very useful Risk Assessment tool to assess risks and vulnerability for preparation purposes.

(13)

Summary and Conclusions

- The Safety-Chain concept proved to be very useful
- The left side of the Safety-Chain should get more attention, especially Pro-action
- There is a need for Risk Assessment instruments to support decision-making processes, especially in the Pro-Action phase

(14)

Risk Assessment in the Decision-Making Process:

In short we can say: **Adequate risk assessment as early as possible can improve the safety aspects in the decision-making process for new activities.**

Thank you.

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7. «Risk Communication and Risk Acceptance» by Mr. Arne Jarl Ringstad, Sr. Research Scientist, Rogaland Research, Norway

Risk communication and risk acceptance

Paper presented at DCDEP's workshop on risk assessment, Oslo, Nov. 1999.

Arne Jarl Ringstad, Rogaland Reseacrh

This is an overview of structure and main points. A detailed paper will be available at the workshop. The final presentation will contain a number of practical examples and illustrations of the main points sketched below.

INTRODUCTION

Presentation of myself, brief outline of the paper.

Three dimensions of the risk-concept:
Risk as a descriptive concept (risk as an objective and scientific concept; risk as a measurable property of the future; risk as the product of probability and loss/injury; risk analysis and rational risk reduction strategies important issues).
Risk as a psychological concept (risk as a subjective concept; risk as a determinant and outcome of behaviour; risk communication, risk perception and human decision-making related to risk important issues).
Risk as a normative concept (risk as a moral concept; risk as a socially construction, risk acceptance (or tolerance) as an expression of shared values – not a consequence of "real" risk levels; risk distribution, risk reduction, and the politics of risk important issues).

RISK COMMUNICATION

Risk communication can be defined as "the act of transmitting information between parties about a) levels of health or environmental risks; b) the significance or meaning of health or environmental health, c) decisions, actions, or policies aimed at managing or controlling health or environmental risks."

Factors that are known to influence risk perception includes

Issues related to presentation format (i.e. quantitative vs. qualitative, relative versus absolute, graphic vs. verbal).
Issues related to the risk source (i.e. long term vs. short term, man-made vs. natural, familiar vs. unfamiliar, observable vs. unobservable, voluntary vs. involuntary).
Issues related to the communicator (i.e. trustworthiness, degree of expert knowledge, objectivity).
Issues related to the recipient (i.e. whether she or her family is risk exposed, personality variables, cultural/contextual variables).
Two viewpoints on risk communication:

1. One way communication
Informing the public about "objective" risk estimates
Success is understood as a decreased distance between lay-people's and expert's risk estimations (perceptions)
Telling the public how to behave in a emergency situation

2. Two way dialogue
Including lay-peoples' concerns in the risk assessment
Success is defined as active public participation and discussion
Helping lay-people to interpret the results and to participate in the development of risk reducing measures

There are pros et cons related to both approaches; the first is the simplest and less costly, the second is more in line with our democratic ideals, but a strong wish to avoid conflicts may end up in paralysis and breakdown of decision making capabilities.

RISK ACCEPTANCE

Many of the issues that are debated in relation to "risk acceptance" an be summed up in the question: "How safe is safe enough?" The answer to this question depends in part on social norms and values related to risk management (e.g. risk distribution) and in part on characteristics of the risk source (see prev. page). For instance, if the risk-exposed group does not benefit from the risk and is furthermore involuntary exposed to the risk, then the threshold for risk reducing measures will lowered.

In addition, the framing of the legislation related to risk management, will have strong consequences for the way risk acceptance issues are handled by the industry or local authorities.

Specific risk acceptance criteria may lead to a general agreement on the nature of risk, and on when risk-reducing measures are necessary. Supervision is made easy, and the criteria are often perceived as just and valid. On the other hand, important conflicts and discussions may be swept under the carpet, and criteria are sometimes of little relevance to the safety management challenges that exist at a local level.

General (or left out) acceptance criteria may induce more substantial debates related to the risk concept, and may facilitate efficient solutions to local problems. Art the same time, general criteria tend to give the industry much leeway concerning when to implement risk reducing measures, and this may be a problem in e.g. a recession.

CONCLUSIONS

There are several areas related to risk communication and risk acceptance that have been omitted in this paper, including:

Consequences of the increased specialisation and professionalisation of risk assessments
Globalisation of risk sources
News media's role
Long term effects of risk exposure (e.g. future generations have to bear the effects of current risk related decisions)

Both “risk communication” and ”risk acceptance” are important concepts when risk assessments are conducted, and when the results of evaluated. Thus, “risk” cannot be isolated from its social and psychological context.

Slides presented by mr. Ringstad

slide 1

slide 2

Dimensions of risk

The descriptive dimension

- Risk is an objective and measurable property of the physical world
- Risk analysis is a basis for rational decision-making
-

The psychological dimension

- Risk is a subjective construct
- Risk shapes behaviour, but not in a simple or linear way
-

The normative dimension

- Risk is defined by social values and norms
- Risk does not shape behaviour, it is an expression of social behaviour and practices
-
-

slide 3

Risk communication - definition

"The act of transmitting information between parties about
a) levels of health or environmental risks
b) the significance or meaning of health or environmental risks
c) decisions, actions, or policies aimed at managing or controlling health or environmental risks."

Renn, 1992

slide 4

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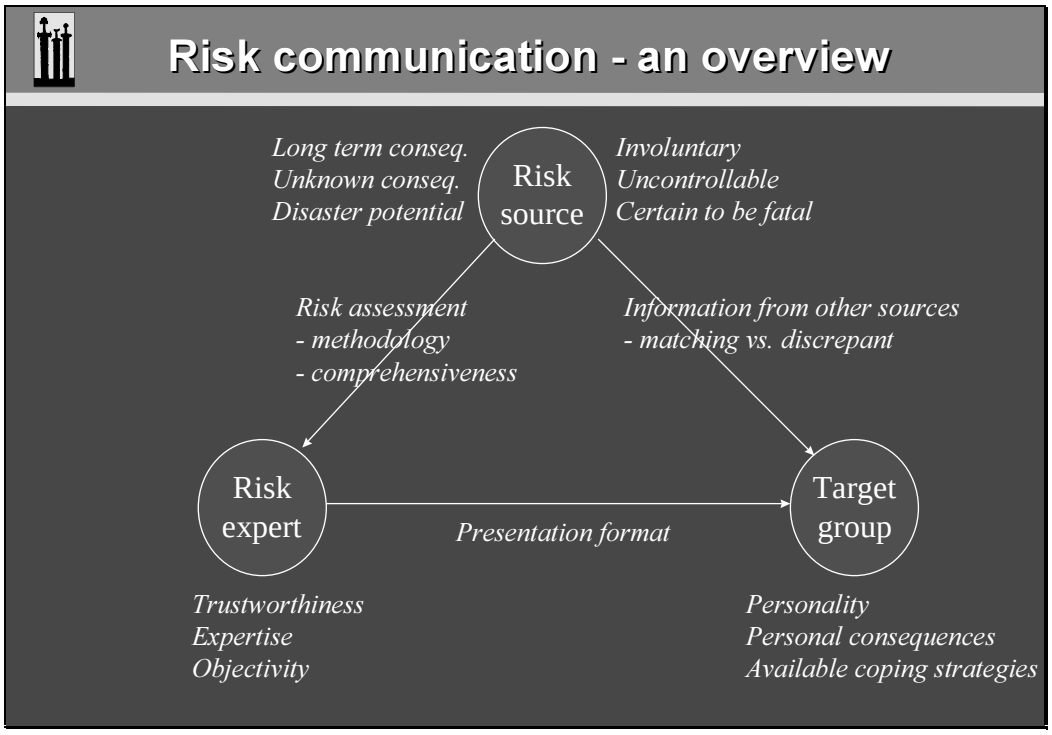

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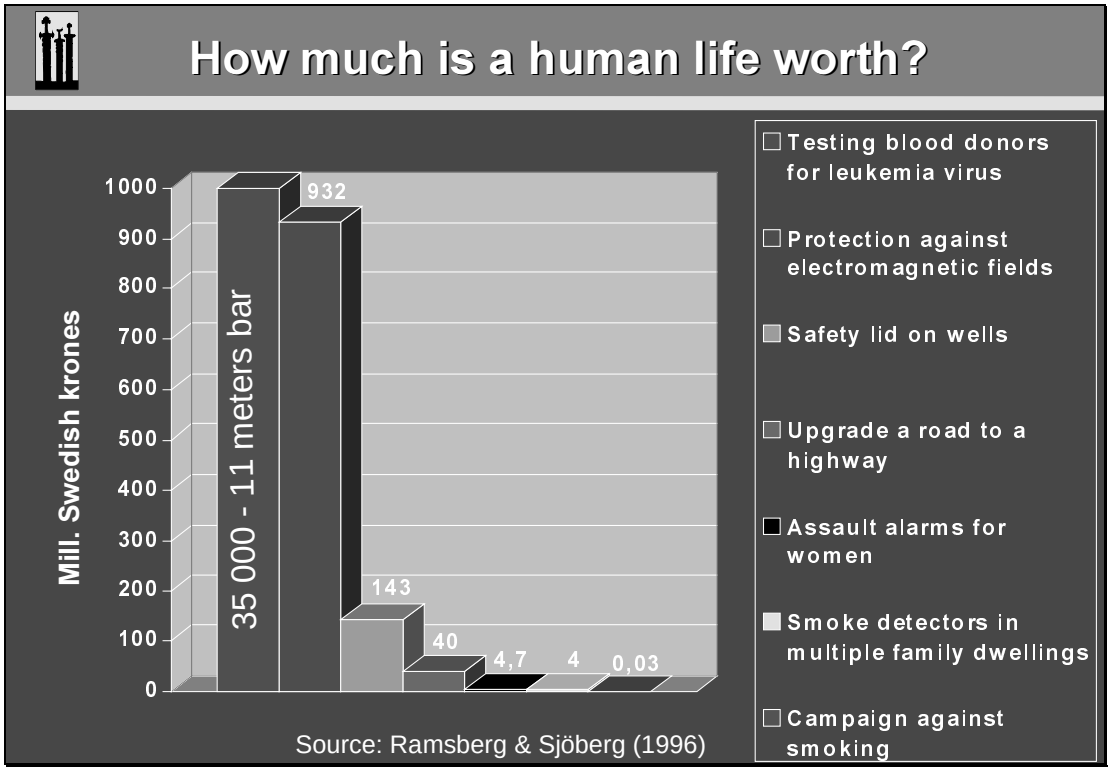

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slide 8

A case from the offshore industry

Background

- An oil company plans exploration drilling close to the southern coast of Norway
- A detailed risk analysis must be conducted before exploration drilling can commence
- The oil company is responsible for the definition of specific acceptance criteria

slide 9

Acceptance criteria

Environmental consequences	*Description*	*Life-time probability of blow-out*
Moderate	Recovery time < 2 years Influence area < 10 km shoreline Some effects on fish, birds and sea mammals	10^{-2}
Significant	Recovery time 2-5 years Influence area: 10-100 km Substantial effects on the fauna Damages to natural amenities	10^{-3}
Serious	Recovery time > 5 years Influence area > 100 km Threat to the survival of some local species of animals Destruction of some natural amenities	10^{-4}

slide 10

Risk estimates vs. acceptance criteria

Consequences	*Accepted probability*	*Estimated probability*	*Acceptable risk*
Moderate	$1x10^{-2}$	$0.004x10^{-2}$	Yes
Significant	$1x10^{-3}$	$0.07x10^{-3}$	Yes
Serious	$1x10^{-4}$	$0.07x10^{-4}$	Yes

slide 11

The debate

- Environmentalists protest, claiming that oil drilling near the coast is a threat to the wildlife.
- A number of stakeholders participate in an intense debate in the news media.
- The oil company was taken to court by representatives from the green movement.
- The oil company won the case - but lost the battle. Exploration drilling has so far not taken place in the area.

slide 12

Stakeholders and arguments

STAKEHOLD.	ARGUMENTS				
	Data	**Risk estimate**	**Assumptions and definitions**	**Risk/cost/ utility**	**Allocation of risk/cost/utlity**
The industry	Valid	Correct	Explicit and valid	Fair	Fair
Unions	Valid	Correct	Explicit and valid	Fair	Fair
3. parties	Not representative	Too low Based on faulty methods	Narrow/ untenable understanding of risk Vague and incomplete acc. criteria	Important con-sequences excluded from the analysis	Unfair
Authorities	Adequate	Adequate	Problematic	Problematic	Problematic
Risk experts	Divergent	Divergent	Divergent	No standpoint	No standpoint

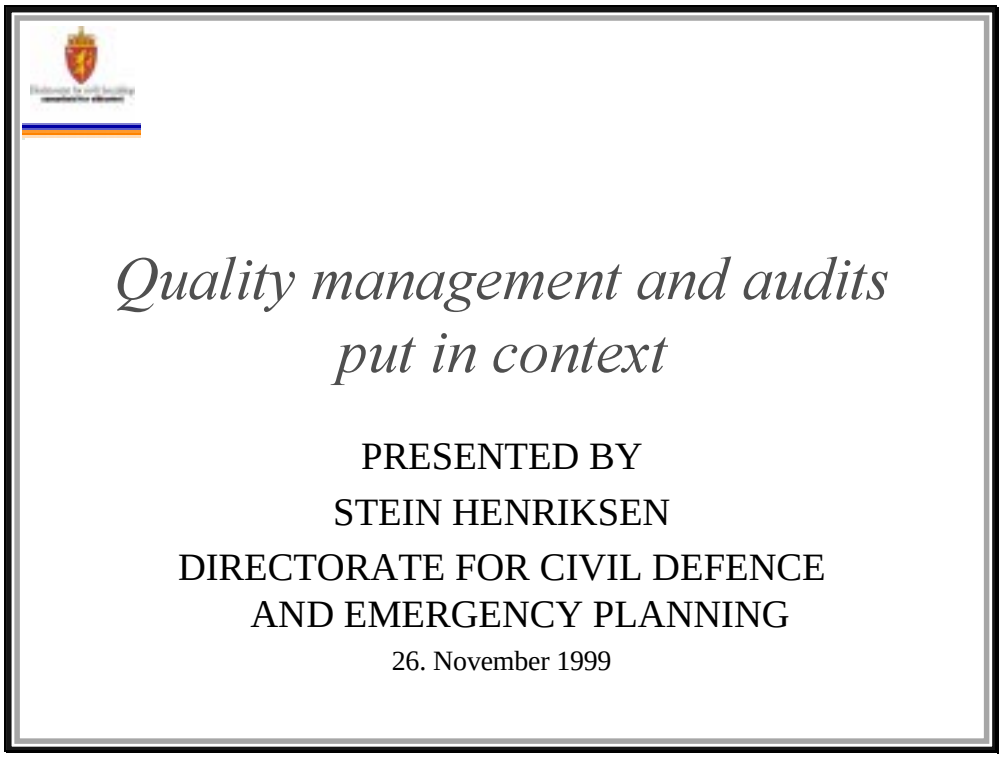
slide 13

Conclusions

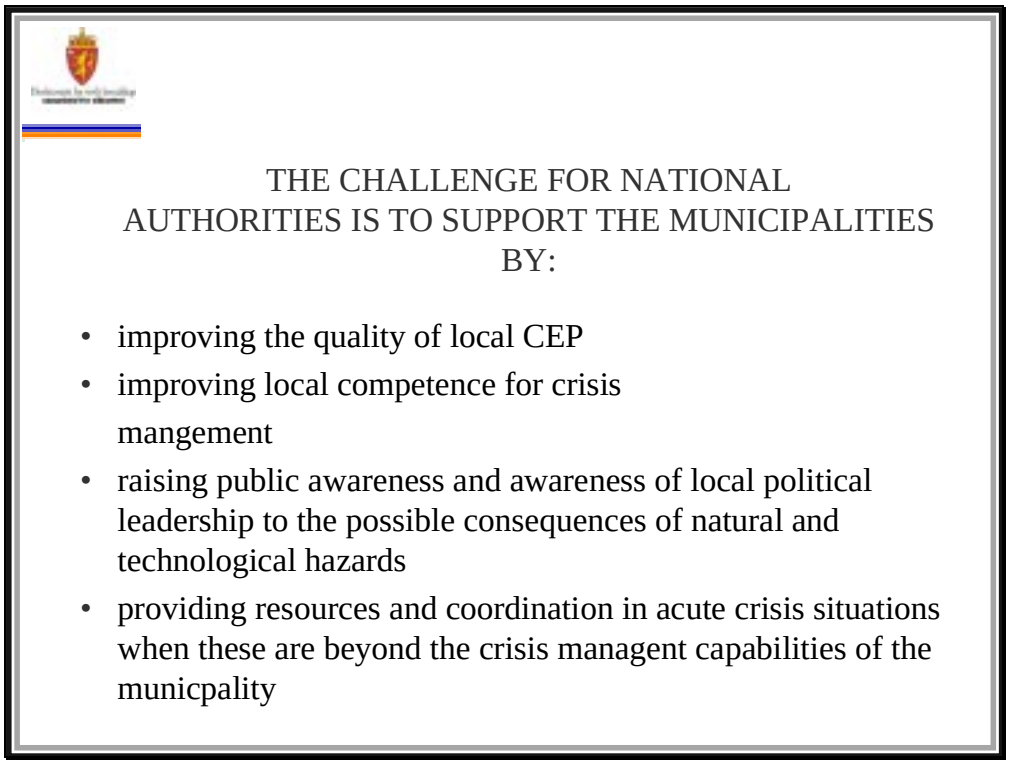
-
- **RC / RA should be based on a multidimensional understanding of risk**
-
- **RC / RA are not limited to risk levels**
-
- **RC / RA should be an integral part of risk assessment**
-
-
-

8. «Quality Management of Risk Management Processes» by *Mr. Stein Henriksen, Adviser, DCDEP, Norway*

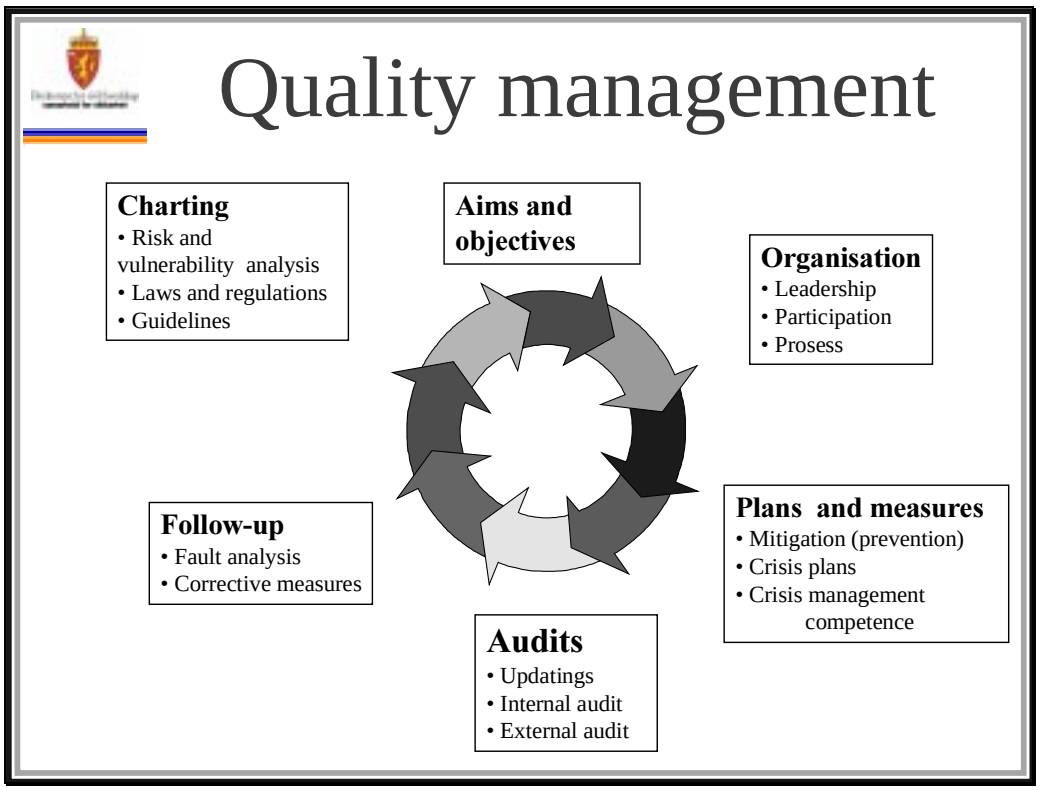
Slide 1



Slide 2



Slide 3



Slide 4

Slide 5

TOOLS PROVIDED BY CENTRAL GOVERNMENT TO IMPROVE THE LOCAL CEP:

- local risk and vulerability analyses
- integration of CEP considerations into other planning processes
- planning guidance
- CEP exercises and other means to improve local competence in crises management
- introducing the concept of "quality management" in CEP

Slide 6

Critical infrastructure

A research programme

- acronym BAS
- by Defence Research Institute
- on behalf of DCDEP, Min of Justice, Min of Communications, others

Slide 7

BAS 1

BAS 1: preliminary research, identifying avenues for futher research

- Telecommunications
- Electric power
- Transport
- Leadership and information

Slide 8

BAS 2

BAS 2 / Vulnerabilities in public telecommunications:

- identifying vulnerabilities
- developing sosio-technological models of interdependence
- recommending measures

Slide 9

BAS 2

Recommendations in general:

- improve network resilience
- improve physical protection of certain types of objects
- improve interoperability between providers of services
- improve protection of information

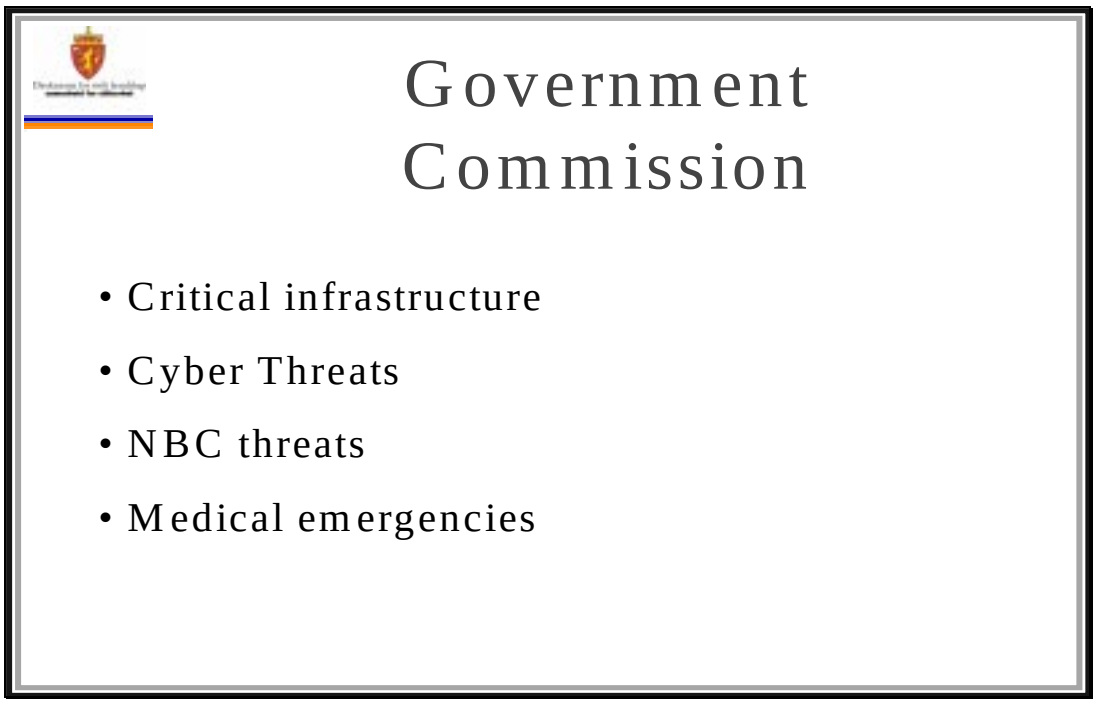
Slide 10

BAS 3 - 4

- BAS 3 / Vulnerabilities of power supply has started and will be completed feb 2001
- BAS 4 (transport) is in the thinking stage
- other possible national research

Slide 11

Slide 12



Slide 13

Government Commission

- Study approaches in other countries
- Use national reference group and experts
- Deliver by 1. July 2000

9. «Risk Assessment as a Tool to Evaluate a Railway Safety Concept» by *Mr. H. P. Plattner, State Fire Chief of Rheinland-Pfalz, Germany*

Hans-Peter Plattner
State Ministery of the Interior
Rhineland-Palatinate

23. November 1999

RISK ASSESSMENT AS A TOOL TO EVALUTE A

RAILWAY SAFETY CONCEPT

Summary

After the railway accident in Eschede, 3. June 1998, began a discussion about the safety of railways in Germany, which still continues. The most important question of these discussion are:

- What are the risks of the railway traffic, particulary the risk of high speed trains ?

- What kind of safety measures can reduced the risk of a railway accident ?

- What kind of safety measures can support the rescue work of the firebrigades and the ambulances after a railway accident ?

In the aim to answer these questionsm a risk assessment was carried out to define the safety standards and to control the safety concept. As a result the general railway safety concept in germany consists on safety measures carried out in four stages : prevention, limitation, self rescue and external rescue.

1. Introduction

After the railway accident in Eschede, 3th June 1998, the confidence in the railway safety was demaged. Eschede has shown, that the safety of every technical system is limited and that it is impossible to guarantee a absolute safety fo any kind of a public transport system, particularly for the high speed railway. During the check up of the german high speed railway ”**I**nter **C**ity **E**xpress (ICE)” rescue measures and rescue planing by fire brigades, ambulances and civil defence forces are very important, because after a railway accident they must impound the necessary help so quick and so effective as possible.

A risk assessment of the railway traffic must record ”risk”, ”rescue possibilities” and ”view of success”. By the discussion of possible accidents case studies are necessary to develop several rescue measures and to assess their view of success. With the result of the risk assessment you can check an existing safety concept or create a new one.Then you can work for the emergency and rescue plans.

2. Risk Assessment

The risk of the railway traffic can be charakterized by the quality of the operational safety or the possibility of an accident and the danger potential. To check and to access the probability of an railway accident is the duty of the railway companies and the federal ministery of traffic. To overcome a railway accident with rescue units it is necessary, to analyse the quality and the quantity of the danger potential. This is the job of the fire brigades, the ambulances, the civil defense and the state ministries of the interior.
The rescue possibilities rely on the local structural and operational measures and the power of the rescue units. In railway tunnels you need for example escape routes, emergency exits and water reservoirs as structural measures. The power of the rescue units depents on their organisation, equipment, education, motivation and availability. Without structural measures like emergency exits, the rescue possibilities will be reduced, even if the rescue units have the same power.

If you connect quality and quantity of a railway accident with the rescue possibilities, especially with the power of the rescue units, you can make a forecast about the rescue success.

During the checking of the railway safety structures we have seen, that risk assessment will be done very effeciv by so-called ”accident- and rescue-scenarios” as case studies. The evaluation of accident statistics and important railway accidents like Eschede can be added to these scenarios.

The special railway danger situation is characterized :
by the kind of railway lines; for example : electrified lines, so-called ”free lines” without tunnels and bridges, long brigdes, long tunnels, high speed lines, lines through urban or rural aereas
and
by the kind of trains; for example : passenger or freight trains, high speed trains, trains with hazardous materials, electric locomotives or diesel locomotives.

A group of experts - fire fighters and railway specialists - developed case studies for the accident- and rescue-scenarios ”fire in a tunnel” and ”technical assistance in a tunnel”.

<u>The scenario ”fire” :</u>
- passanger train, length 400 meters
- 300 persons involved
- 30 persons injured, 10 persons not able to walk
- originating fire in one coach in the middle of the train
- full developed fire spreading to neighbored coach at the arrival of the fire brigade

- no hazardous goods

The scenario ”technical assistance” :
- passanger train, length 400 meters
- 300 persons involved
- 60 persons injured, 20 persons severe injured and to be rescued by technical equipment

A third case study ”accident with hazardous materials on the free line” will be finished next year.

For very complicated technical systems risk assessment is the right method to plan rescue measures. For technical systems, which still exists like the railway, isk assessmant is the right tool to control the historic safety concept. And for new technical systems it is necessary to recognize the risks, particulary the danger potential, and to plan the right rescue measures by risk assessment.

3. The Safety Concept

Risk Assessment is the basis of the safety concept to manage a railway accident. This safety concept includes six components :

1. compagnies rescue service, for example the emergency management and the emergency units of the railway company

state rescue, for example rescue units like fire brigades and ambulances, rescue planing

3. equipment for companies rescue service and state rescue service

4. education for companies rescue personal and state rescue personal

5. structural measures, for example escape routes, emergency exits and water reservoirs for firefighting

6. operational measures, for example neutralization of the emergency brake and separation of passenger and fright train in tunnels

The system ”fire protection” can be divided in two parts : ”fire fighting” and ”prevebtive fire protection”. The safety concept to manage a railway accident can be structured in the same way :

1. the components companies rescue service, state rescue service, equipment and education build up the ”basic safety concept” like ”fire fighting” an

2. the copmponents structural and operational measures build up the ”additional safety concept” like the ”preventive fire protection”.

This safety concecept is one part of the general railway concept, which was created by the German Federal Railway in the 1980ies.

4. The General Railway Safety Concept

The German Railway Company is using a general safety concept with four stages :

Stage 1 : prevention, reduction of the probability of an accident

Stage 2 : limitation of the consequences of an accident by infrastructure, rolling stock and operational measures

Stage 3 : self rescue, support for involved persons to rescue themselves

Stage 4 : external rescue by the safety concept to manage a railway accident, help for injured or helpless persons by fire brigades, ambulances and civil defence forces

10. «Post Earthquake emergency damage and usability assessment of buildings» by *Prof. S. Anagnostopoulos, University of Patras, Greece*

Lecture not available

11. «Portuguese System for Flood Warning and Surveillance» by Dr. Rui José Raposo Rodrigues, Head of Water Resources Department, Institute of Water, Portugal

PORTUGUESE SYSTEM FOR FLOOD WARNING AND SURVEILLANCE.
RISK AND VULNERABILITY.

Abstract

The Portuguese Institute for Water has been using since 1995 a procedure to cope with floods, either from International rivers as from smaller semi-urban basins, where real-time monitoring is coupled with reale-time hydrologic and hydraulic modeling. The experience on the follow-up from the risk analyses performed in the last tree consecutive years of flooding is now being incorporated into the new Civil Protection Action Programs in cooperation with the Portugueses Civil Protection Agency.

A brief review of the risk analyses performed, as well as description of the methodologcal components of the flood warning system will be presented, with emphasis on the GIS environment used for flood plain mapping in real time.

12. «Dam Risk Management at Downstream Valleys - a NATO Integrated Project and Case Study» by *Prof. A. Betâmio de Almeida, Technical University of Lisbon, Portugal*

DAM RISK MANAGEMENT AT DOWNSTREAM VALLEYS
A NATO INTEGRATED PROJECT AND CASE STUDY

Abstract
One of the concerns about future and existing dams is its safety and the possibility of serious accidents including the dam failure. This concern is particulary important for people living along the valley downstram the dam. Contemporary safety legislation and technical guidelines impose the consideration of dam failure scenarios and the valley inundation maps, zoning and the preparation of civil protection procedures, namely emergency plans, warning systems and exercises.

In open societies, where public information and participation is increasing, this concern is very important. In fact, despite the increasing safety of dams due to improved knowledge and engineering quality, a full non-risk guarantee is not possible and an accident can occur due to abnormal environmental factors, inadequate operation, change of hydrologic conditions or just because the dam is loosing strength capacity due to its age.

In order to develop an integrated and advanced technology to solve problems related to valley risk management and dam safety, the «Laboratório Nacional de Engenharia Civil (LNEC)» and the «Technical University of Lisbon (UTL-IST)» are being working in a NATO Project (Science for Stability Program) since 1994.

The paper includes remarks about dam risk concerns and on the need for public participation and shared responsibility including dam owners, safety authorities and public.

The paper also describes the main developments achieved by this NATO project including the preliminary conclusions of the first sociological field study on dam break risk perception on an European valley, so far.

Part 2 enclosures

13. List of participants

PARTICIPANTS - EU WORKSHOP ON RISK ASSESSMENT ROYAL CHRISTIANIA HOTEL, OSLO, 25TH TO 26TH NOVEMBER 1999

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14. Program - Workshop on Risk Assessment

Workshop on Risk Assessment
Oslo 25 - 26 November 1999

Thursday 25th November

Chairman: Mr. Svein Berbu, Director,
The Norwegian Directorate for Civil Defence and Emergency Planning (DCDEP)

09.00 - 09.30 Registration of Participants

09.30 - 09.45 **Opening and Welcome**
Ms. Marit Stene Myrvåg, Director, DCDEP

\- 10.00 **Welcoming remarks on behalf of the EU Commission**
Mr. Ernst Schulte, Administrator, DG-XI - Civil Protection Unit

10.00 - 10.15 **The Prevention Project**
Mr. Jukka Metso, Chief Engineer, Ministry of the Interior, Finland

10.15 - 10.45 **Risk Assessment Procedures Used in Different EU-Countries, Conclusions from a Survey by the Finnish Environment Institute**
Ms. Harriet Lonka, Research Officer, FEI

10.45 - 11.05 Break

Session I: Experiences with Risk Assessment and its follow up procedures

11.05 - 11.25 **Dimensional Planning and the use of Fire Brigades**
Mr. Anders Arnhus, Adviser, Directorate For Fire and Explosion Prevention, Norway

11.25 - 11.45 **Risk Assessment as a Tool to Evaluate a Railway Safety Concept**
Mr. H. P. Plattner, State Fire Chief of Rheinland-Pfalz, Germany

11.45 - 12.05 **Post Earthquake emergency damage and usability assessment of buildings**
Prof. S. Anagnostopoulos, University of Patras, Greece

12.10 - 13.20 Lunch

13.20 - 13.40 **Risk Mapping for Swedish Communities: A Geographic Perspective for Planning and Decision Making for Risk Management**
Ms. Janet Edwards, Project Leader, and
Mr. Mattias Strömgren, City Planner, Swedish Rescue Services Agency

13.40 - 14.00 **Risk Mapping and the Cross Border Nature of Risk**
Mr. Nic M.J. Herzig, Chairman of the Commission for Public Safety of the EUREGIO Maas-Rhine project, the Netherlands

14.00 - 14.20 **Portuguese System for Flood Warning and Surveillance**
Dr. Rui José Raposo Rodrigues, Head of Water Resources Department, Institute of Water, Portugal

14.20 - 14.40 **Dam Risk Management at Downstream Valleys - a NATO Integrated Project and Case Study**
Prof. A. Betâmio de Almeida, Technical University of Lisbon, Portugal

- 15.00 **The Safety Chain Project**
Mr. Peter Dekker, Senior Policy Adviser,
Ministry of the Interior, the Netherlands

15.00 - 15.15 Break

Session II: Discussion Session on the Experiences With - and the Follow Up of Risk Assessment

- 16.30 **Working Groups**
Introductions by Mr. Svein Berbu, Director, DCDEP

- 17.00 **Report from Working Groups and Close of day one**
Moderator: Mr. Svein Berbu, Director, DCDEP

1800 Departure from the hotel to Frognerseteren Restaurant

Friday 26th November

Session III: Acceptability and Management of Risk Analysis

09.00 - 09.40 **Risk Communication and Risk Acceptance**
Mr. Arne Jarl Ringstad, Sr. Research Scientist, Rogaland Research, Norway

09.40 - 10.20 **Quality Management of Risk Management Processes**
Mr. Stein Henriksen, Adviser, DCDEP

10.20 - 10.40 Break

10.40 - 12.00 **Plenary Discussion Session**
Moderator: Mr. Svein Berbu, Director, DCDEP

12.00 - 12.15 **Closure and Farewell**

12.30 Lunch

Reading list

DCDEP publications available in English:

- Guidelines for municipal risk and vulnerability analyses (1995)
- Guidelines for Emergency Planning (1999)
- A guide to Information Preparedness (2000)
- Risk Assessment in Europe - A summary from a EU Workshop on Risk Assessment arranged in Oslo 25-26 November 1999 (2000)
- Risk Assessment in Europe - Lectures presented on the EU Workshop on Risk Assessment arranged in Oslo 25-26 November 1999 (2000)

Order a publication?
The publications can be downloaded from the Internet at www.dsb.no (choose the English site). The publications can also be ordered, in smaller numbers, free of charge (as long we have them on stock). State your name, address, title and number of the publication(s) you are interested in and send your request on fax.