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Specific Targeted Research or Innovation Project

(IMP)3

Risk Assessment
D 3.2 Report WP 3

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IMProving the IMPlementation of Environmental IMPact Assessment

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FOREWORD

The project (IMP)3 – IMProving the IMPlementation of Environmental IMPact Assessment is carried out within the 6th framework programme investigating the application of the environmental impact assessment (EIA) in Europe. It ties in with the results of the report from the Commission to the European Parliament and the Council that revealed that there are still weaknesses as well as considerable variability in the Member States' implementation of the EIA-Directive.

(IMP)3 focuses on the improvement of the EIA-application concerning human health, risk assessment and project types subject to EIA. It was accompanied by an effective communication-process with DG Research and DG Environment. We would like to thank Marialuisa Tamborra, Laura Tabellini and David Aspinwall for their support.

The results of (IMP)3 are based on an investigation of the actual application of EIA in the European Member States surveyed by a questionnaire spread across European EIA-stakeholders and interviews in ten European countries. We would like to thank the 183 EIA-experts who returned the questionnaire and the 53 interviewees in Europe, USA and Canada for their support. Their valuable input forms the empirical data basis of our research.

(IMP)3 shall provide decision support to the policy making process on Community level and contribute to an improved knowledge basis on EIA application such as stimulate discussions within the European EIA community.

1 CONTEXT OF THE STUDY

The development of projects, as e.g. the construction of main roads and railway-lines, the development of industrial plants, shopping centres and theme parks, etc. can cause adverse effects to the environment. Therefore the European Union has enacted the EIA-Directive (Directive 85/337/EEC) to perform an assessment of the environmental effects of those projects which are likely to have significant effects on the environment (environmental impact assessment – EIA).

The EIA Directive has been in place for almost 20 years. A report of the Commission to the European Parliament and the Council evaluated its application and effectiveness and revealed that there are still weaknesses as well as considerable variability in the Member States' implementation.[1] As a result the Commission aimed for a deeper evaluation of problematic aspects of the EIA Directive and launched a project within the 6th framework programme.

The project IMProving the IMPlementation of Environmental IMPact Assessment – (IMP)3 is based on the results of the report from the Commission to the European Parliament and the Council on the application and effectiveness of the EIA Directive. Concentrating on some of the weak points the report outlined, (IMP)3 focuses on three main objectives:

- Objective A: a better incorporation of human health aspects into EIA;
- Objective B: a better integration and more consistency of risk assessments, regarding various sources of risks (natural hazards, accidents, sabotage); and
- Objective C: a survey of project types subject to EIA particularly focusing on various screening methods, different sets of project types and threshold values/criteria applied.

This report focuses on risk assessment in EIA (objective B). It examines the ways and the extent extraordinary (abnormal, non-standard, non-routine) hazards and risks are dealt with in EIA in European Union Member States, both within the regulatory framework and in EIA practice. The overall objective within the (IMP)3 project is to make substantial contributions to more consistency, enhanced coverage and better integration of risk assessment in EIA practices in the European Union Member States (cf. chapter 1.1.1).

The focus of this report on Risk Assessment is on extraordinary (abnormal, non-standard, non-routine) hazards and risks. For the purpose of this report, 'extraordinary risks' are defined as risks of significant adverse consequences to man and the environment due to the occurrence of extraordinary hazards that are associated with proposed projects subject to EIA. The concept of 'extraordinary hazards' and resulting risks is opposed to those effects of a project that are related to its normal, standard or routine operating conditions.

The study of (IMP)3 was carried out by an international and interdisciplinary team, consisting of members from the following institutions:

- ÖIR – Österreichisches Institut für Raumplanung (Austrian Institute for Regional Studies and Spatial Planning); Austria

[1] Report from the Commission to the European Parliament and the Council on the application and effectiveness of the EIA Directive (Directive 85/337/EEC as amended by Directive 97/11/EC). How successful are the Member States in implementing the EIA Directive.

- UBA – Umweltbundesamt (Federal Environment Agency); Austria
- WCH – Wales Centre for Health; United Kingdom
- Nordregio – Nordic Centre for Spatial Development; Sweden
- CITTA – Research Centre for Territory, Transports and Environment at the Faculdade de Engenharia da Universidade do Porto; Portugal
- SZAP – Slovenská Agentúra Životného Prostredia (Slovak Environmental Agency)

(IMP)3 shall provide an important input to the process of improving the application of EIA, also considering potential amendments to the EIA Directive and aims to stimulate discussions within the European EIA community. The suggestions for potential steps to be taken are primarily addressed to the European Commission.

1.1 Risk assessment and EIA

EIA and risk assessment are based on very similar concepts and broadly have the same goals (Brookes, 2001). They both deal with the prediction of future consequences arising from activities or planned interventions. Uncertainty about the exact nature, frequency and magnitude of those consequences is inherent to both EIA and risk assessment (ADB, 1997). They both seek to inform decision-makers about the significance of adverse consequences and are decision-supporting tools that should aid decision-making on measures to mitigate, reduce or eliminate adverse impacts, or the risk of those impacts occurring, respectively. Both instruments are essentially interdisciplinary, and their application involves a number of similar procedural steps.

Environmental risk assessment basically addresses four questions (ADB, 1997; Kjorven, 1998):

- What can go wrong with a project?
- What adverse consequences might occur to human health and the environment?
- What is the range of magnitude of adverse consequences?
- How likely are these consequences?

Recent major industrial accidents in Europe (e.g. Toulouse, Enschede) as well as an increase in damage caused by natural disasters worldwide (e.g., earthquakes, hurricanes, etc.) have demonstrated drastically that unforeseen hazardous events can cause fatal effects on man and the environment and lead to enormous consequential costs and financial losses. This has also underpinned the need to consider risks due to extraordinary events in the processes of planning and licensing developments and human activities. Enhanced integration of risk assessment in EIA can contribute much to minimizing the risks of environmental disasters.

Given the close affinities between EIA and risk assessment, it may be surprising that both approaches have rather developed in parallel than in mutual cross-fertilisation. This may be to some extent be explained by the fact that it is relatively recently that risk assessment techniques have been extended to wider environmental applications (cf. chapter 1.3.1). Also, EIA has a strong rooting in legislations and regulatory frameworks, whereas integration of risk assessment approaches into environmental policy and legislation does not have such strong historical traditions (Brookes, 2001).

However, in recent years risk assessment and risk management approaches to environmental and ecological have become increasingly important (Fairman et al., 1999). At a global level, for instance, risk assessment is the major approach to controlling chemical risks in Agenda 21 of the UN Conference on Environment and Development (UNEP, 1992). A number of international organizations, such as the OECD (Organisation of Economic Cooperation and Development), ECOTOC (European Centre for Ecotoxicology and Toxicology of Chemicals), WHO (World Health Organization), US EPA (Environmental Protection Agency), and others have carried out significant work on environmental risk assessment.

On the European policy level, the Fifth Environmental Action Programme of the EU has defined risk assessment as a priority goal: "*(...) It is essential that over the remainder of this decade the assessment and management of risks and the response to accidents and catastrophes should be improved considerably*" (EC, 1993b). A number of EC Directives, as well as accompanying guidance on their application, is strongly based on, and/or require application of risk assessment and risk management. As part of a non-exhaustive list, the following pieces of EU legislation may be mentioned: Directive 93/67/EEC on risk assessment for new notified substances, Commission Directive No 1488/94 on risk assessment for existing substances, Regulation 793/93 on the evaluation and control of existing substances, Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocide products on the market, Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances, Directive 90/220/EEC on deliberate release into the environment of genetically modified micro-organisms, and a number of others.

While examples for applying complete environmental risk assessments in EIA may be rather rare on an European level, certain risk assessment techniques have in fact been frequently used in EIAs, in particular techniques of human health risk assessment, assessment of distribution and exposure paths of pollutants, exposure assessments and dose-response assessments for substances, etc. Safety risk assessments are quite common for certain accident-prone project types involving high-risk technologies (nuclear power plants, chemical process industries, etc.), although in these cases the commanding regulatory force usually is not EIA legislation, but rather subject-specific legislation and control regimes under the Seveso II Directive. Both the World Bank and the Asian Development Bank have published Guidelines on EIA that provide detailed guidance on applying risk assessment in EIA (WB, 1991; ADB, 1997) and have integrated risk assessments in their project preparation and implementation processes (Kjorven, 1998).

This Work Package is much based on the assumption that risk assessment can offer many benefits as both a supporting and complementary technique in EIA (Brookes, 2001), and that risk-based considerations may in many cases even be required to fulfill the substantive objectives of EIA as an instrument for precautionary and preventive environmental protection.

1.1.1 Objectives

The overall objective of this report within the (IMP)3 project is to make substantial contributions to more consistency, enhanced coverage and better integration of risk assessment in EIA practices in the European Union Member States.

The focus of this report is on extraordinary (abnormal, non-standard, non-routine) hazards and risks. For the purpose of this report, 'extraordinary risks' are defined as risks of significant adverse

consequences to man and the environment due to the occurrence of extraordinary hazards that are associated with proposed projects subject to EIA. The concept of 'extraordinary hazards' and resulting risks is opposed to those effects of a project that are related to its normal, standard or routine operating conditions.

Extraordinary risks may arise from various hazardous incidents or exceptional conditions that might affect projects and might cause them to present environmental problems. Extraordinary hazards may result from hazards that are inherent to the project itself (e.g., accidents), or they may result from exposure of a project to external hazards (e.g., natural hazards, external accidents) that might impact on the project. Extraordinary hazards that are within the scope of this work package comprise in particular the following hazard categories:

- Natural hazards (earthquakes, floods, avalanches, landslides, heavy weather conditions, etc.);
- Internal accidents: accidents within the proposed project caused by technological failure, human failure (error, mismanagement, etc.), or a combination of both (man-technology interactions), including various degrees of non-standard/abnormal modes of operation (disturbances of normal operating conditions, hazardous incidents, major accidents);
- external accidents: exposure of the proposed project to accidents in other existing installations in the project environment that could affect the project;
- Sabotage, including various forms of unauthorised interferences (vandalism, etc.);
- Impacts of the proposed project on the hazard potential and damage potential (vulnerability) that is pre-existent in the area of project location.

In detail, **Work Package 3** pursues the following **operational objectives**:

- Comparative analysis of practical and regulatory approaches to risk assessment in EIA in EU Member States, based on empirical stakeholder surveys and desk research, with particular regard to:
  - the extent to which different hazard categories and risk types are covered in EIA,
  - the risk concepts, approaches, models, and methods applied to risk assessment and risk management in EIA,
  - the application of risk as a screening criterion according to Annex III.1 of the EIA Directive,
  - the procedural integration of risk assessment into the EIA process,
  - the coordination with risk assessments under other development consent procedures subject to control regimes according to the IPPC, Seveso II and SEA Directives,
  - the effectiveness of risk assessment in EIA,
  - the barriers to wider application of risk assessment in EIA.
- Identification and analysis of strengths and weaknesses of the current regulatory framework and of current EIA practices in terms of risk assessment.
- Identification of key challenges to be tackled to accomplish better integration of risk assessment in EIA.

- Development of a range of policy options that could be taken on a European policy level to enhance the consideration of risks in EIA, including an analysis of strengths and weaknesses, opportunities and threats of each policy option.

In response to a request that was articulated by the contracting body of the (IMP)3 project during one of the technical coordination meetings, the issue of 'major social risks' has been integrated into the project. Thus, an additional objective has been added to the scope of this Work Package:

- Examination of the ways and the extent to which major social and socio-economic impacts (e.g., unemployment, impoverishment, migration, resettlement, etc.) are addressed in EIA.

The objectives respond directly to the findings of the last the **five-year review** of the European Commission on the implementation of EIA in the Member States, which has revealed a number of shortcomings and weaknesses regarding the application of risk assessment in EIA practice. In particular, the report indicated the following inconsistencies between Member States (EC, 2003a):

The main findings of the five-year report were summarized as follows:

> "*Risk is dealt with in a wide variety of ways and at very different levels across the EU, partly in response to the variety of geographical, geological, climate and other conditions. Risk is a screening criteria in Annex III and risk assessments appear in many EIS and yet for most Member States risk is seen as separate from the EIA process as it is often handled by control regimes to which the EIA Directive is not applied. Relationships between EIA and national environmental control regimes are complex and there appears to be little real co-ordination between the EIA Directive and other Directives such as IPPC and the Habitats Directive*" (EC, 2003a: p. 86).

1.2 Methodology

1.2.1 The “triangle-approach” of (IMP)3

Research on the improvement of the application of the environmental impact assessment needs a sound literature review, including especially existing evaluation reports and different types of national legislation as well as a sufficient communication with EIA-stakeholders and applicants in Europe and with EIA-experts at the European level.

Even if the investigation of the three core fields of research conducted in (IMP)3 (human health, risk assessment and projects subject to EIA) requires the analysis of rather different sources in order to meet the needs of the feature of each thematic field, all three are dealing with the application of EIAs in Europe.

Consequently for gathering the data required from various sources, a kind of “triangle-approach” was developed. Thereby, the literature review forms the basis of the “research triangle”, whereas both sides cover the communication-tools with the EIA-applicants in Europe: on one side a questionnaire was distributed to about 970 EIA-stakeholders and on the other side interviews have been conducted with 64 selected EIA-experts.

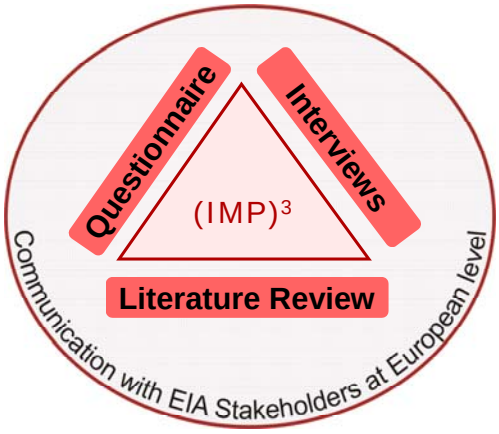

Figure 1 (IMP)3 "triangle-approach" for gathering and analysing data

Consequently, (IMP)3 deals with three different types of data available:

- qualitative data concerning the legal basis and the relevant discussions in the scientific world of EIA policy and application as laid down in the literature;
- quantitative data about the actual application of EIA in the EU Member States deriving from the analysis of the questionnaire; and
- qualitative data about the estimation of the strong and weak points of EIA-application in selected European countries gained from the analysis of the **interviews** conducted.

In addition to the analysis of the relevant sources and data, a communication-strategy with relevant stakeholders on EU-level was set up (see chapter 1.2.4).

1.2.2 Literature review

The literature review covers the existing relevant literature including the main documents at European level and selected national laws concerning the application of EIA. The results of the research are presented in chapter 2.

1.2.3 Questionnaire

Types of EIA-stakeholders

The questionnaire and the interviews aimed to provide an overview of the experience of the actual EIA-applicants in Europe in terms of human health, risk assessment and EIA project types. Therefore (IMP)3 not only addressed the administrative staff at the national level who is dealing with EIAs. Moreover, it addressed the very basis of the EIA-applications including consultants and NGOs. So it was necessary to involve a broad spectrum of representatives of different types of stakeholders. The different EIA-stakeholder-groups addressed are:

- representatives of national governments,
- regional bodies with competence in EIA-issues,
- NGO's,
- representatives of the private sector as e.g. consultants,
- others as e.g. researchers.

Database: stakeholder list

The questionnaire and the interviews aimed to provide an overview of the experience of the actual EIA-applicants in Europe in terms of human health, risk assessment and EIA project types. Therefore (IMP)3 not only addressed the administrative staff at the national level who is dealing with EIAs. Moreover, it addressed the very basis of the EIA-applications including consultants and NGOs. So it was necessary to involve a broad spectrum of representatives of different types of stakeholders. The different EIA-stakeholder-groups addressed are:

- representatives of national governments,
- regional bodies with competence in EIA-issues,
- NGO's,
- representatives of the private sector as e.g. consultants,
- others as e.g. researchers.

Database: stakeholder list

A list of EIA-stakeholders in the European Member States served as a database for the distribution of the questionnaire and the selection of the interview-partners. The list was established by the use of the expert-network of the (IMP)3-team members with the support of members of the EIA/SEA expert group.

All in all, 970 EIA-stakeholders have been selected representing the different types of stakeholders. However, in statistical terms they do not represent a random sample of all actors being involved in EIA issues throughout Europe, moreover it is a list of experts directly dealing with the application of EIAs.

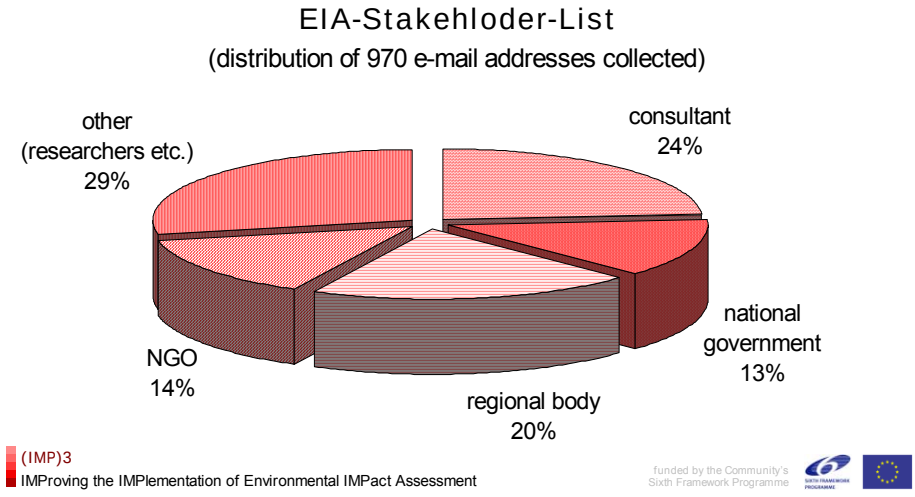

Figure 2 Types of EIA-stakeholders covered by the stakeholder list

As most of the stakeholders are practitioners, their answers reflect mainly the situation they are confronted with day by day while doing their job. Consequently, they mirror the way of the application of the EIA Directive that is implemented in national and regional legislation throughout the EU Member States.

Thus the empirical results derived from this data source are based on personal perceptions of the EIA-stakeholders and are mainly valid for the empirical sample of (IMP)3. They give indications to actual EIA practices and cannot be generalized. Nevertheless, the different approaches of the various stakeholder groups show a picture that does not only reflect the administrative point of view, but also the views of practical experience.

Development and distribution of the questionnaire

As the aim of the questionnaire was to get a broad view of the situation in Europe and due to the limited time of practitioners to complete the questionnaire, it had to be kept short and simple. So it focused mainly on multiple choice answers, usually combined with one additional open question at the end. The questionnaire was developed by an interactive process between all partners of the (IMP)3-team in close collaboration with representatives of DG Environment.

Based on the list of EIA-stakeholders, the questionnaire was disseminated via e-mail to 970 addresses. The questionnaire was attached to a covering letter prepared in eleven languages (English, Czech, Finnish, French, German, Hungarian, Polish, Portuguese, Slovak, Spanish and Swedish).

Return rates

Within the first two weeks after distributing the questionnaire, 106 completed questionnaires have been returned. After a second reminder another 77 were transmitted. So, all in all, the analysis of (IMP)3 is based on 183 completed questionnaires, bringing the return rate to 19%.

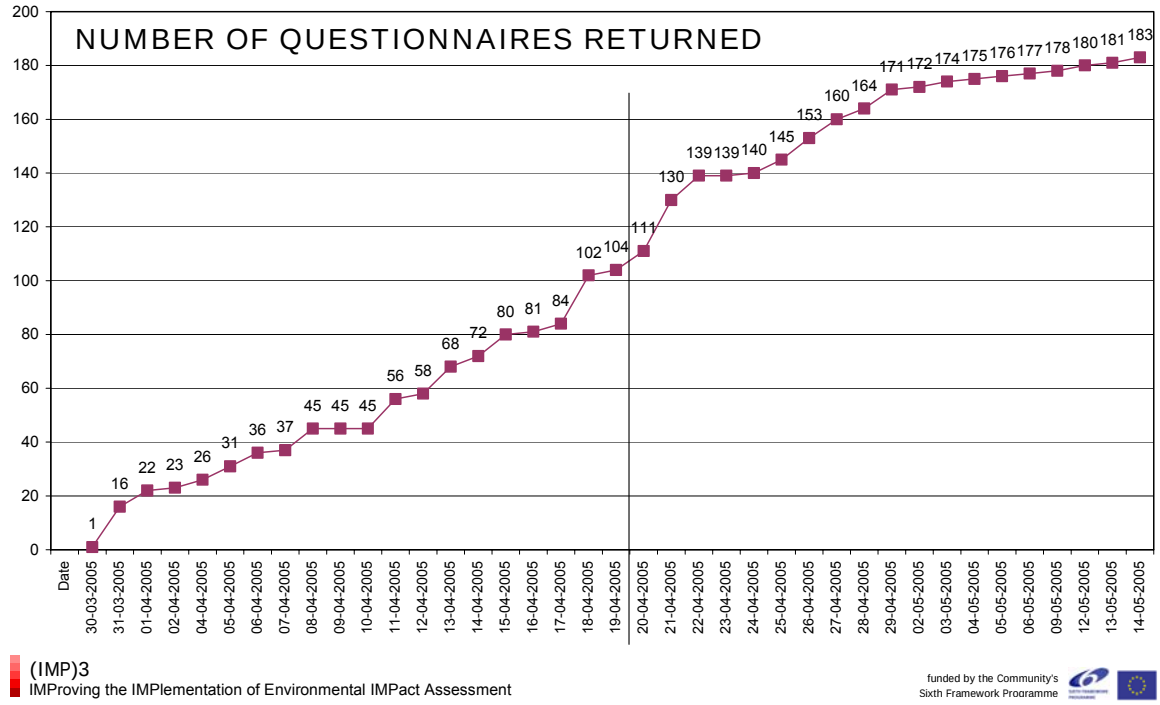

Figure 3 Time response of questionnaires returned

Represented countries

According to the response rate, the numbers of respondents from each Member State vary largely. Most questionnaires were returned from Slovakia (33 respondents), the UK (22), followed by Germany (12) Austria (11) and Sweden (11). So 30% of respondents come from just two countries (18% from Slovakia and 12% from the UK).

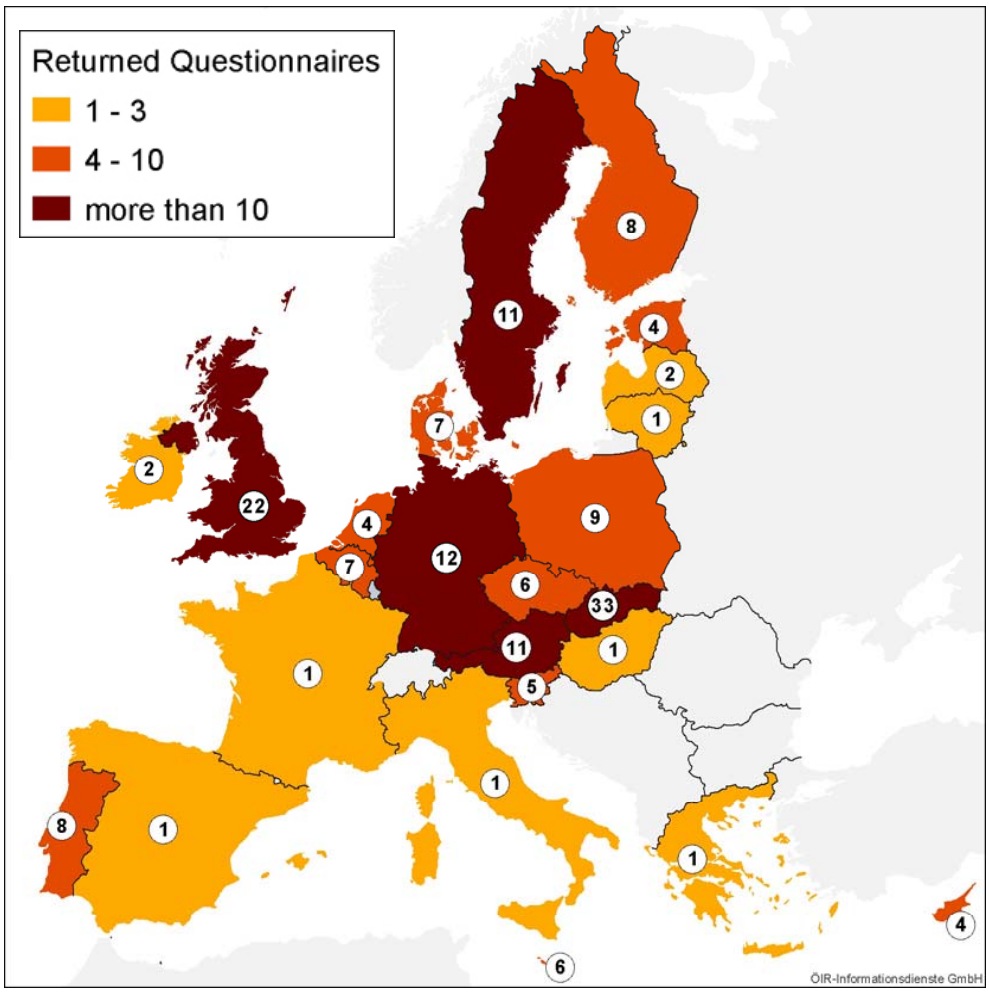

Figure 4 Geographical distribution of questionnaires returned

From some Member States just one completed questionnaire has been returned (Estonia, France, Greece, Hungary, Italy, Lithuania) and there was no response from Luxemburg. So Slovakia and the UK are four and three times 'over-represented' in terms of respondents while Estonia, France, Greece, Hungary, Italy, Lithuania, Ireland, Luxembourg and Latvia are 'under-represented' by a similar factor.

Statistical analysis – response rates per country	
Total no. of questionnaire respondents	183
Mean no. of respondents per country	7
Median no. of respondents per country	6
Mode	1
Range	min=0 max=33

Figure 5 Statistical analysis – response rates per country

Consequently, the feedback cannot be interpreted as a representative random sample of stakeholders across the EU. Furthermore, a country-by-country analysis is not possible especially for the under-represented Member States. Therefore no calculation of any numerical results beyond the analysis of frequencies and percentages is made, and verbal descriptions are mainly used. No further statistical processing of empirical data such as average values is done. However, the database gives an impression of the view of stakeholders, that are pro-actively interested in contributing to the development of the EIA-legislation.

QUESTIONNAIRES DISSEMINATED + RETURNED

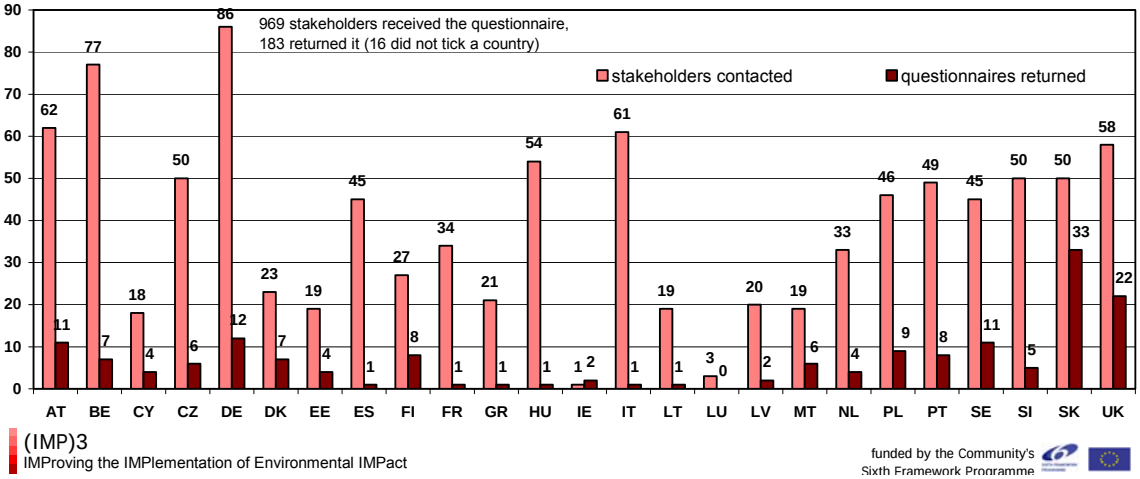

Figure 6 Questionnaires disseminated and returned

Represented stakeholder groups

The questionnaires returned covered answers of all different stakeholder groups. The smallest group amongst the respondents are NGO's (12 respondents/6.6%), whereas the largest group are the consultants (68 respondents/37.2%). The administrative view on EIA-application (representatives from regional governments resp. national governments) is covered by 58 respondents (31.6%).

Statistical analysis – response rates per stakeholder group	
Total no. of questionnaire respondents	183
Mean no. of respondents per stakeholder group	26
Median no. of respondents per stakeholder group	26
Mode	29
Range	min=1 Max.=68

Figure 7 Statistical analysis – response rates per country

The comparison of the frequency distribution of the stakeholders contacted with the frequency distribution of the stakeholders who answered, the business sector (consultants) is over-represented whereas the NGO's are under-represented. However, as the database was not a random sample of EIA stakeholders across the EU, statistical analysis and interpretations going beyond a calculation of frequencies and percentages were avoided.

stakeholders contacted via questionnaires and stakeholders who answered				
	stakeholders contacted		stakeholders answered	
stakeholder type	number	percent	number	percent
National government	128	13.2%	29	15.8%
Regional government	200	20.6%	29	15.8%
NGO	144	14.8%	12	6.6%
consultants	226	23.3%	68	37.2%
scientists and other proponents	272	28.0%	45	24.6%
Total	970	100.0%	183	100.0%

Figure 8 Stakeholders contacted via questionnaires and stakeholders who answered

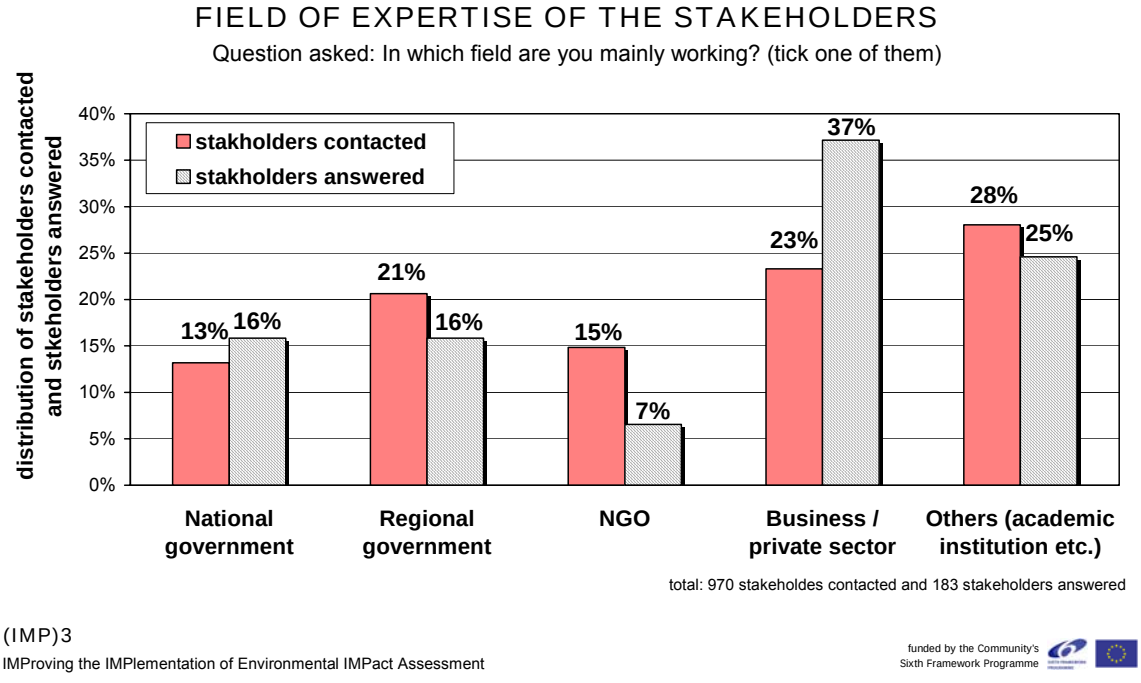

Figure 9 Field of expertise of the stakeholders

Role of the stakeholders in the EIA-process

The stakeholders responding to the questionnaire are involved in the EIA-process from very different sides[2]: 75 respondents are writing or preparing environmental impact statements (EIS) for the developer and another 16 are involved in the development of projects, both groups mirroring their experience with EIAs mainly from the proponents' side.

59 persons are reviewing submitted EISs and providing expert opinions/comments on EIS, additionally 37 ticked the category "dealing with EIA as regulatory authority". Both groups represent the views from the administrative side.

Nine respondents to the questionnaire were involved in EIAs representing the position of a NGO. 36 are concerned with EIA from a scientific side (e.g. researcher, scientist, academic teacher).

[2] As one person can be involved in the EIA-process in different roles, more than one answer was allowed. So the sum of the options ticked (278) outweighs the number of questionnaires returned (183).

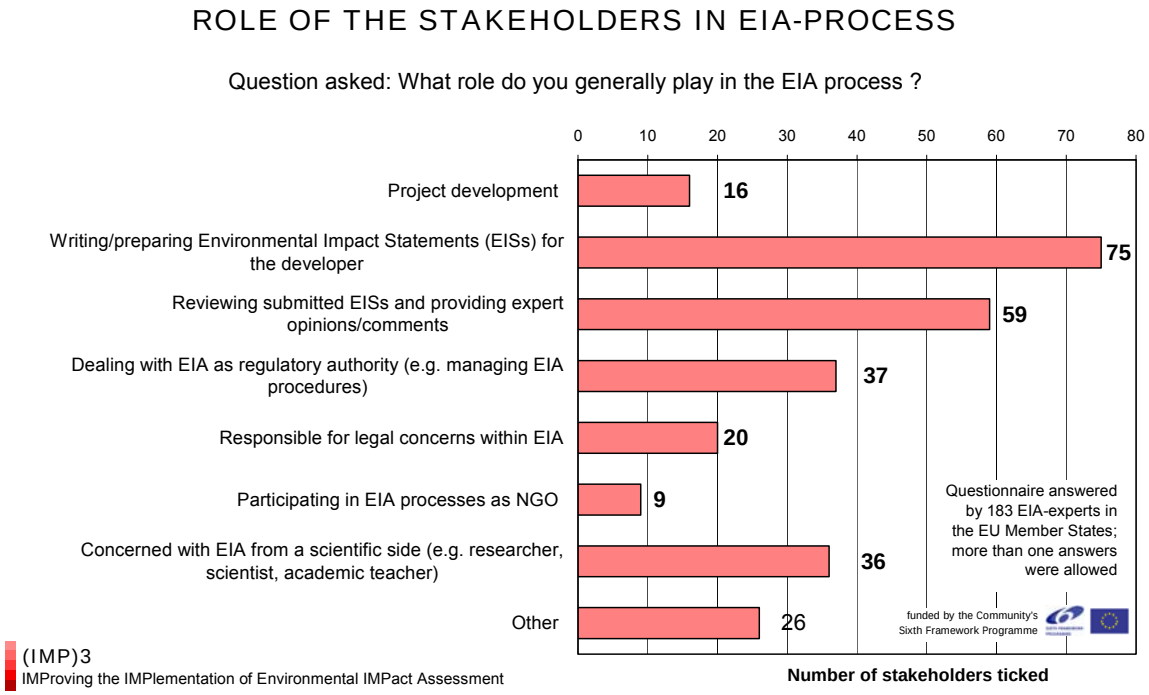

Figure 10 Role of the stakeholders in the EIA-process

Statistical analysis – "Role of the stakeholders in EIA-process"	
Total no. of questionnaire respondents	183
Total no. of answers ticked	278
Mean no. of respondents per stakeholder group	35
Median no. of respondents per stakeholder group	31
Range	min=9 Max.=75

Figure 11 Statistical analysis – Role of the stakeholders in EIA-process

1.2.3.1 Interviews

In order to get a more detailed image of the application of EIA, interviews with selected EIA-stakeholders were conducted. This approach leads to more profound insights into the actual day-to-day difficulties in EIA implementation and a more thorough picture of which methods are in use and the pros and cons of different methods, especially because the interviewees can provide information going beyond the information gained by the very formal structure of the questionnaire. The selection of the interviewees followed two different sets of criteria: a geographical one and a stakeholder-oriented one.

Geographical criteria for the selection of the interviewees

As the results of the interviews should reflect the European situation the following criteria were taken into account:

- interviewees from new European Member States and old European Member States
- interviewees from large MS and small MS

- interviewees from MS from the southern, the northern, the eastern and the western part of the EU

Regarding these criteria, interviewees from the following ten European MS were selected:

- Austria (old MS, small country, Central Europe);
- Czech Republic (new MS, small country, Central Europe);
- France (old MS, large country, Western Europe);
- Germany (old MS, large country, Central Europe);
- Latvia (new MS, small country, Eastern Europe);
- Poland (new MS, large country, Eastern Europe);
- Portugal (old MS, small country, Southern Europe);
- Slovakia (new MS, small country, Eastern Europe);
- Sweden (old MS, small country, Northern Europe); and
- United Kingdom (old MS, large country, North Western Europe).

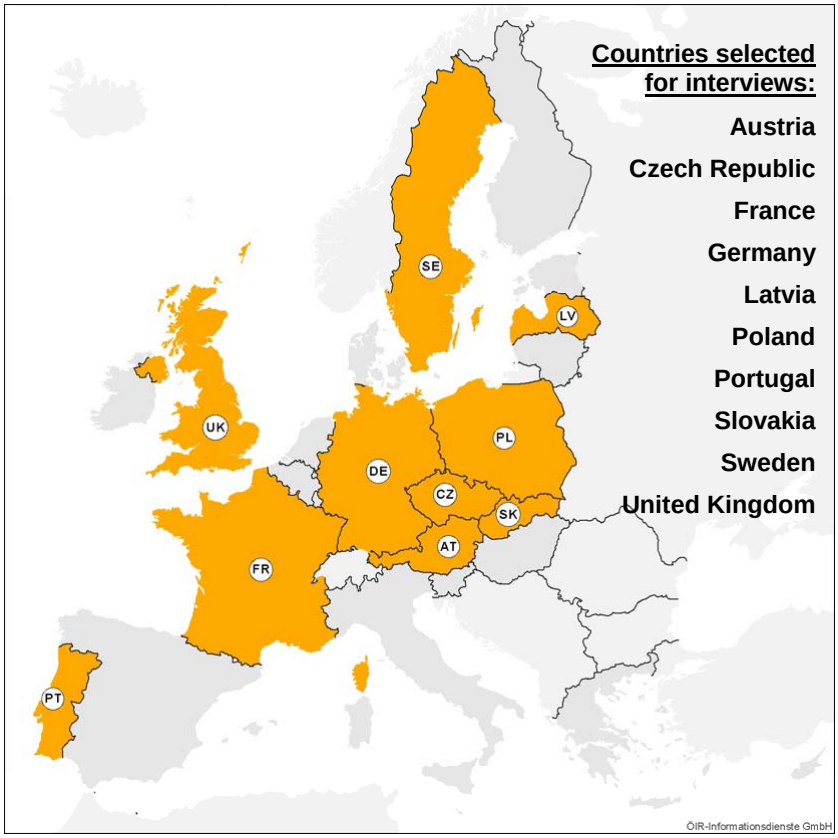

Figure 12 Geographic distribution of the countries selected for interviews

In order to compare the EIA-application in Europe with the way countries outside Europe apply EIAs, additionally to the 10 European countries selected, two non-EU foreign countries were chosen for a more detailed investigation of their EIA application. The two selected countries are USA and Canada because of their similar conditions as highly industrialised countries and their long experience with EIA. (The National Environmental Policy Act of 1969 enacted by the Congress

of the United States of America in 1969 was worldwide the first law coming up with the term “environmental impact assessment“ on a legal basis.)

Stakeholder-oriented criteria for the selection of the interviewees

The EIA-experts interviewed should form a comprehensive picture of the EIA-application in each of the countries selected. Thus the views of experts at national and regional level being mainly involved in the transformation of the EU-Directive into national or regional legislation should be taken into account as well as the views of persons actually dealing with projects subject to EIAs, as e.g. consultants, NGOs or representatives from the administrative side. Thus, the following EIA-stakeholder-groups have been taken into account for selection:

- representatives of national governments,
- regional bodies with competence in EIA-issues,
- NGO’s,
- representatives of the private sector as e.g. consultants,
- others as e.g. researchers.

Interview guide and protocols

In order to prepare the interviews, an interview-guide has been developed by the (IMP)3 consortium and discussed with representatives of DG Environment. All in all, 50 interviews with 64 interviewees have been conducted (33 interviews in European countries and an additional 17 in USA and Canada). Each of the interviews was minuted in order to gain a well-structured basis for the analysis.

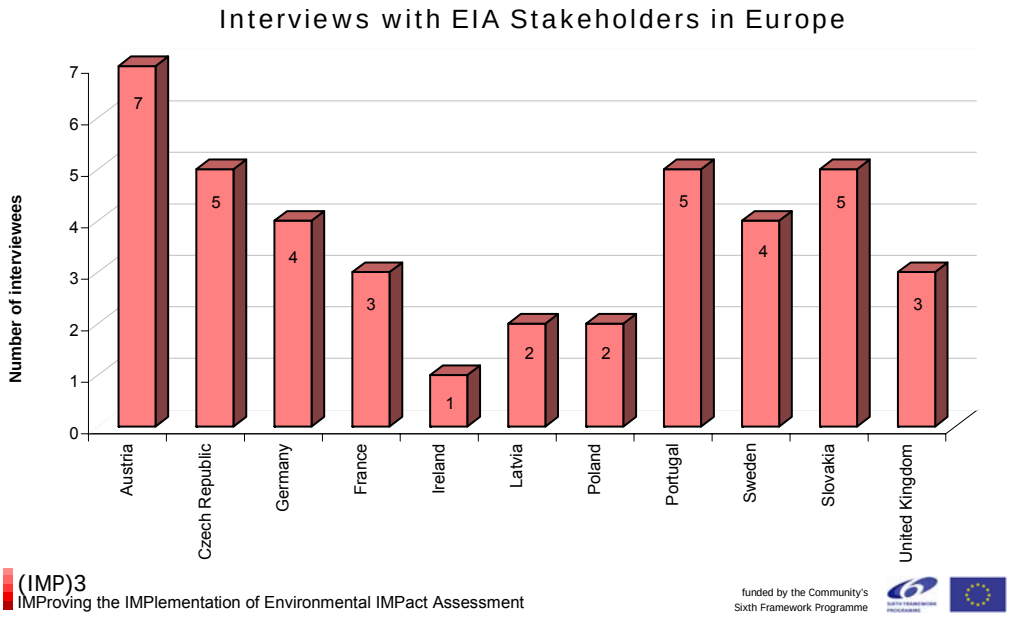

Figure 13 Number of EIA stakeholders interviewed

Role of stakeholders in the EIA-process

EIA-stakeholders interviewed						
Country	Stakeholder type					
	national government	regional government	NGO	consultant	others (scientist etc.)	total
Austria	1	4	0	2	0	7
Czech Republic	2		1	2		5
Germany		2		1	1	4
France	1			1	1	3
Latvia	2					2
Poland	2					2
Portugal	1	1	1	1	1	5
Sweden	1	1	1	1		4
Slovakia	1		1	1	1	4
United Kingdom		1		1		2
Canada	2	2		3	1	8
USA	13	3	2			18
total	26	14	6	13	5	64

Figure 14 Number of interviewees per country and stakeholder type

1.2.4 Policy options and SWOT-Analysis

Based on the findings of the literature review, the analysis of the questionnaire and the interview results several policy options were elaborated within each of the three main themes of (IMP)3 (human health, risk assessment and projects subject to EIA) to increase the consistency of the application of EIA across the European Union.

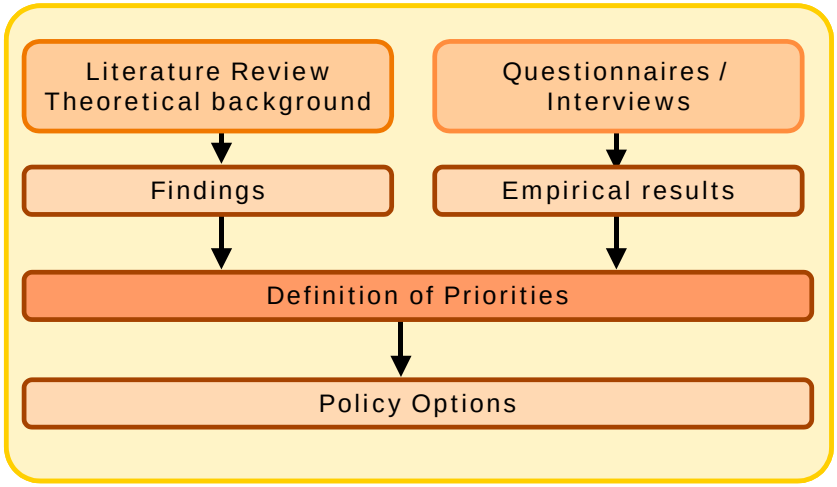

Figure 15 Deduction of policy options from the results of the analysis conducted

The policy options aim at tackling the identified weaknesses of the current European EIA practice overcoming the most important barriers on the way forward. They also attempt to build on and advance the strengths that partly exist.

The policy options represent a range of different courses of actions that the European Commission could take to better exploit the full potential of EIA to act as an effective instrument of preventive and precautionary environmental protection. The variety of the options comprises the whole range of potential measures that could be taken into account at the European level. This includes both "soft" and legislative courses of action. They are designed to operate mainly along three major axes:

- guidance;
- supportive measures;
- regulatory or legislative measures.

The development of such a range of policy options, as opposed to a simple list of recommendations, is a more robust approach as it recognizes that different levels of action are possible and that each has advantages and disadvantages.

The policy options presented in the report are addressed to the European Commission. Yet, eventually they are targeted at Member States and EIA stakeholders and are intended to influence actual implementation and application of EIA on national and regional level. Their main functions are to provide decision support to the policy making process on Community level, to assist informed decision-making on possible future amendments to European legislation, and to contribute to improvement of guidance such as supportive measures for EIA application, but also to stimulate discussions within the European EIA community.

For each policy option, a SWOT-Analysis has been conducted, which provides indicative lists of strengths and weaknesses, opportunities and threats. This form of a SWOT-Analysis is a simple, yet flexible and robust tool for decision-support that is meant as a basis for discussion outlining potential pros and cons of a decision. However, it can not substitute a more rigid cost-benefit-risk analysis to be done on part of the Commission.

SWOT-Analysis	
Strengths	Weaknesses
■	■
Opportunities	Threats
■	■

Figure 16 Template table of a SWOT-Analysis

1.2.5 Communication process at EU level

As the results of (IMP)3 shall serve for a more harmonized application of the EIA-Directive and take into account various policy options possibly being taken at European level, a close communication with relevant stakeholders at EU-level was required. Therefore, a communication process with representatives of DG Environment and the EIA/SEA expert group and DG Research was

established, in order to feed back the research approach and the intermediate results with relevant stakeholders at EU-level.

SEA/EIA Expert Group

The national experts on SEA and EIA on governmental level (= SEA/EIA Expert Group) meet twice a year in order to discuss relevant issues about EIA and SEA on the European level. The meeting is chaired by a member of DG Environment.

This group of experts was informed at the start of the project about the research focus and their remarks on the research topic were taken into account at the elaboration of the details of the research of (IMP)3. Moreover, some of the group-members supported the (IMP)3-team in order to find relevant EIA-stakeholders at the national level. Intermediate results of the data-analysis were presented to the SEA/EIA Expert Group and the final results will be presented and discussed at upcoming meetings.

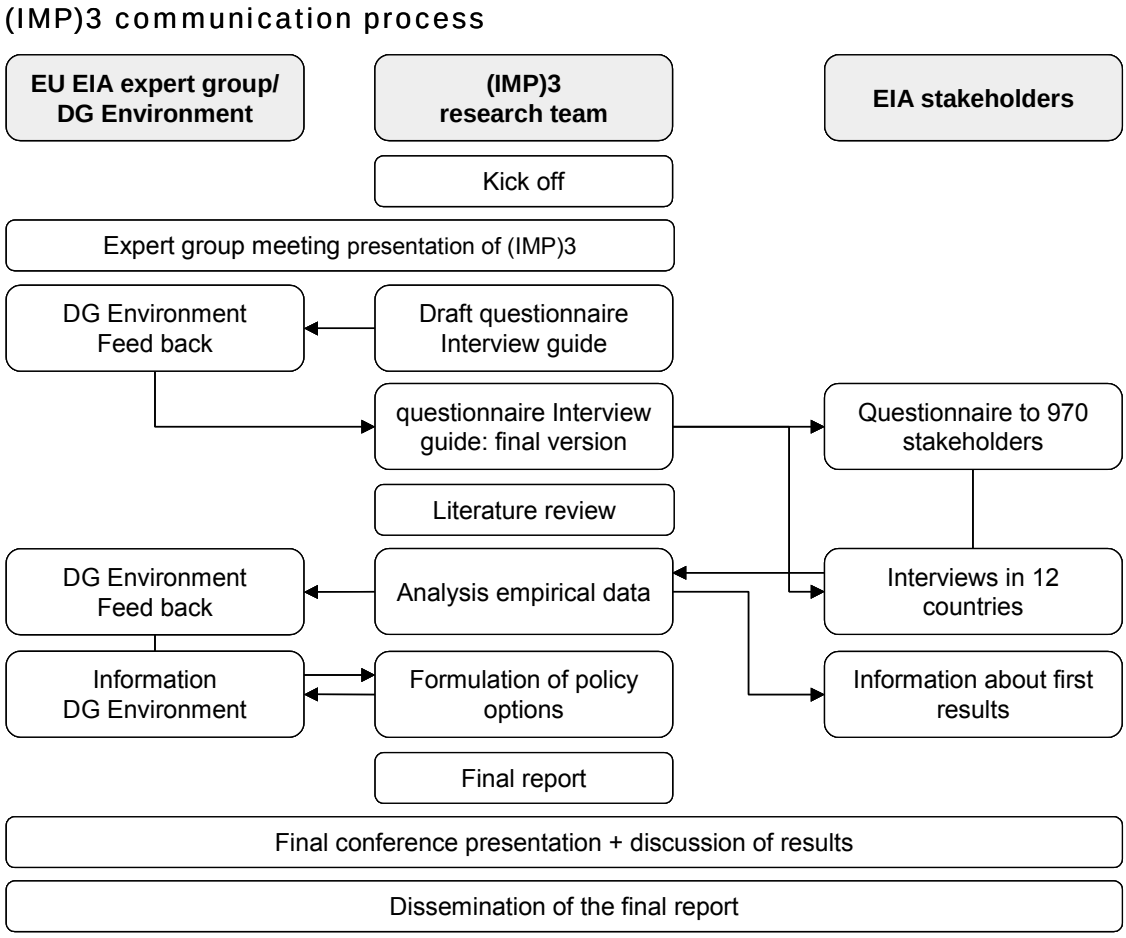

Figure 17 (IMP)3 communication process with EIA-stakeholders at EU-level

DG Environment

In order to ensure the usability of the results of (IMP)3, serving as input for the policy making process on the European level, members of DG Environment were informed about the work plan and the progress of the project and their feed-back was incorporated into the next steps of (IMP)3. The following formal contacts were established:

- 1st co-ordination meeting at the start of (IMP)3: general information about the project and fine-tuning of the research focus of (IMP)3;
- 2nd co-ordination meeting: presentation of the draft questionnaire and the draft interview guide;
- 3rd co-ordination meeting: presentation of first results of the analysis of the empirical data coming from the questionnaire and the interviews, agreement about the form of the results of (IMP)3 (elaboration of several policy options including a SWOT-Analysis for each option); and
- pre-information about the policy options proposed by (IMP)3.

The close contact with DG Environment aimed to ensure that the results of (IMP)3 are a useful contribution to the policy making process of DG Environment concerning the improvement of EIA-application.

1.2.6 Organising the work and reporting

Based on the main issues of (IMP)3, human health, risk assessment and projects subject to EIA the work of (IMP)3 is organised along five work-packages (WPs):

- WP1 concentrates on the gathering of empirical data about the application of EIA in Europe and abroad, including the dissemination of a questionnaire to EIA-stakeholders in all 25 Member States and interviews with EIA-stakeholders;
- WP2 “Human health” focuses on Objective A: a better incorporation of human health aspects into EIA;
- WP3 “Risk assessment” concentrates on Objective B: a better integration and more consistency of risk assessments, regarding various sources of risks (natural hazards, accidents, sabotage);
- WP4 “Projects subject to EIA” focuses on Objective C: a survey of project types subject to EIA; and
- In WP5, the results of WP1 to WP4 are merged into a final report and a conference has been organised in order to discuss the issues raised at a broader level.

Within these work-packages, research is taken into account at international and national levels such as the activities of the World Health Organisation on Health Impact Assessment, studies at European level and national studies related to the specific themes. The actual report concentrates on Risk Assessment.

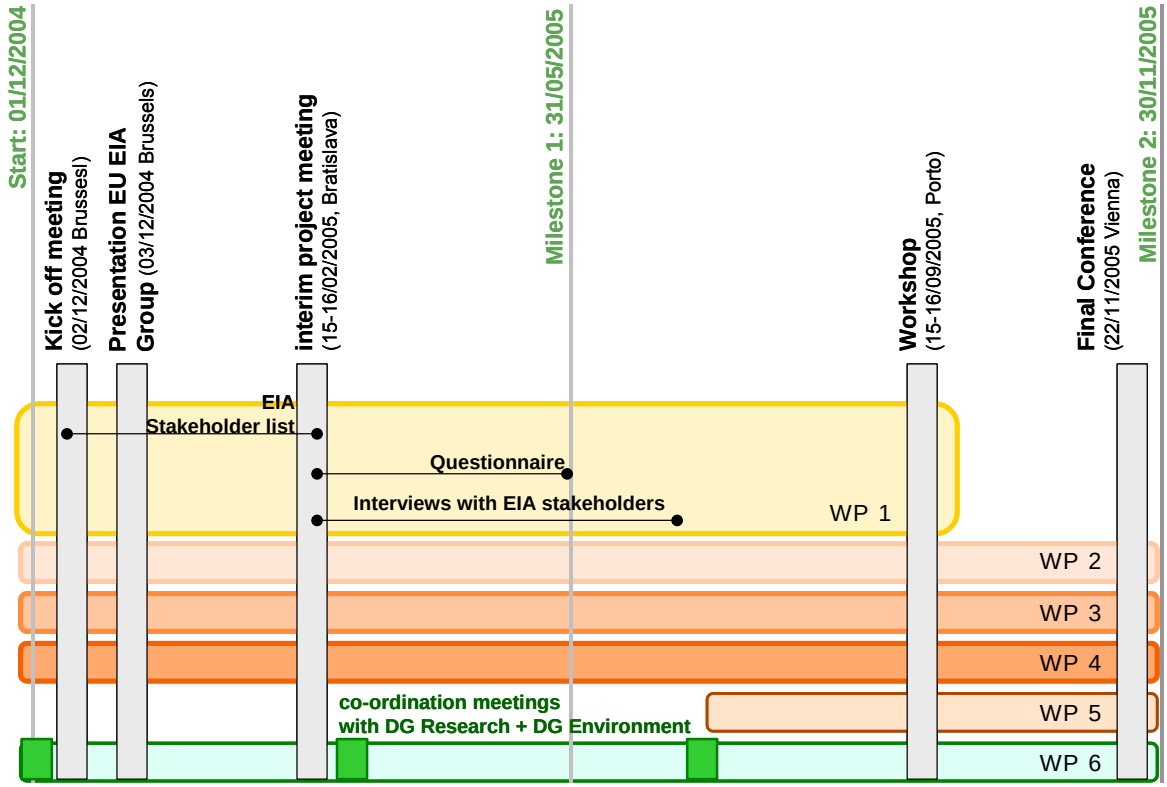

Figure 18 Timetable (IMP)3

Reporting

The results of (IMP)3 are laid down within four reports:

- Report Human Health (results of work-package 2);
- Report Risk Assessment (results of work-package 3);
- Report Projects Subject to EIA (results of work-package 4); and
- Final Report.

The three work-package reports comprise all relevant information about the results within each main theme of (IMP)3 (human health, risk assessment and projects subject to EIA). Each of them includes the relevant information so that it can be read and understood without reading the other reports.

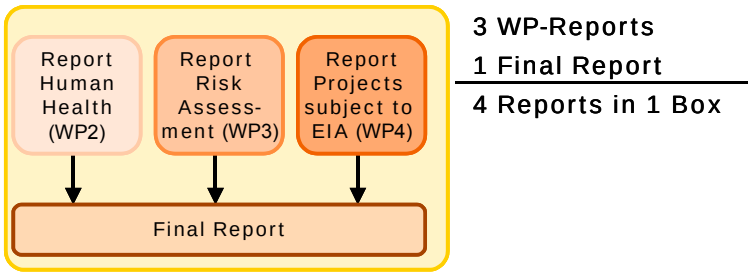

Figure 19 Structure of the reports of (IMP)3

The final report sums up the most important results of the work-package reports. In particular it presents an overview of the SWOT-Analysis of the policy options.

1.3 Contribution to policy developments

(IMP)3 goes in line with the European policy to establish a sustainable development, which is laid down e.g. in the Sixth Environment Action Programme of the European Community *"Environment 2010: Our future, Our choice"* and the European Spatial Development Perspective (ESDP).

The main goal of (IMP)3 to contribute to the process of a more harmonized application of EIAs meets directly the scientific and technological needs of the policies of the Community related to the application of the EIA-Directive (97/11/EC). In detail (IMP)3:

- provides a better understanding of "impacts" and clarifies different interpretations of environment, health, vulnerability, risks, ... within EU 25;
- provides a better understanding of EIA applications;
- analyses the improvement of the coherence of EIA with different assessment tools (health impact assessment etc.); and
- gives proposals for the integration of health aspects into EIA, how to come to a risk characterisation and suggestions for improving the coverage of projects types likely to have adverse effects on the environment.

Setting up policy options in the three core fields of the research human health, risk assessment and project types, (IMP)3 contributes directly to the scientific and technological needs of the policies of the Community in terms of the improvement of the application of the EIA.

1.4 Theoretical background: Risk assessment

1.4.1 Concepts and definitions

Based on an extensive review of literature on environmental risk assessment, the following chapter provides an introduction to the conception of 'risk' and associated terms and concepts that are vital to most conceptual approaches to risk assessment in an environmental context. To facilitate understanding of language that is used repeatedly in this report, general definitions of key terms that are common to most models of risk assessment are provided. Differences between schools, models and fields of application of risk assessment notwithstanding, some basic underlying characteristics and rationales of risk assessment are outlined, applying a broader understanding of a complete risk assessment process that encompasses risk management and social aspects, as well as the linkages between them and some associated problems.

General models of risk assessment that are particularly relevant in the context of EIA are presented. Based on an overarching framework, key steps of performing an environmental risk assessment are outlined in detail. Furthermore, an overview is given of those schools of environmental risk assessment that are most established and are most often applied in practice,

including applications within EIA, namely, human health risk assessment and ecological risk assessment.

1.4.1.1 General remarks

Risk assessment is a comparatively young field of science whose first systematic approaches emerged in the 1940ies and 1950ies paralleling the onset of nuclear industry and responding to a growing need for safety hazard analyses in aerospace operations and chemical process industries (Kolluru, 1996). Drawing on research in decision and engineering sciences and following applications to fields as diverse as insurance, banking, military, food and drug safety, occupational health and safety, and technological and chemical safety risk analyses, risk assessment has since then been introduced to environmental sciences, environmental policy and environmental legislation, starting out with the adoption of risk assessment approaches by the US Environmental Protection Agency (EPA). Since then, different schools of applying risk assessment principles and methods to environmental problems have developed, including Environmental Risk Assessment, Human Health Risk Assessment and Ecological Risk Assessment. Today, risk assessment is a rapidly evolving, dynamic and highly diversified domain of knowledge. Thus, risk assessment literature has become specialized and fragmented (Covello & Merkhofer, 1993), as have concepts, models, definitions, and methods. Due to the fact that risk conceptions and approaches to risk assessment have been developed and applied across a broad range of disciplines and activities, there is no common theory and no unified terminology (Brookes, 2001). At present, there are no universally accepted definitions of key terms like "risk" and "risk assessment". Rather, competing definitions with often relatively narrow applicability have been proposed (Covello & Merkhofer, 1993). The lack of consolidated concepts and clarified nomenclature implies that the language of risk assessment bears all disadvantages of ill defined terminologies, including ambiguity, inconsistency, and high fluctuation of terms (Gazso, 2005). Moreover, while risk assessment appears to relate to things that everyone knows from common experience, yet the meaning of key terms often differs considerably from meanings in ordinary language (Calow, 1998). It is neither the intention nor is it possible to give a complete overview of the 'state-of-art' of risk assessment or to elaborate a 'unified' approach to risk assessment concepts and definitions on the following pages. Rather, it is the purpose of this chapter to give a brief introduction to some key concepts and key terms that are vital for the understanding of this report and to present some basic models of risk assessment in an environmental context, as far as they appear relevant to EIA.

1.4.1.2 The concept of risk

Despite divergences in definitions, most definitions of "risk" have several key elements in common. Most definitions include at least three main elements (Covello & Merkhofer, 1993; Gazso, 2005):

- the possibility of an adverse outcome (damage, harm, loss);
- the probability that an adverse outcome will occur, which can also be described as uncertainty over the occurrence, timing, and magnitude of those adverse consequences; and
- a functional linkage between probability of occurrence and magnitude of adverse consequences.

More detailed, risk is a complex concept that usually comprises a number of distinct components. As risk assessment has gradually shifted from hazard-based to risk-based approaches during the

last decades (Fairman et al., 1999), most modern definitions of risk put much emphasis on the clear distinction of hazards, adverse consequences, and risk as such, as well as on the linkages between these elements. According to most definitions in an environmental context, the existence of risk requires the presence of the following components:

- **Hazard**: A hazard can be described as a situation, or an event, or a chemical, biological, or physical agent, or a set of conditions that has the potential to cause harm. A hazard presents a source of risk but not risk per se (Kolluru, 1996). A hazard may be an industrial installation that can release or otherwise introduce a risk agent into the environment, an accident within a plant, a river flood, or the planting of a genetically modified crop. With regard to chemicals, a hazard is the intrinsic ability of a chemical substance to cause toxic effects to organisms (Erickson, 1994).
- **Exposure**: Adverse consequences can only occur if a receiving target system, e.g. humans, environmental compartments, or material assets, is actually exposed to a hazard. This requires the chance of access to or contact with a hazardous agent or situation via an exposure process, which includes a transmission or transport mechanism that provides a pathway between a hazard and a potential receptor. Environmental media (air, water, soil) may act as possible pathways or avenues of exposure. Furthermore, a causal process must exist by which exposure produces adverse health or environmental consequences and that usually involves various routes of exposure by which risk agents get in contact with or enter receptors, for instance via contact of an organism's outer boundary with chemical, biological or physical agents. Possible routes of entry may include e.g., inhalation, ingestion, or dermal contact. A hazard presents a risk only if there is a possibility that a receptor may actually be subjected to a hazard, which usually requires joint occurrence in time and space of these two components. This relationship can be described in exposure scenarios. The likelihood of potential harm being realised depends on the circumstances that lead to a particular exposure scenario (Calow, 1998). The risk-based concept of exposure can be further split up into the two following risk components:
  - **Receptor**: A receptor can be described in broad terms as a part of the receiving environment, a target system or a protection object that may be harmed or damaged in consequence of a hazard occurring (DEFRA, 2000). Potential receptors may include humans, individual organisms, plant and animal species or populations, entire ecosystems, or material assets.
  - **Pathway**: Some kind of actual or potential connection has to exist between a hazard and a receptor. Pathways can be described as routes, avenues or effect-carrying mechanisms by which a receptor encounters a hazard. Environmental media pathways include air, water, and soils.
- **Adverse consequences**: Provided all the abovementioned risk components are present, the occurrence of a hazard may lead to damage or harm to human health, the natural environment or material assets of the built environment. The possibility of an adverse outcome is essential to the concept of risk. The magnitude or severity of adverse consequences depends, amongst others, on the characteristics of the hazard and on the sensitivity of the receiving environment towards the impacts of a hazard, i.e. on the vulnerability of receptors.
- **Connectivity**: The use of the hazard (risk source) – pathway – exposure – receptor scheme has the big advantage of making clear that the existence of risk requires actual or potential connectivity between the individual risk components, i.e. connectivity between a

hazard and potential receptors via exposure and exposure pathways, which can be viewed as being links in a risk chain (Merkhofer, 1987). If one of these components is missing, there is no risk, and no further need for a risk assessment exists (DOE, 1995).

- **Uncertainty**: Uncertainty is inherent to the concept of risk. Risk involves thinking in potentialities. It implies that neither what exactly will happen, nor when it will happen, nor what and how severe the effects exactly will be is known. If the outcome of something is certain, we do not speak of risk (Crawford-Brown, 1999). That is why risk is expressed using properties like probability, frequency, and variability. In probabilistic terms, risk is a probability distribution within a range of different possible outcomes. Above all, uncertainty over the future is the main reason why risk assessment is needed.

There is no single definition of risk that encompasses the whole complex functional system of hazards, likelihood, exposure, consequences, vulnerability and associated socio-cultural aspects. However, most definitions have in common that risk is usually characterised as a qualitative description or a quantitative measure which represents a function of the probability of occurrence of a defined hazard and the magnitude of the adverse consequences of the occurrence within a certain range of possible outcomes. Risk is usually considered within a certain time frame.

In the assessment of (large-scale) disaster risks to regions or regional communities, and here in particular to the assessment of risks from natural hazards, risk is often defined as a function of the hazard potential and vulnerability. Regional vulnerability is mainly determined by the existent damage potential and regional coping capacity, which describes the capacity of a region to cope with the effects of a disaster occurring (Schmidt-Thome, 2005).

1.4.1.3 Risk Assessment

In general terms, risk assessment comprises the scientific methods of confronting and expressing uncertainty in predicting the future (ADB, 1997). Regardless of differences in schools and approaches, it can be defined as a systematic process for describing and/or quantifying the risk associated with some substance, situation or action by gathering, structuring, and analyzing available information on hazards, exposure, and consequences. The European Environment Agency (EEA) defines risk assessment as a procedure in which the risks posed by inherent hazards involved in processes or situations are estimated either quantitatively or qualitatively (Fairman et al., 1999). Using a similar approach, the US Environmental Protection Agency (EPA) has defined risk assessment as a qualitative or quantitative evaluation of the environmental and/or health risk resulting from exposure to a hazardous agent. The key tasks of any risk assessment process are to estimate the probability of occurrence of a hazard and the probable magnitude of adverse effects – including safety, health, ecological or financial effects – over a specified time period (Kolluru, 1996).

The term 'risk analysis' is often used synonymously to 'risk assessment', but sometimes it is used in a broader meaning that also encompasses aspects of risk management (Kolluru, 1996).

Uncertainty is an inherent and unavoidable aspect of risk assessment. The advantage of a systematic risk assessment, compared to mere straight-forward impact predictions, is that it can and should make uncertainty explicit (Brookes, 2001). Uncertainty is usually expressed and quantified by using the well-established methods of probability theory. Thus, a quantitative risk assessment typically generates a probability distribution for a range of possible consequences of

different magnitudes, including further measures for uncertainty of risk estimates, such as confidence intervals etc. (Covello & Merkhofer, 1993; Kolluru, 1996).

However, in the light of more recent contributions from psychological and social sciences, and responding to the growing need for stakeholder involvement, 'classical' definitions of risk assessment like the ones outlined above may be viewed as rather one-dimensional technical concepts. During the last few decades, gradually a new and wider risk-based paradigm has emerged that encompasses also psychological, sociological and cultural dimensions of risk (Gazso, 2001), and that puts stronger emphasis on 'soft' issues like risk perceptions, risk communication, and societal and cultural values. In epistemological terms, Crawford-Brown (1999) has discriminated three different conceptions of risk: While in the objective conception risk is considered a measurable, objective property of the physical world, the subjective school postulates that risk is a condition of the human mind, a sense that the future might hold undesired outcomes, an emotional response to the uncertainty of the world. Aspects of both the rational and the subjective conceptions of risk are to some extent synthesized by the psychologistic conception which claims that "*...risk is the set of all adverse outcomes which a rational person might believe to be possible when confronted with evidence about the frequency, severity and variability of effects*" (Crawford-Brown, 1999: p. 11).

Basically, risk assessment addresses the following questions (Fairman et al., 1999):

- What can go wrong to cause adverse consequences?
- What is the probability or frequency of occurrence of adverse consequences?
- What are the range and distribution of the severity of adverse consequences?
- What can be done, at what cost, to mange and reduce unacceptable risks and damage?

1.4.1.4 Risk Management

The main reason for wanting to assess and specify risks is to provide a sound information basis so that they can be prevented, reduced, managed or eliminated (Calow, 1998). In the end, risk assessment is about decision-making, and about taking actions under uncertainty (SRU, 1999).

Risk management can be defined as the process of developing and evaluating alternative risk management options and of selecting and implementing the most appropriate options. The information generated by risk assessment provides a systematic framework for identifying the most significant risks as well as time-sensitive, action-sensitive and investment-sensitive risks. It facilitates prioritizing risks and designing effective risk reduction and control measures, whereby an optimal resource allocation can be accomplished which aims at achieving the greatest reduction of the most unacceptable risks in the most cost-efficient way (Kolluru, 1996). Thus, the threat of directing huge funds at minor risks with low effectiveness in terms of risk reduction shall be avoided (Brookes, 2001; Sunstein, 2002).

In general, there are three main options available to the risk manager when presented with a risk problem. These options are (DEFRA, 2000):

- to reject the intention altogether because it poses unacceptable risks;
- to accept whatever risk is imposed; or

- to reduce the risk in some way.

Reducing the risk can be done by doing one or more of the following (DEFRA, 2000):

- modifying the hazard;
- modifying the receiving environment;
- modifying exposure;
- modifying the consequences of a risk.

Modifying one or more of those risk components can be done by taking risk prevention, reduction, control or mitigation measures, or by taking precautionary measures to contain and limit adverse consequences (alarm plans, emergency plans, rescue and evacuation plans, etc.).

Risk assessment is, of course, not the only basis for risk management. Risk assessment is a decision-supporting instrument, but it is no substitute for decision-making. It can provide estimates of risk, but it can not answer questions like "how safe is safe?" and "how clean is clean?". Deciding on acceptability, or tolerability, of risks is the domain of risk management. Thus, decision-making on risk management involves also consideration of issues like societal values, public perceptions and preferences, costs and benefits, and technical feasibility, as well as their balancing, ranking and weighting, and often difficult trade-offs between them (Kolluru, 1996; DEFRA, 2000). Methods that may be used for comparing and evaluating alternative risk management options include cost-benefit analysis, cost-effectiveness analysis, trade-off analysis, multi-criteria analysis, and other techniques of options appraisal (ADB, 1997; DEFRA, 2000). In particular cost-benefit analysis can be a powerful tool that entails a full accounting of the consequences of alternative courses of actions, including the omission of actions. It allows weighing the benefits and effectiveness of risk reduction measures against their costs, including environmental costs, weighing both against the amount of risk, and producing sensible priority-setting. By putting all arguments on the screen, it enables correction of cognitive limitations, such as overreacting to risks of high salience but very low probability by devoting large amounts of resources to them, and neglecting substantial risks that receive less public attention (Sunstein, 2002). In the decision-making process it is also important to consider the environmental consequences and secondary risks that may be associated to particular risk management measures and their implementation. A full cycle of risk management would also include monitoring of compliance with measures on the ground and of their effectiveness as well as a review stage.

Dating back to recommendations made by the US National Research Council in its landmark report "Risk Assessment in the Federal Government: managing the process" (NAS-NRC, 1983), a tendency has developed to keep risk assessment separate from risk management. This view is based on the rationale that risk assessment should be based on scientific criteria to the extent possible, whereas risk management usually involves political, social, economic, and technological issues as well. According to this paradigm, science should be isolated from socio-political considerations to avoid prejudgment of assessment results by cost implications and value judgments (Calow, 1998; Kolluru, 1996; Bartell, 1996; Wentsel, 1998). However, experience has shown that both the assessment and management phase often suffer from this disjunction (Kolluru, 1996). In practice, risk assessors often need input from risk managers to adequately define the assessment problem, risk management options may need re-assessment to determine whether it reduces the risks to an acceptable level, and each option may introduce new risks (Calow, 1998;

DEFRA, 2000). Thus, there is a need to iterate between assessment steps and management (Brookes, 2001). The NRC committee itself has pointed out that "*...risk assessment and risk management functions are analytically distinct, but in practice they do – and must – interact. (...) Separation could also impair the risk manager's ability to obtain assessments that are timely and in a useful form*" (NRC, 1983: p. 152). In contrast to the dominating American risk assessment model, which discriminates assessment and management phase, in the Canadian model the first steps of risk management – development of options and option analysis – begin early in the process and are integrated with the assessment phase (Kolluru, 1996).

1.4.1.5 Environmental Risk Assessment: Models and procedural frameworks

Environmental Risk Assessment

Environmental Risk Assessment (ERA) can be defined as the process of evaluating the likelihood and magnitude of adverse effects in, or transmitted by, the natural environment from hazards that result from human activities (ADB, 1997). Drawing on Calow (1998), the term 'environmental risks' can be seen as having two different meanings on different levels. First, it refers to risks of negative effects on the environment, i.e. on people and ecosystems, comprising both non-human communities (animals, plants) and abiotic environmental compartments (Fairman et al., 1999). Second, it refers to risk agents that are released into, or otherwise introduced to the environment, i.e. to the environmental routes of exposure for both humans and ecosystem components (Calow, 1998).

Environmental Risk Assessment is usually used as an umbrella term covering Human Health Risk Assessment, Ecological (or eco-toxicological) Risk Assessment, and specific industrial applications of risk assessment that examine endpoints in people, biota or ecosystems. Thus, both Human Health Risk Assessment and Ecological Risk Assessment represent subsets of environmental risk assessment.

Figure 20 presents a typology of risk assessment according to Fairman et al. (1999) and Fairman & Mead (1996), which illustrates the position of different practical applications within Environmental Risk Assessment.

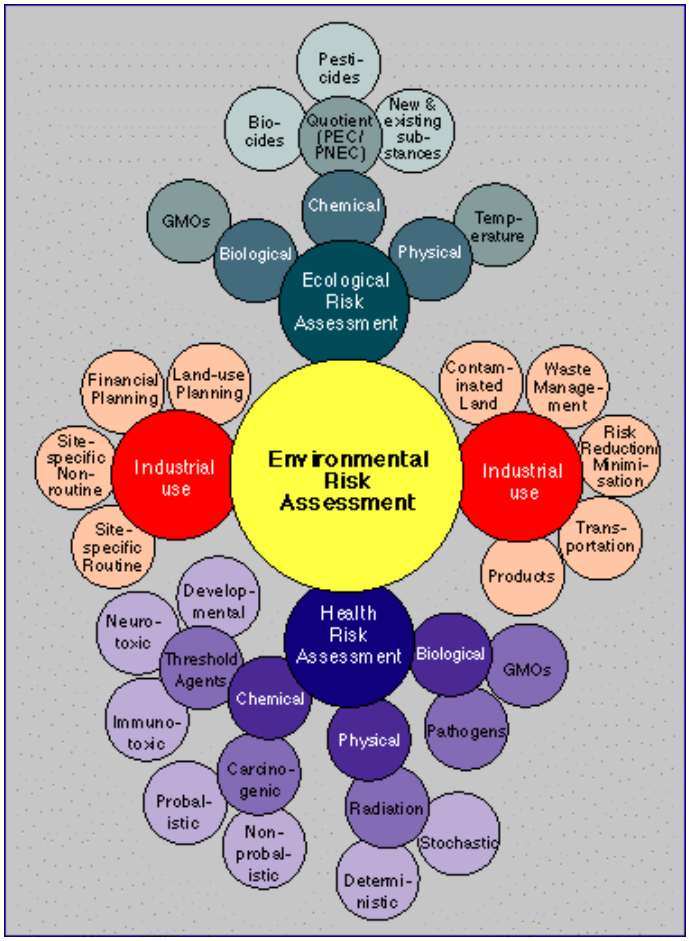

Figure 20 A typology of risk assessment (Fairman et al., 1999; Fairman & Mead, 1996).

Various models and frameworks of the process of performing an Environmental Risk Assessment exist. While the distinction of process key-stages varies according to application purposes, organisations and authors, nonetheless a number of unifying principles underlying most risk assessments can be identified. With a view to the particular focus of this report, the unified model of risk assessment developed by Covello & Merkhofer (1993), as adapted and modified by Fairman & Mead (1996; 1999), appears to be most meaningful for demonstrating the applicability of Environmental Risk Assessment to EIA purposes (Figure 21).

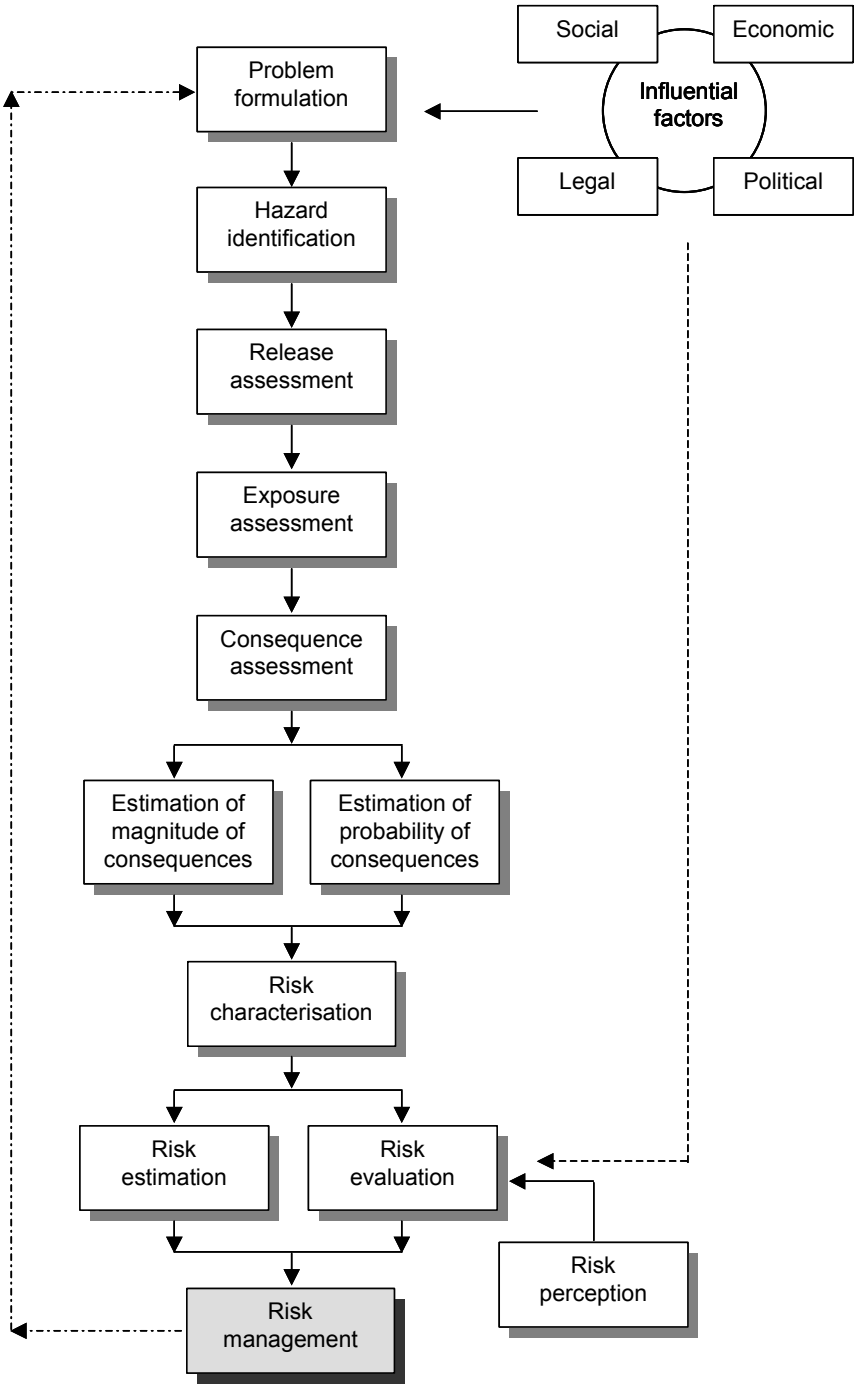

Figure 21 A model of environmental risk assessment (based on Fairman et al., 1999).

Following this model, and including risk management, an Environmental Risk Assessment is composed of the steps listed below. These steps are usually closely interrelated and may often be part of an iterative process, rather than distinctly separate steps. Depending on the situation, not all steps may be required in each application.

1. Problem formulation
2. Hazard identification
3. Release assessment

4. Exposure assessment
5. Consequence assessment
6. Risk characterisation
   6.1 Risk estimation
   6.2 Risk evaluation
7. Risk management

Problem formulation

In the initial problem formulation stage, the assessment problem is defined, the purpose of the assessment is formulated, and the nature and scope of the risk assessment is delineated (Bartell, 1996). This usually involves describing and integrating available information on the baseline conditions of the total system of which the particular problem is a part of, including both the state of the environment and characteristics of the project or any other intention, respectively (ADB, 1997; DEFRA, 2000). The risk source is specified and hazards that might be released from the risk source are narrowed down and characterised (Fairman et al., 1999). Further relevant risk components – pathways, receptors, and consequences, as well as connectivity between them – are identified and characterised (DEFRA, 2000). The problem formulation begins to ask first questions about the timing, frequency, magnitude, and duration of risk sources, or stressors, and adverse impacts (ADB, 1997). Relevant legal framework conditions and possible regulatory standards, e.g. for determining acceptability of risk, are identified (Fairman et al., 1999). Assessment endpoints and measurement endpoints are selected and defined (Bartell, 1996; Suter, 1993). Scoping of the assessment also involves the determination of the methods to be applied and the setting of boundaries on the spatial and time scales for the risk assessment (ADB, 1997; DEFRA, 2000). Based on such information, a conceptual model of the assessment problem and of the hypothesized relationships between all risk components will be set up (DEFRA, 2000). The final product of the problem formulation stage is a plan for the performance of the risk assessment (US EPA, 1998). Both the conceptual model and the analysis plan should be viewed as dynamic and subject to refinement in light of new information, increasing knowledge and changing assessment objectives, which may require several iterations between problem formulation, risk assessment and risk management (Bartell, 1996).

Problem formulation requires interaction between risk assessors and risk managers. Managers must specify the objectives of the overall assessment. This information will be used by risk assessors to determine what data are needed, how to quantify exposure, what environmental resources are at risk, and what format of the assessment output is consistent with the needs of risk managers. The initial approaches suggested by the assessment team should be reviewed by managers to ascertain if the anticipated nature of results appears helpful in designing and selecting risk reduction measures (Bartell, 1996). Some risk assessment frameworks call for such integration at the outset of the assessment, but advocate separation between assessment and management through subsequent stages (US EPA, 1992). Others favour continued interaction throughout the assessment process.

In particular with regard to EIA, it would be important to involve the public affected by a development proposal in the process of problem formulation alongside the technical experts. By excluding the problem perceptions of the public, the outcome of the risk assessment could easily

become unacceptable to those affected, thereby jeopardizing public acceptance of the final decision of the authorisation process and of the entire development (Fairman et al., 1999).

Hazard identification

Hazard identification is a largely qualitative process that involves determination of those risk agents or incidents that have the potential to cause harm to receptors of interest, such as people, organisms, or ecosystems (NAS-NRC, 1983). Apart from screening and detecting possible sources of harm, it also involves identifying and analysing the conditions under which they potentially produce adverse consequences (Covello & Merkhofer, 1993). In toxicological human health risk assessment, for instance, it requires identification of those chemical substances that can cause an increase in the occurrence of a particular adverse health effect if humans are exposed to that chemical. For that purpose, a cause-effect relationship has to be established and its scientific evidence has to be weighted (NAS-NRC, 1983). Typically, the expected environmental concentration of a hazardous agent is compared with the toxic threshold (Suter, 1993).

However, while hazard identification for a single chemical may be a comparatively clear and distinct step, in large industrial facilities or plants with complex processes and technological systems a large number of disparate hazards can be involved, and hazard identification can be a major undertaking. Here, hazard identification may involve examining possible impacts of routine operation as well as identifying the consequences of deviations from normal operation, e.g. due to accidents or external impacts on the project by the occurrence of natural hazards (Fairman et al., 1999). Triggered by an initial event of fault, the source of the hazard may be an entire chain of events that eventually leads to the release of a risk agent into the environment. In such cases, a considerable share of the time and resources that are dedicated to risk assessment may have to be invested in this assessment step. In some way, hazard identification can be viewed as a preliminary, albeit predominantly qualitative risk assessment (ADB, 1997).

As can be seen from this rough outline, the identification of hazards has an enormous influence on the overall scope of the risk assessment. Because of the importance of this step, it is sometimes classified as a separate process that is conducted prior to the actual risk assessment (Covello & Merkhofer, 1993).

It is important not to overlook secondary and multiple hazards that may arise. For example, during a flood (primary hazard) river sediments may be deposited on agricultural land. If these sediments were to be contaminated, toxic substances might enter the food chain or infiltrate into the ground water, thereby posing an additional hazard (DEFRA, 2000).

Release assessment

Following Covello & Merkhofer (1993), release assessment consists of describing and/or quantifying the potential of a risk source to release or otherwise introduce risk agents into an environment accessible to people, plants, animals, or other things that people value. This typically includes a description of the types, amounts, timings, and probabilities of the release of hazards (toxic substances, kinetic energy, etc.) and a description of how these attributes might change as a result of various actions or events. Release assessment may be applied to both normal and non-routine operation. If applied, for example, to a plant that produces emissions of pollutants, release

assessment would involve predicting and modelling emission levels during operation. In addition to normal conditions, an examination of what could possibly go wrong to cause non-routine releases, how likely this is, what the releases would be, and in what quantity would form part of the release assessment (Fairman et al., 1999).

The 'unified' framework presented by Covello & Merkhofer (1993), which has been built on and extended by Fairman et al. (1999), is one of the few risk assessment models that explicitly treats release assessment as a separate step. It appears particularly useful to the concept of 'extraordinary hazards' that is at the focus of this report because "*...for important types of risk, such as industrial accidents or failures involving large technological systems, quantifying and describing the potential of a risk source to release risk agents into the environment consumes as much or more effort than the other steps of risk assessment. In such cases, obtaining a detailed quantitative understanding of the amount and probability of a release – and how a release might be altered by various actions – is an essential step toward obtaining an accurate understanding of risk*" (Covello & Merkhofer, 1993: p. 29).

Exposure assessment

An exposure assessment consists of describing and quantifying the relevant conditions and characteristics of human and environmental exposures to hazards produced or released by a risk source (Fairman et al., 1999). It deals with the mechanisms that bring receptors into contact with a risk agent. i.e. with how the hazard might be encountered (Bartell, 1996; ADB, 1997). No exposure means no risk. Exposure assessments typically involve:

- a qualitative description, or quantitative estimation, of the intensity, frequency, and duration of exposure;
- a description of the exposure pathways that transport or distribute a risk agent within the environment and connect it to a potential receptor, and which may be various environmental media (air, surface water, ground water, soil, sediments) or the food chain;
- routes of exposure, or routes of entry, such as inhalation, ingestion, absorption through the skin, or otherwise physical contact;
- the nature and characteristics of the receptors (human population, animal/plant community, material assets, etc.) that might be exposed, such as population size, sensitive population groups, material values, etc.;
- any other condition that might affect adverse consequences (NAS-NRC, 1983; Covello & Merkhofer, 1993).

Exposures may be assessed for different exposure scenarios that link the abovementioned determinants. In practice, exposure assessment may include modelling the fate and transport of pollutants, which are produced by a plant or might be released due to an accident, through relevant environmental compartments, taking into account dilution and transformation of hazardous substances. The effects on human or environmental receptors strongly depend on their sensitivity to a particular risk agent. Thus, it is crucial to know whose exposure is going to be examined, which should have been defined during problem formulation. For example, human exposure can be influenced by such factors as composition of a population in terms of age and sex; amounts of time that are spent in the vicinity of a pollution source, at work, or at home; personal habits; presence of

individuals or groups that are particularly sensitive or susceptible to a certain stressor (Fairman et al., 1999). If a toxic substance is transmitted via the food chain, food storage practices, food preparation, and dietary habits have a major influence on the amount of the substance actually consumed. A comprehensive exposure assessment may also have to account for the cumulative effects of simultaneous exposures via distinct environmental media (Covello & Merkhofer, 1993).

It becomes clear that exposure assessments can be very complex and may involve large uncertainties, which should be considered in any calculations. The uncertainties in all estimates should be recorded and described (Bartell, 1996).

Consequence assessment

In consequence assessment, the potential consequences associated with exposure to a risk agent are examined. It usually consists of describing and quantifying the causal relationship between specified exposures of a receptor to a hazard and the health and environmental consequences of those exposures, as a function of various possible exposure conditions (Covello & Merkhofer, 1993; Fairman et al., 1999). In human health risk assessment, typical endpoints include mortality, morbidity, illnesses, injuries etc. For the assessment of ecological consequences, considerably less well-defined endpoints exist. Often, surrogates for environmental damage to the target of interest will have to be used (Calow, 1998).

In toxicological risk assessments, dose (concentration) – response (effect) relationships are usually used to quantify the relationship between the magnitude of exposure and the probability of occurrence of an adverse effect, i.e. to predict the reaction of an organism to certain levels of exposure (NAS-NRC, 1983; US EPA, 1998). The data required for dose – response assessment may be derived from experimental toxicity testing, epidemiology, and dose-response modelling. To account for the extrapolation of data from laboratory tests, other similar projects, or generalized studies, dose – response relationships often embody safety factors (Suter, 1993). Both the construction of dose-response relationships and the predicted environmental concentrations of a given hazardous agent involve considerable uncertainties. The first type of uncertainty may be expressed as variability about the dose producing a particular effect, and the latter type of uncertainty should be properly expressed as probability distributions (Calow, 1998).

In most handbooks and guidelines of risk assessment, the dose – response scheme is used. However, the somewhat broader concept of 'consequence assessment' allows better for consideration of various kinds of impacts on the environment (Covello & Merkhofer, 1993).

Approaches to consequence assessment that bear some analogies to dose – response assessments are, for example, applied in flood damage assessment, where standard depth – damage curves are used to relate the depth (and flow speed) of flood waters to the magnitude of damage to buildings, taking into account the duration of exposure to the flood waters (DEFRA, 2000).

Risk characterisation

Risk characterisation is the final, concluding step of the risk assessment process. It integrates the information generated by all previous steps – hazard identification, release assessment, exposure assessment, and consequence assessment – to produce qualitative and quantitative expressions of health and environmental risks, usually by combining the probabilities that adverse consequences will occur with the severity of those consequences (Calow, 1998; Bartell, 1996; Kolluru, 1996). By producing summary measures of risk, in risk characterisation the nature, likelihood, timing and magnitude of adverse consequences are described (NAS-NRC, 1983). Risk characterisation provides the summary output of risk assessment that serves as the risk assessor's input to risk management (Suter, 1993).

Dependent on the respective model, risk characterisation is often seen as encompassing and integrating two more or less distinct steps – risk estimation and risk evaluation (Fairman et al., 1999; DEFRA, 2000). In most cases, ***risk estimation*** pertains to the 'scientific' process part of producing quantitative measures of risk. These measures typically may include estimated numbers of people experiencing health impacts of various severities over time and measures indicating the nature and magnitude of adverse consequences to the natural environment (Covello & Merkhofer, 1993). Any risk estimation should include a discussion of the variability and uncertainties of the risk estimate, as well as of the sources of such uncertainties (Calow, 1998; Bartell, 1996). The most rigorous way to express uncertainty over the consequences is through probability distributions for risk outcomes, accompanied by attendant expressions of uncertainty, such as confidence intervals and error measures (Covello & Merkhofer, 1993). Probability distributions may be curves plotting the frequency of occurrence of adverse events of a given severity versus the magnitude of the consequences per event for given scenarios, thereby linking the 'how often' and 'how bad' aspects of risk (ADB, 1997). Despite being the logical output of a full-blown quantitative risk assessment, outputs of this type have up to date seldom been provided in practice, except for high-risk technologies like nuclear power plants (Covello & Merkhofer, 1993).

However, apart from computing numerical measures of risk, also qualitative expressions of risk can be very useful and may even be the preferred approach in cases where the magnitude of risk is limited and uncertainties are comparatively small, depending on the nature of the project or activity whose risks are to be assessed. The simplest way of combining likelihood of occurrence and severity of consequences in a qualitative way is the use of matrices, which can be designed to be as simple or complex as appropriate (Brookes, 2001). More complex approaches include the use of multi-criteria analyses which can involve ranking, scoring and weighting methods to obtain an overall risk score (Munier, 2004; Brookes, 2001).

In any case, risk characterisation should include a summary and interpretation of key assumptions underlying the risk assessment and of its strengths and limitations (Calow, 1998; US EPA, 1998).

Having determined the probability and magnitude of the adverse consequences that may arise as a result of exposure to a hazard, it is important to place risk estimates in some sort of context (DEFRA, 2000). This step of examining what risk estimates actually mean in practice is sometimes referred to as ***risk evaluation*** (Fairman et al., 1999). Its ultimate purpose is to determine the significance of a risk and to make judgments on its acceptability or tolerability (Brookes, 2001; DEFRA, 2000). This can be a complex task because it entails value judgments, should acknowledge public risk perceptions, and touches on social, cultural, and political factors (Fairman

et al., 1999; DEFRA, 2000). Evaluating the significance of risk can be facilitated by comparing specific estimated risks with other similar risks, which is an often applied approach in comparative health risk assessment (Calow, 1998). If pre-existing measures are available that provide a reference frame for judgments, such as legal limit values, toxicological thresholds, environmental quality standards, or flood defence standards, these will usually be used for determining significance and acceptability of risk (DEFRA, 2000). For certain fields of application and in a number of countries, formalised quantitative approaches are in place for this purpose. For example, in the UK the Tolerability of Risk (ToR) framework has been developed for health and safety assessments by the Health and Safety Executive (HSE), which is mainly applied to nuclear industry, industries involving chemical hazards, and some offshore industries (HSE, 1992). Following a similar concept, the principle of reducing the health and safety risks to employees and the public as far as is reasonably practicable (SFAIRP) has been laid down in the Health and Safety at Work Act (Gould, 1998). In other cases, political, ethical or cultural standards will have to be used. Sometimes, technical risk limit values are agreed upon prior to the outset of risk assessment, which would then form an important input to problem definition. Risk evaluation may also involve establishing a relationship between risks and benefits, which may be incorporated into the final results of risk characterisation (Fairman et al., 1999).

Risk evaluation provides important information for communicating results of risk assessment to the public as well as to decision-makers, and it is obviously closely interrelated with the decision-making process and risk management. On account of its 'non-scientific' nature, risk evaluation is often excluded from risk assessment and seen as the first step of risk management (Fairman et al., 1999; Duffus, 2001). However, whatever the formal model may be it forms an important interface between the predominantly scientific-technical process of risk assessment and the processes of risk communication and risk management, which are strongly influenced by socio-political factors. Typically, risk evaluation is an interactive process involving risk assessors, risk communicators, risk managers, decision-makers, and various groups and individuals of the public affected (Calow, 1998).

Health Risk Assessment and Ecological Risk Assessment are both to be seen as applications of Environmental Risk Assessment. Thus, they represent subsets of Environmental Risk Assessment.

Health Risk Assessment

According to the definition of the WHO (World Health Organization), health risk assessment (HRA) is the quantitative evaluation of the environmental health risks to a population resulting from exposure to a chemical or physical agent, e.g. a pollutant. It combines exposure and toxicity assessment findings to estimate risk of adverse impacts from environmental pollution on the health of the exposed population. Health risk assessment methodologies make use of the attributable risk as a way to illustrate such an impact (Beagleholde et al.; 1993; WHO, 2004). Consequences or endpoints are grouped into cancer risk and in a diverse, catch-all non-cancer category (Kolluru, 1996b).

Compared to health impact assessment, which can include qualitative as well as quantitative information and evidence, human health risk assessment is a more specific form of assessing health risks because typically it focuses on toxicological or radiological risks. It tends to use quantitative data, to apply at least partly quantitative methods and to produce numerical estimates

of risk. Thus, in typological terms health risk assessment may form a subset of a wider health impact assessment.

The process of human health risk assessment was first described as a four-component paradigm by the US National Research Council of the National Academy of Sciences in 1983 (NAS-NRC, 1983) and was subsequently updated in 1994. Most international health organisations, e.g. the International Programme on Chemical Safety (IPCS), and many national health agencies, e.g. US EPA, have adopted this approach.

In the following paragraphs, the US EPA approach to health risk assessment, which builds on the NAS-NRC model, is briefly outlined; the method described here is oriented toward quantifying risks associated with hazardous chemicals and contaminated sites. The four-step model is basically in accordance with the models presented in guidelines by such organisations as the WHO (e.g.: Beagleholde et al., 1993) and the European Commission (e.g.: EC, 2003b).

The US Environmental Protection Agency (US EPA) defines human health risk assessment as the characterization of the potential adverse health effects of human exposures to environmental hazards.

Risk assessments can be either quantitative or qualitative in nature. The elements of a human health risk assessment consist of planning and scoping, acute hazards, evaluating toxicity, assessing exposures and characterizing risks. The four steps of health risk assessment are:

1. Hazard identification (planning and scoping)
2. Dose-response assessment (toxicity assessment)
3. Exposure assessment
4. Risk characterization

Hazard identification tries to answer the question: what agents (substances) could damage health? It entails identification of the contaminants that are suspected to pose health hazards, quantification of the concentrations at which they are present in the environment, a description of the specific forms of toxicity (carcinogenicity, neurotoxicity, etc.) that can be caused by the contaminants of concern, and an evaluation of the conditions under which these forms of toxicity may be expressed in exposed humans (NAS, 1994). In the process of hazard identification it is determined whether exposure to a chemical agent can cause an increase in the incidence of a particular adverse health effect (e.g., cancer, birth defects) and whether the adverse health effect is likely to occur in humans. The process examines the available scientific data for a given chemical (or group of chemicals) and develops a weight of evidence to characterize the link between the negative effects and the chemical agent (US EPA, 2005).

Dose-response assessment tries to answer the question: how is dose related to adverse effects? It is the process of quantitatively evaluating the toxicity of a given chemical agent as a function of human exposure to that chemical agent. The relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the exposed population forms the basis for the quantitative dose-response relationship. From these relationships, toxicity values (e.g., reference doses and slope factors) are derived that can be used to estimate the incidence or potential for adverse effects in an exposed population (US EPA, 2005). The

development of quantitative dose-response relationships may involve the use of mathematical models. This step may include an assessment of variations in response, for example, differences in susceptibility between young and old people (NAS, 1994).

Exposure assessment focuses on the question: which people are, or will be, exposed to what, when, where, and for how long? It involves specifying the population that might be exposed to the agent of concern, identifying the routes through which exposures can occur, and estimating the magnitude, duration, and timing of the doses that people might receive as a result of their exposure (NAS, 1994). Exposure assessments may consider past, present, and future exposures using varying assessment techniques. This may include fate and transport models or the results of environmental sampling and analysis. The exposure assessment process includes the following steps: (i) characterize exposure setting, (ii) identify exposure pathways, and (iii) quantify exposure (US EPA, 2005).

Risk characterization involves integration of information from the first three steps to develop a qualitative or quantitative estimate of the likelihood that any of the hazards associated with the agent of concern will be realized in individuals or groups of people. This is the step in which risk assessment results are expressed (NAS, 1994). To estimate potential no carcinogenic effects, comparisons are made between projected intakes of substances and toxicity values; to estimate potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure are determined from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and to the extent possible, estimates of the uncertainties embodied in the assessment are also presented (US EPA, 2005).

The following figure shows the basic steps in a health risk assessment process, according to the framework of the US Committee on Risk Assessment and Management (CRAM).

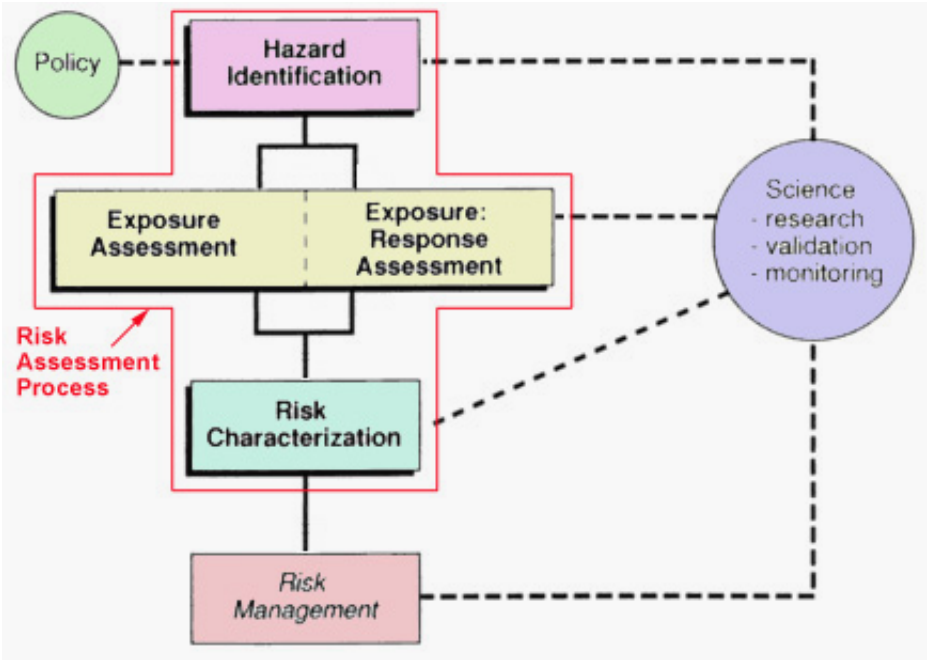

Figure 22 The CRAM integrated human health/ecological risk assessment framework (Barnthouse, 1994).

Ecological risk assessment

Ecological risk assessment is the characterization of the adverse ecological effects of environmental exposure to hazards imposed by human activities, i.e. of the effects those activities can have on the plants and animals that make up ecosystems. According to US EPA, it is a process that evaluates the likelihood that adverse ecological effects have occurred, are occurring, or will occur as a result of exposure to one or more stressors (US EPA, 1992). In practice, it has up to date mostly been the application of the science of eco-toxicology to public policy (Suter, 1993).

Compared to human health risk assessment or safety risk assessment, endpoints in ecological risk assessment are much more difficult to define. Typical assessment endpoints may be local extinction of species, decreased reproductive value, changes in abundance of species, etc. Ecological risk assessment is used to systematically evaluate and organize data, information, assumptions, and uncertainties in order to help understand and predict the relationships between stressors and ecological effects in a way that is useful for environmental decision making. An assessment may involve chemical, physical, or biological stressors, and one stressor or many stressors may be considered. The source, or cause, of ecological risks are termed stressors and may include, *inter alia*, toxic chemicals, radionuclides, erosion, filling of wetlands, logging, mining, introduction of invasive alien species, pest outbreaks, etc. (Bartell, 1996).

Ecological risk assessment is still a comparatively young field of science that is nonetheless evolving dynamically. Organisations such as US EPA, US NRC (National Research Council), FAO (Food and Agricultural Organisation), WHO (World Health Organisation), and IPCS (International Programme on Chemical Safety) are involved in the advancement of methods and approaches. However, most guidelines and practical applications of ecological risk assessment are known from the US, where US EPA has taken considerable efforts in establishing, developing and standardising approaches. Thus, in the following the US EPA model of ecological risk assessment is outlined.

The process of ecological risk assessment includes three basic stages:

1. Problem formulation
2. Analysis
   - 2.1 Characterization of exposure
   - 2.2 Characterization of ecological effects
3. Risk characterisation.

The stages of ecological risk assessment basically correspond to the ones of health risk assessment: problem formulation accords to hazard identification, characterization of exposure to exposure assessment, and characterization of ecological effects to exposure-response assessment. Risk characterisation is common to both models.

In *problem formulation*, the purpose for the assessment is articulated, the problem is defined, and a plan for analyzing and characterizing risk is determined. Initial work in problem formulation includes the integration of available information on sources, stressors, effects, and ecosystem and receptor characteristics. From this information two products are generated: assessment endpoints and conceptual models. Either product may be generated first (the order depends on the type of risk

assessment), but both are needed to complete an analysis plan, the final product of problem formulation.

Analysis is directed by the products of problem formulation. During the analysis phase, data are evaluated to determine how exposure to stressors is likely to occur (characterization of exposure) and, given this exposure, the potential and type of ecological effects that can be expected (characterization of ecological effects). The first step in analysis is to determine the strengths and limitations of data on exposure, effects, and ecosystem and receptor characteristics. Data are then analyzed to characterize the nature of potential or actual exposure and the ecological responses under the circumstances defined in the conceptual model(s). The products from these analyses are two profiles, one for exposure and one for stressor response. These products provide the basis for risk characterization.

During *risk characterization* the exposure and stressor-response profiles are integrated through the risk estimation process. Risk characterization includes a summary of assumptions, scientific uncertainties, and strengths and limitations of the analyses. The final product is a risk description in which the results of the integration are presented, including an interpretation of ecological adversity and descriptions of uncertainty and lines of evidence (US EPA, 1998).

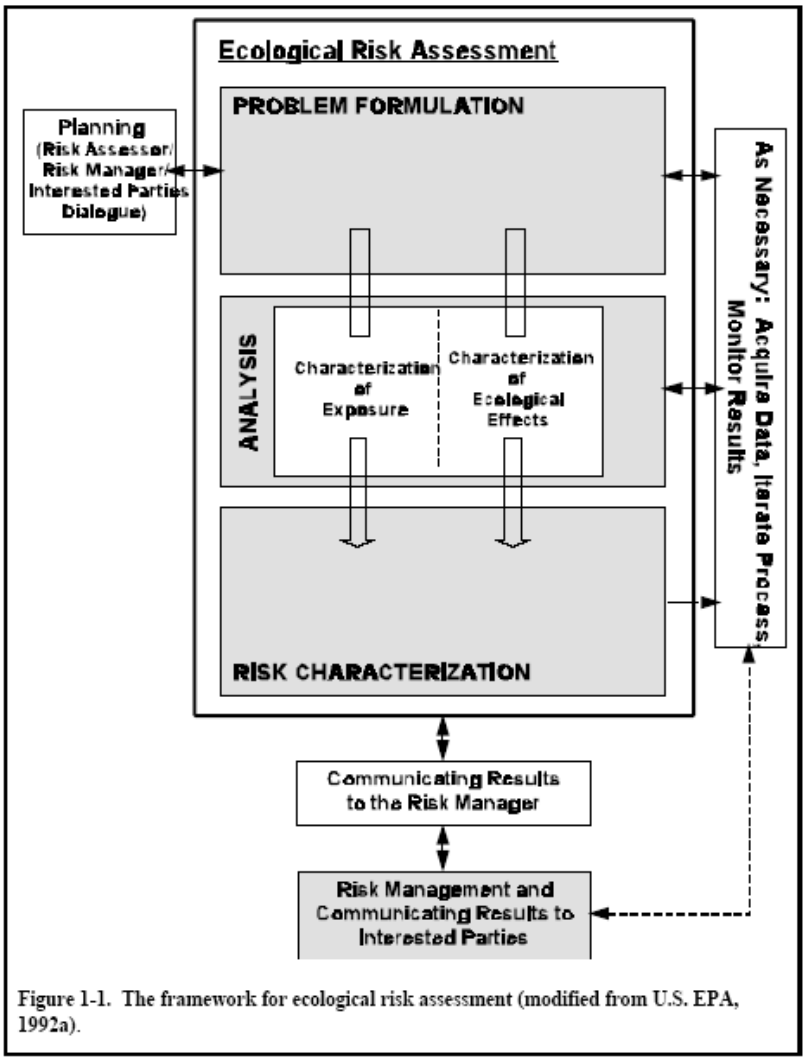

Figure 23 The US EPA framework for ecological risk assessment (US EPA, 1992)

1.4.1.6 Definitions

Based on definitions that appear to be broadly accepted and are often used in relevant risk assessment literature, the following definitions of key terms pertaining to the concept of risk and to risk assessment shall apply within this report:

Hazard

A property, an event or a situation with the potential to cause harm. A hazard can be a chemical, biological or physical agent, or a threatening event, or characteristics of a system that represent the potential for an accident. A hazard is a source of risk that does not mean risk per se and that does not necessarily produce risk. It produces risk only if an exposure pathway exists and if exposure creates the possibility of adverse consequences (Royal Society, 1992; Brookes, 2001; Kolluru, 1996; DEFRA, 2000).

Risk

A measure that combines the probability, or frequency, of the occurrence of a particular hazard and the magnitude of the adverse consequences or harm arising to the quality of human health or the natural and man-made environment as a result from exposure to that hazard. Risk increases as the probability, or magnitude, or both, increase. Adverse consequences may comprise e.g., injury, disease, natural resource damage, species loss, property damage, economic loss (Brookes, 2001; Calow, 1998; Kolluru, 1996; DEFRA, 2000, Crawford-Brown, 1999).

Exposure

Potential contact or interaction of a receptor with a hazardous agent or situation. Exposure occurs when there are complete pathways between a chemical, biological or physical agent and potential receptors (e.g., humans, non-human organisms) (Kolluru, 1996; NRC, 1993; Covello & Merkhofer, 1993).

Exposure pathways

Means by which risk agents are transmitted, e.g. the route by which a given receptor population is exposed to a toxic substance (via drinking water, air, dermal contact etc.) (Covello & Merkhofer, 1993).

Receptor

A part of the receiving environment that is exposed to a hazard. Receptors may be humans, animals, plants, habitats, ecosystems, material assets, etc.

Probability

A measure that specifies the expected or anticipated likelihood or frequency of occurrence of an event or an outcome (Covello & Merkhofer, 1993; Kontic, 2001).

Vulnerability

The degree to which a system is susceptible to, and unable to cope with, injury, damage or harm; the sensitivity of the receiving environment to the consequences of a hazard. In that context, it is an important determinant of the magnitude of adverse consequences of a hazard. The concept of vulnerability is mostly applied within subsets of risk assessment that deal with large-scale natural hazards assessment, or within the context of spatial planning. Here, vulnerability and the hazard potential within a region are seen as the two most important determinants of risk, and regional vulnerability is measured as a combination of the territorial damage potential with the territorial coping capacity (Schmidt-Thome, 2005; Greiving 2004; Kjorven, 1998).

1.4.2 Risk Assessment in the context of EIA

Recalling from Chapter 1.1, when addressing abnormal risks in EIA, the following questions should to be answered:

- What can go wrong with a project?
- What adverse consequences might occur to human health and the environment?
- What is the range of magnitude of adverse consequences?
- How likely are these consequences?

According to ADB (1997), a normal EIA should answer the first two questions and give at least a qualitative indication of the magnitude of the impacts, but does not fully answer the probability and the consequences with the range and distribution of their severity. Environmental risk assessment addresses all of the four questions and is in particular able to answer the last two questions and, typically, to quantify risk (ADB, 1997; Kjorven, 1998).

Uncertainty is an inherent and unavoidable aspect of EIA, but traditional EIA methods mostly fail to address this issue adequately (Brookes, 2001). Typically, impact predictions of EIA are deterministic, i.e. the language of EIA often expresses an “if, then” finding without explicitly addressing the probabilities that are implied. Where numerical values are used in EIA, normally a single representative measure is chosen which is usually either an average value or, alternatively, a worst case value (ADB, 1997; Brookes, 2001). This can be very misleading, particularly where there are considerable uncertainties about an outcome and if the actual data are widely scattered (Harrop & Pollard, 1998). The strength of a systematic risk assessment, compared to mere straight-forward impact predictions, is that it can and should make uncertainty explicit (Brookes, 2001). It can be used to express the likelihood of an outcome. Uncertainty is usually expressed and quantified by using the well-established methods of probability theory. Thus, a quantitative risk assessment typically generates a probability distribution for a range of possible outcomes of different magnitudes and the confidence, or other measures for uncertainty of risk estimates, with which that range is held to be true (Covello & Merkhofer, 1993; Kolluru, 1996). Environmental risk assessment informs managers and decision-makers about the frequency and severity of adverse consequences to the environment caused by their activities or planned interventions. Risk assessment is particularly effective in providing a frame of reference in decision-making of complex risk issues. Risk management involves reaching decisions on a range of options and balancing these risks against the costs and benefits (in particular including the environmental costs and

benefits) of risk management measures. Communicating the nature and scale of risks is a key part of the risk management process.

However, a complete environmental risk assessment can be costly and complex. Consequently, a quantitative risk assessment will be performed as a part of the EIA process only when uncertainties are large and important for prudent decision making (ADB, 1997), and when there are arguments that risk is significant, i.e. when potential damage is severe and/or the likelihood of its occurrence appears to be high. In fact, these prerequisites in many cases might apply to 'extraordinary risks', such as risk of natural disasters or major accidents.

With regard to applying risk assessment in EIA, it is important to recognize that there are different levels of sophistication, complexity and, hence, costliness for risk assessment. It does not necessarily have to progress as far as the quantitative stage, only if circumstances warrant such a detailed level of analysis. The degree of sophistication should be determined by: the magnitude and significance of the risk examined, the sensitivity of receptors, the quality of available data, and the means by which risks are to be communicated (Brookes, 2001).

The different levels of risk assessment can be described as follows (Brookes, 2001; EA, 1997):

- Risk screening and prioritisation: the process used to determine the range of risks and the factors that control whether they will result in environmental damage, and to identify the most important risks.
- Generic quantitative risk assessment: the use of generally available and tested models to provide simple quantification of the risk.
- Tailored quantitative risk assessment: the development of specific models to meet a particular purpose; usually complex and costly.

Only if risk screening provides evidence that there are significant risks, it would be required and justified to proceed with a more detailed risk assessment (Figure 24).

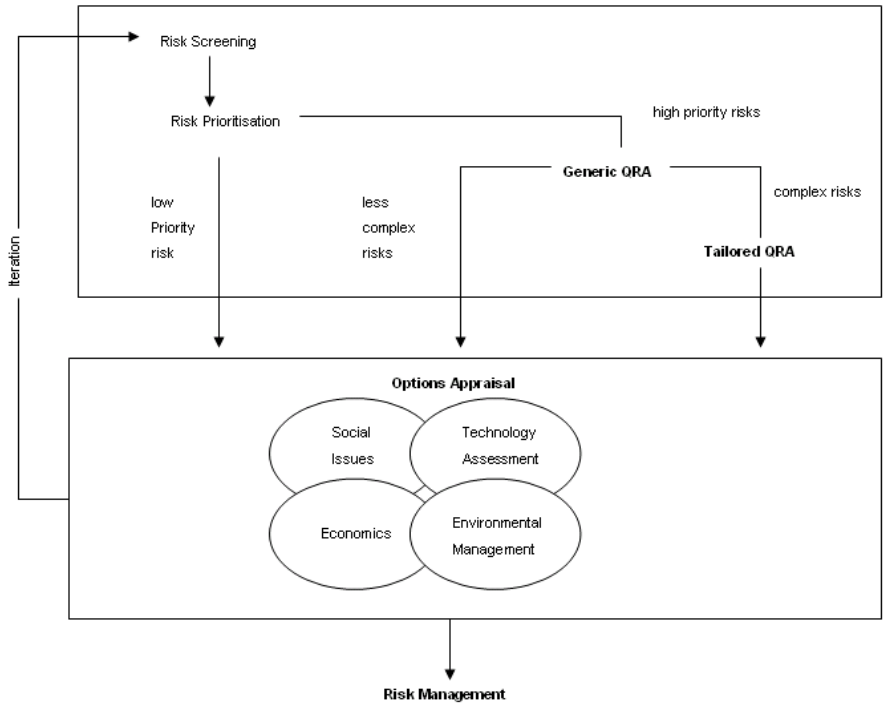

Figure 24 Framework for environmental risk assessment at different levels of sophistication (Brookes, 2001).

Figure 25 shows how the relationship between significance of risk, cost of risk assessment and the level of sophistication of assessment techniques applied.

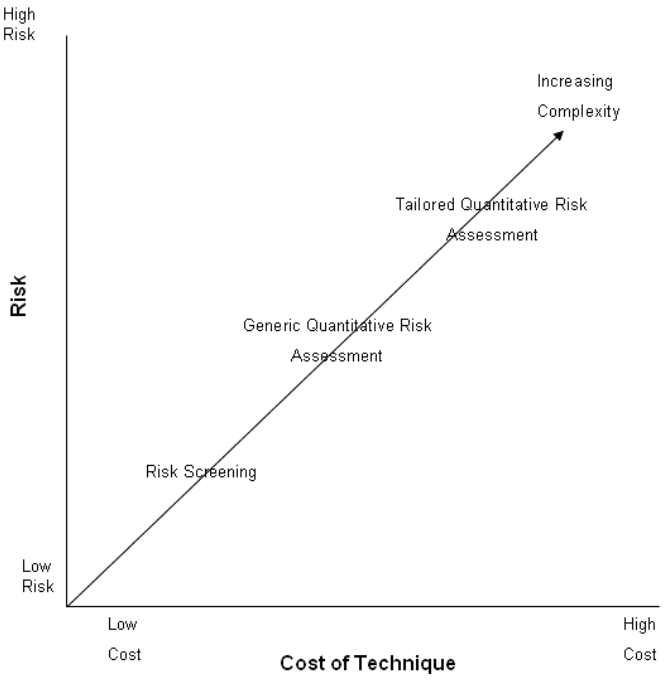

Figure 25 Levels of sophistication of risk assessment in dependence on increasing risk and cost (Brookes, 2001).

A pragmatic approach to environmental risk assessment can transform a sometimes complex and resource-intensive process into a practical aid for decision-making. Figure 26 provides a framework for a tiered approach to environmental risk assessment that appears particularly adequate to be integrated into EIA procedures. Within that framework, the level of effort put into assessing each

risk is proportionate to its priority. On each tier, a complete risk assessment process involving all major key steps should be conducted, albeit with different degrees of effort and different techniques. Progressing from one tier to the next is only needed if risks are significant.

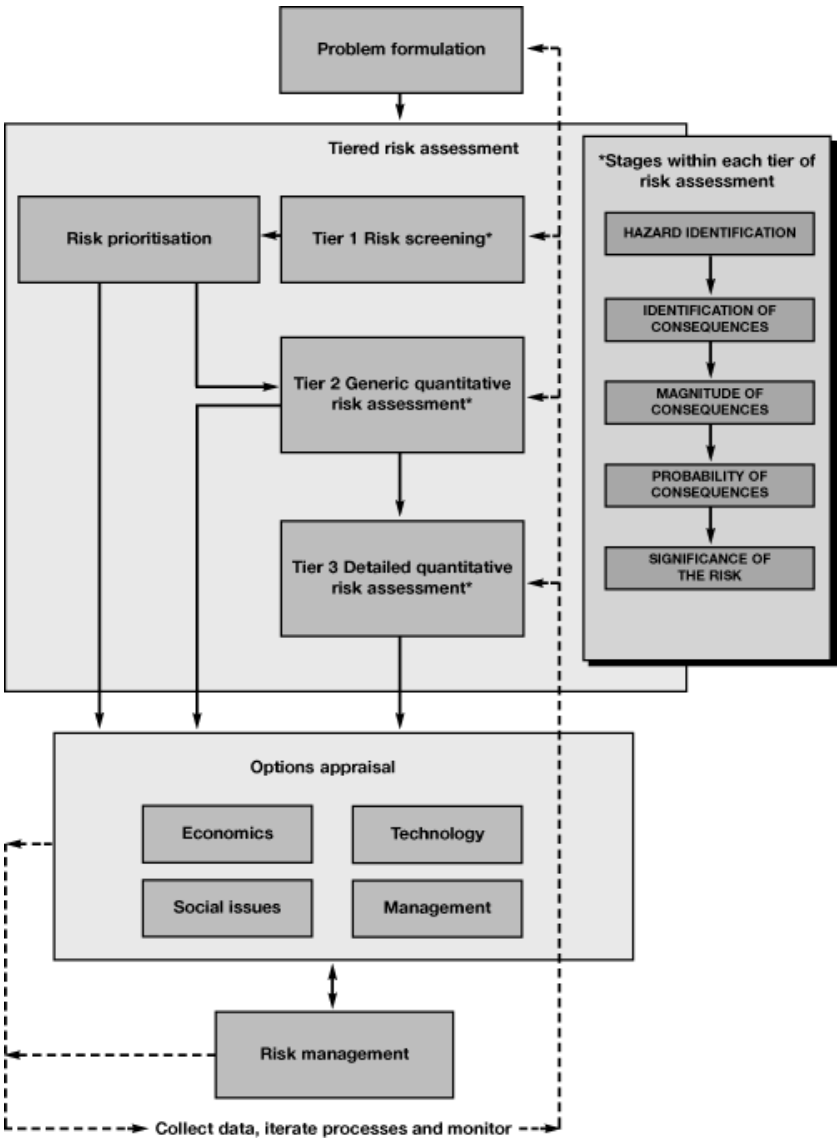

Figure 26 A framework for a tiered approach to risk assessment (DEFRA, 2000).

Typically, environmental risk assessment is an extension of EIA, undertaken when uncertainties are large and important to project success (ADB, 1997). In practice, risk assessments have often been applied as a follow-up to an EIA. Other times, the EIA process may be primarily focused n environmental risks form the very beginning, resulting in an EIS that may essentially be a risk assessment study (Kjorven, 1998).

However, it may be more appropriate to integrate EIA and risk assessment as far as possible, and to undertake a qualitative risk screening (tier 1) at the screening and/or scoping stages of an EIA procedure. Depending on its outcome, it could then be decided whether a more detailed risk assessment is required or not.

2 RELEVANT LEGISLATION, GUIDANCE AND PREVIOUS RESEARCH

This chapter presents the results of a desk study on legislation, guidance and previous research:

- The extent to which aspects related to extraordinary risks are reflected and incorporated in European Community legislation on EIA are examined. The EIA Directive is introduced and the concept of risk expressed in the Directive is discussed. The material interrelationships between the Directive and risk assessment are analysed and the scope of the Directive in terms of risk assessment is examined.
- Other major risk-related European Community Directives are introduced and aspects related to risk assessment and risk management issues are characterised.
- EIA legislations and closely EIA-related regulatory frameworks on national and sub-national level in a sample of Member States as well as in selected non-EU countries are reviewed as to the extent risk issues are incorporated and as to the ways the consideration of extraordinary risks is regulated. A comparative analysis along crucial themes is conducted in order to get indicative results on the risk concepts incorporated and on the question if, what, and to what extent legal requirements to consider risks in EIA exist. Types of legal national implementation of the EIA Directive with regard to the coverage of risks are identified and illustrative examples are highlighted.
- Relevant guidance on EIA on both the EU level and national levels, as far as available and accessible, is reviewed in order to get indicative results on what recommendations exist for good application of EIA in terms of risk assessment.
- Previous empirical research is reviewed.

2.1 European and national legislation with regard to risk assessment in EIA

2.1.1 European level

Environmental law of the European Community is found in the EC Treaty, the directives, regulations and decisions adopted by the Community's institutions, the international agreements that the EC has ratified, and the case law of the European Court and the Court of the First Instance.

According to the EC Treaty, three forms of legally binding instruments may be applied by the legislation-building institutions of the European Community – directives, regulations and decisions. Directives represent the main source of environmental law on the European Community level, while regulations and decisions are legal instruments that have not often been used to regulate environmental matters.

Directives are the most common form of EC legislation. They set out a result which member states are to achieve (for example, that drinking water must comply with certain standards) but leave it up to the Member States to decide how that result will be accomplished.

To fully comply with directives Member states have to transpose, implement and apply them correctly by:

- Passing national laws which give full effect to the directive within the timetable laid down in the directive itself and inform the Commission that they have passed the required laws (transposition of EC into domestic law). In passing laws to implement a directive, member states do not need to transpose the directive word for word into their national legislation. However, they must make sure that the laws passed guarantee the full application of the directive. This means that where the directive is intended to create rights for individuals, the persons concerned must be able to see what their rights are and, if necessary, rely on them by appealing to national courts. Adopting administrative practices which can be altered easily and which may not receive adequate publicity will not be enough to implement a directive. States cannot escape the obligation to pass laws to implement directives. Even where they are in practice already acting in accordance with the directive's requirements, states must pass laws implementing the directive's provisions.
- Making sure that domestic laws are complied with in practice, and that application of domestic laws "on the ground" conforms to the provisions of directives (law enforcement).

2.1.1.1 The EIA Directive (Directive 85/337/EEC as amended by Directive 97/11/EEC)

This chapter gives a brief introduction to the EIA Directive, its scope and objectives, its role within wider European Union environmental policy and its evolution since the passage of Directive 85/337/EEC. Next, the scope of the Directive with particular regard to extraordinary risks is analyzed (cf. also chapter 4.2).

Introduction to the EIA Directive

The EIA Directive – Council Directive 85/337/EEC as amended by Directive 97/11/EEC – on the Assessment of the Effects of certain public and private Projects on the Environment is a key instrument of European Union environmental policy (EC, 2001c) and one of the principal pieces of European Union environmental legislation (EC, 2003a). It requires an assessment of the environmental impact of any project likely to have significant effects on the environment before development consent can be given. The prime purpose of EIA is to identify any significant environmental effects of a major development project, and where required and possible to design mitigation measures to reduce or remedy those effects, in advance of any decision to authorise the construction of the project. The directive lays down procedures for assessments but does not prevent a project from obtaining consent, even if the EIA shows that it will damage the environment.

The operational objectives of the Directive are set out in Article 3:

> *"The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case and in accordance with Articles 4 to 11, the direct and indirect effects of a project on the following factors:*
> *– Human beings, fauna and flora*
> *– Soil, water, air, climate and the landscape*
> *– Material assets and the cultural heritage*
> *– The interaction between the factors mentioned in the first, second and third indents"*

Projects that may require assessment are listed in two Annexes to the Directive. Projects in Annex I must always be subject to EIAs before they receive consent. For projects listed in Annex II, it is up to the Member States to determine through thresholds or criteria or case-by-case examinations if an EIA is required. For both purposes, the setting of thresholds or criteria and case-by-case examinations, the relevant selection criteria listed in Annex III are to be considered.

Various general definitions of EIA as an instrument of environmental policy and its final ends exist. Wood (1995) has summarized the purpose of EIA in concise terms as follows:

> *"(…) EIA should lead to the abandonment of environmentally unacceptable actions and to the mitigation of the point of acceptability of the environmental effects of proposals which are approved"* (Wood, 1995).

EIA has been described as a technique to improve the knowledge base for decision-making through a process of information generation related to the identification, prediction and assessment of the effects of project implementation. In recent years, the role of EIA has been expanded to become increasingly integral to environmental planning and resource decision-making, rather than serving simply as a check upon them. EIA processes should supply decision makers with an indication of the likely consequences of their actions. EIA can also be seen as a management tool, that takes place in a political context where outcomes of decisions are often reached through a long-term process that involves trade-offs, compromises and stakeholder interactions.

As a tool to aid decision making, EIA is widely seen as a proactive environmental safeguard that, together with public participation and consultation, can help to meet the EU's wider environmental concerns and policy principles. Achieving equal levels of quality and environmental protection as well as equal levels of safety of citizens is a vital element of territorial cohesion and a major goal of European Union policy and legislation. To achieve these objectives, the EIA Directive must be applied as consistently as possible across the EU as a whole (EC, 2003a). However, evidence from EC's previous reviews of the operation of the Directive has indicated considerable inconsistencies in implementation of the Directive among the Member States (EC, 1993a; 1997). The findings of the last five-year report of the Commission on the implementation of the Directive have reconfirmed that great difficulties in achieving consistent implementation continue to persist (EC, 2003a). A major objective of the amending Directive 97/11/EC was, in part, to minimize the differences of application between Member States and to harmonize implementation (EC, 2003a). However, some Member States have still failed to fully transpose and implement the last amendment to the Directive (Directive 2003/35/EC), and the EIA Directive is among the EU Directives with the worst implementation record.

Risk in the context of the EIA Directive

In principle, the concept of risk is inherent to the EIA Directive. A main task of an EIA is the prediction of those impacts that are likely to be caused by a project, an evaluation of the significance of those impacts, which involves a judgment on impact magnitude and probability, and the development of mitigation measures to reduce negative impacts. These are also main tasks within a risk assessment and risk management process. Therefore, the Directive itself is rooted in a risk-based concept.

However, the EIA Directive mainly refers to risks under normal conditions, i.e. to impacts connected to planned – standard or routine – operation of a project. The scope of the EIA Directive is much less clear with regard to extraordinary, or abnormal, risks, i.e. with regard to the possibility that implementation of a project might lead to significant adverse environmental consequences under exceptional circumstances, under non-routine or non-standard modes of operation, or due to any unplanned hazardous incident.

On the one hand, close material interrelationships between the objectives of EIA, according to the Directive, and risk assessment appear to exist. Article 3 and Annex IV para. 4 require EIA to assess the "*direct and indirect effects*" of a proposed project on, *inter alia*, the environment, human beings, and material assets resulting from, *inter alia*, "*the existence of the project*". An increase in the hazard potential or in the damage potential (vulnerability) of a site in consequence of implementation of a proposed project can be understood as "*significant effects*" on man and the environment (Greiving, 2005). If environmental impacts of a project are caused by an internal accident or sabotage, or by impacts of the environment (natural and external technological hazards) on the project, this can also be understood as a "*direct effect*" or an "*indirect effect*" of "*the existence of the project*". These rationales are in support of the hypothesis that the concept of 'extraordinary' risks and their consideration and assessment in EIA is within the material scope of the Directive.

On the other hand, these material interrelationships are to a large extent implicitly hidden in the Directive and do seldom become manifest in explicit verbal terms. Closer analysis of the Directives' text also reveals that the manifest and explicit scope of the Directive in terms of extraordinary risks is limited:

While the Directive does not exclude consideration of extraordinary hazards, explicit reference to the consideration of risks under non-standard operation of a project, or under exceptional conditions, is restricted to Annex III.1 to the Directive. Annex III, which has been introduced with the amending Directive in 1997 (Directive 97/11/EC), lists selection criteria that are to be applied in accordance with the provisions of the screening Article 4 (3). Under 'characteristics of projects', the screening criteria provided by Annex III.1 include the criterion

> "*the risk of accidents, having regard in particular to substances or technologies used*" (Annex III.1).

Since risk of accidents is ever present and a situation of zero risk does not exist, what needs to be considered in screening decisions is, therefore, not the mere presence of risk, but whether there is a significant risk of accidents and whether the consequences of a risk event happening would be likely to cause significant environmental effects (EC, 2003a).

However, apart from Annex III.1, no further explicit mentioning is made of extraordinary hazards or risks in the Directive. Neither the term "risk" nor the term "accidents" is defined or specified further anywhere in the Directive.

In an indirect way also the screening criteria listed under "location of projects" in to the Directive bear potential relevance to risk-based considerations. Annex III.2 requires that the "*environmental sensitivity of geographical areas likely to be affected by projects*" must also be considered in screening decisions. By listing densely "*populated areas*", the "*existing land use*" and various types of naturally sensitive areas as screening criteria, a material relationship to the hazard potential and

the vulnerability of the project environment is implicitly touched upon. However, this material interrelationship is not stated explicitly in the Directive.

The field of application of Annex III is confined on drafting screening provisions and case-by-case decision-making related to Annex II projects. Annex I projects, which are subject to mandatory EIA, are out of the scope of application of Annex III. An explicit obligation to apply the criterion "risk of accidents" throughout the entire EIA procedure and in particular to the identification, description and assessment of significant effects in the EIS is not present in the Directive. This supports the conclusion that the Directive does not require in a manifest way to consider “risk of accidents” in other stages of the EIA procedure than screening.

It can be concluded that close material interrelationships between the EIA Directive and the assessment of extraordinary risks do exist, but that on an explicitly verbalised level the concept of extraordinary risks in the Directive appears to be restricted to applying “*risk of accidents*” as a screening criterion.

2.1.1.2 The Seveso II Directive (Directive 96/82/EC)

On 9 December 1996, Council Directive 96/82/EC on the Control of Major-Accident Hazards – the so-called Seveso II Directive – was adopted. From 3 February 1999, the obligations of the Directive have become mandatory for industry as well as the public authorities of the Member States responsible for the implementation and enforcement of the Directive. Responding to recent industrial accidents in Toulouse and Enschede, the Directive was last amended in 2003 by Directive 2003/105/EC.

The Seveso II Directive has fully replaced its predecessor, the original Seveso Directive (Directive 82/501/EEC), which had been adopted in 1982 following major accidents in chemical industries. Important changes have been made and new concepts have been introduced into the Seveso II Directive. This includes a revision and extension of the scope, the introduction of new requirements relating to safety management systems, emergency planning and land-use planning, and a reinforcement of the provisions on inspections to be carried out by Member States.

The aim of the Seveso II Directive is two-fold. Firstly, the Directive aims at the prevention of major-accident hazards involving dangerous substances. Secondly, the Directive aims at the limitation of the consequences of such accidents for man (safety and health aspects) and the environment (environmental aspect). Thus, the focus of the Directive is on risk control and risk management measures aiming at prevention of major accidents and limitation of the consequences of such accidents happening.

The scope of the Seveso II Directive refers solely to the presence of dangerous substances in establishments. It covers both, industrial activities as well as the storage of dangerous chemicals. The Directive provides for three levels of proportionate controls in practice, where larger quantities of hazardous substances mean more controls. A company who holds a quantity of dangerous substance less than the lower threshold levels given in the Directive is not covered by this legislation but will be proportionately controlled by general provisions on health, safety and the environment provided by other legislation which is not specific to major-accident hazards. Companies who hold a larger quantity of dangerous substance, above the lower threshold contained in the Directive, will be covered by the lower tier requirements. Companies who hold even larger quantities of dangerous substance (upper tier establishments), above the upper

threshold contained in the Directive, will be covered by all the requirements contained within the Directive.

The Directive contains general and specific obligations for both, operators of establishments that are subject to the Directive and authorities. Obligations for lower tier establishments include:

- submitting a notification to the competent authority;
- establishing a major-accident prevention policy.

Obligations for upper tier establishments include:

- preparation of a safety report;
- establishment of a safety management system;
- preparation of internal emergency plans for response measures by the operator, including consultation with personnel;
- preparation of external emergency plans by local authorities, based on consultations of the operator with authorities;
- regular testing of internal and external emergency plans in practice;
- controls on land use planning in the vicinity of existing establishment, to ensure maintenance of appropriate distances between hazardous establishments and residential areas;
- reporting of major accidents to the Commission by Member States;
- establishment of an inspection system (systematic appraisal of establishments or at least one on-site inspection per year).

Important areas excluded from the scope of the Seveso II Directive include nuclear safety, the transport of dangerous substances, their intermediate temporary storage outside establishments, and the transport of dangerous substances by pipelines.

2.1.1.3 The IPPC Directive (Directive 96/61/EC)

The Directive on Integrated Pollution Prevention and Control (IPPC) – Council Directive 96/61/EC – sets out a framework of common rules on permitting for certain industrial installations. The main types of industry covered are energy, production and processing of metals, the mineral industry, the chemical industry, waste management and other activities (including pulp and paper making plants; dyeing of textiles, tanning of hides; slaughterhouses; food production processes; intensive rearing of poultry and pigs; installations for disposal or recycling of animal carcasses and animal waste; installations treating substances, objects or products with organic solvents where their treatment capacity exceeds certain limits; and installations for the production of carbon electro graphite by means of incineration or graphitization).

The Directive pursues an integrated approach to pollution control, which aims at prevention of emissions into the environment wherever this is practicable, and where it is not, at minimizing emissions in order to achieve a high level of protection for the environment as a whole. For that purpose, the whole environmental performance of a plant has to be taken into account, including

emissions into air, water, and land, use of raw materials, energy efficiency, and generation of waste. The geographic location and the local environmental conditions shall be considered.

All industries covered by the directive require a permit to be allowed to operate. Permits must, in particular, contain emission limit values based on the concept of Best Available Techniques (BATs). BATs mean those technologies and ways in which an installation is designed, built, maintained and operated that are most advanced and effective in preventing or reducing emissions, taking into account economical and technical viability and their costs and advantages.

The IPPC Directive contains several explicit interfaces to risk assessment and risk management. Installations must be operated in such a way that

> "*the necessary measures are taken to prevent accidents and limit their consequences*" (art. 3 para. a).

A permit is, amongst others, required to

> *"(…) contain measures relating to conditions other than normal operating conditions. Thus, where there* is *a risk that the environment may be effected, appropriate provisions shall be made for start-up, leaks malfunctions, momentary stoppages and definitive cessation of operations"* (art. 9 para. 9).

The considerations to be taken into account when determining BATs include

> *"the* need *to prevent accidents and to mimimize the consequences for the environment"* (Annex IV para 11).

In Article 6 para. 2, a formal linkage to the Seveso Directive has been established, as well as to other relevant legislation, including potentially the EIA Directive: Where information supplied in accordance with the requirements provided for by other relevant legislation fulfils any of the conditions required for application for permit under the IPPC Directive, that information may be included in, or attached to, the application.

2.1.1.4 The SEA Directive (Directive 2001/42/EC)

The Strategic Environmental Assessment (SEA) Directive – Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the Assessment of the Effects of certain Plans and Programmes on the Environment – entered into force on 21 July 2001 and had to be implemented by Member States before 21 July 2004. The objective of the Directive, as set out in Article 1, is to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that an environmental assessment is carried out for certain plans and programmes, during their preparation and before their adoption, which are likely to have significant effects on the environment.

The public and environmental authorities can give their opinion and all results are integrated and taken into account in the course of the planning procedure. After the adoption of the plan or programme the public is informed about the decision and the way in which it was made. In the case of likely transboundary significant effects the affected Member State and its public are informed

and have the possibility to make comments which are also integrated into the national decision making process.

In order to avoid duplication of the assessment, relevant information that is obtained at other levels of decision-making or through other Community legislation may be used for preparing the environmental report.

In Annex I to the SEA Directive, the information to be provided with the environmental report is specified, including, amongst others, information on the following:

> *"(f) the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors;*
>
> *(g) the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme"* (Annex I, para f to g).

In Annex II, "*criteria for determining the likely significance of effects*", in accordance with Article 3 (5) are listed. These include, inter alia:

> *"- the risks to human health or the environment (e.g. due to accidents);*
>
> *- the value and vulnerability of the area likely to be affected"* (Annex II, para. 2).

Similar to the EIA Directive, in the SEA Directive risks due to accidents are a criterion for determining if a plan or programme is subject to a SEA. However, it is noteworthy that the risk concept expressed in Annex II of the SEA Directive is considerably more inclusive and comprehensive than is Annex III of the EIA Directive ("*risks to health and the environment*" versus "*risk of accidents*").

There are strong material interrelationships between risk assessment and risk management on the one hand, and several of the criteria for significance in Annex II ("*vulnerability*"; "*risks to human health or the environment*") of the SEA Directive, on the other hand (Greiving (2004). Furthermore, the procedural provisions of the SEA Directive offer a suitable framework for integrating risk assessment and management into SEA. Greiving (2004) concludes that such procedural integration is feasible and necessary for fulfilling the requirements of the SEA Directive.

2.1.2 National and sub-national level

In this chapter, a comparative review of national EIA legislations is conducted, taking into account the closely interrelated regulatory framework, as appropriate. The purpose of this part of the desk study is to analyse the ways the issue of extraordinary risks is dealt with in national legislations. The comparative analysis is focussed on key themes, and its findings are presented and discussed along these themes. Within some of the themes, different types of legal implementation of risk aspects are identified. The development of typologies inevitably required a certain amount of abstraction. Thus, the types may be arguable, and the construction of different typologies is certainly possible. Non-exhaustive country-specific examples are used to highlight certain types of implementation and patterns risk is dealt with in national legislative systems. All results are

indicative; they are often supplemented and sharpened by findings from the empirical studies (cf. chapter 3) and should be read in conjunction with those findings.

2.1.2.1 Risk as a screening criterion

'Risk of accidents' is a screening criterion in Annex III.1 to the Directive. Since risk of accidents is ever present and a situation of zero risk does not exist, what needs to be considered in screening decisions is, therefore, not the mere presence of risk, but whether there is a significant risk of accidents and whether the consequences of a risk event happening would be likely to cause significant environmental effects (EC, 2003a).

Regarding the implementation of the screening criterion 'risk of accidents' of Annex III.1 to the Directive into national EIA legislation, basically three types of transposition can be identified in the set of Member States chosen for in-depth review.

Implementation type 1: No case-by-case screening

In most of the 10 sample Member States under investigation, mixed screening systems that combine different types of thresholds/criteria with case-by-case examinations are in operation, with the exceptions of ***France*** and ***Portugal***, whose EIA systems generally do not provide for case-by-case screening decisions. Therefore, the screening criteria of Annex III to the Directive have not been transposed to the French and the Portuguese EIA systems, and there is no need for a legal requirement in the EIA Acts of these two countries to apply 'risk of accidents' as a screening criterion, as there is no case-by-case screening.

Implementation type 2: Adoption of the risk concept in compliance with Annex III to the EIA Directive

Apart from France and Portugal, national EIA legislations of ***most Member States*** under consideration here have adopted risk of accidents as a screening criterion in case-by-case examinations. Most of these countries have transposed "*risk of accidents, having regard in particular to substances or technologies used*", according to Annex III.1 to the Directive, literally or in very similar wordings to their domestic legislation, including Austria, Czech Republic, Germany, Latvia, and the UK.

Implementation type 3: Implementation of an extended risk concept that exceeds requirements of Annex III to the EIA Directive

There is not much evidence that there are national EIA acts whose screening criteria would reflect a broader understanding of abnormal project-related risks going beyond considering technological and chemical hazards due to accidents in the proposed project. Only in the ***Slovak Republic*** a markedly wider concept of risk that exceeds the explicit requirement of the EIA Directive has been implemented into screening provisions. In Annex 2a of Act No. 391/2000, Coll., amending Act No 127/1994 on Environmental Impact Assessment,

> "*risk of accidents, with regard to utilised substances and technologies, as well as other possible risks connected to implementation of an activity*" (Annex 2a, Act No. 391/2000, Coll.)

is laid down as a screening criterion. Interpreted literally, the expression "*all other possible risks*" can be assumed to include all extraordinary risk types that are of interest to the given report (natural hazards, internal and external accidents, sabotage).

Further risk-relevant aspects related to screening

In all EIA systems that use a combination of thresholds and case-by-case approaches in screening, the field of application of screening criteria to case-by-case examinations, in accordance with Annex III.1 to the Directive, is naturally restricted to a limited number of project types, i.e. to those project types that do not require mandatory EIA if defined thresholds are exceeded. Regarding application of the screening criteria laid down in Annex III, Member States have repeatedly reported difficulties in interpreting and implementing them (EC, 2003a; IMPEL, 1998), and translation of screening regulations into decision-making on projects is often subject to considerable discretion on part of the competent authorities (cf. chapter 3.3.4). Review of national EIA regulations does not allow for valid statements as to the degree risk of accidents has been taken into consideration as a criterion in defining thresholds for project types subject to mandatory EIA.

Besides “risk of accidents”, in an indirect way also the screening criteria listed under “location of projects” in Annex III.2 to the Directive bear potential relevance to risk-based considerations. By stating that the “*environmental sensitivity of geographical areas likely to be affected by projects*” must be considered in screening decisions, and the vulnerability of the receiving project environment, including the damage potential present at the site and its coping capacity, are implicitly touched upon. By listing densely “*populated areas*”, the “*existing land use*” and various types of naturally sensitive areas as screening criteria, Annex III.2 makes indirect reference to the likelihood of exposure to hazards and to the magnitude of potential adverse consequences of a risk event occurring.

Most national screening provisions have adopted some or all of the criteria referring to the “*environmental sensitivity of geographical areas*” from Annex III.2. However, no EIA act in any of the sample Member States has taken the opportunity to make explicit references to risk-related determinants, for example by establishing an explicit linkage to the vulnerability of the project environment to risk events, or by referring to the susceptibility of project locations to the occurrence of natural hazards, to the damage potential pre-existent at the site, or to the likelihood of exposure. German legislation has gone comparatively far by introducing an Annex II (2) to the German EIA Act, which requires a site-related case-by-case screening procedure for a limited number of projects whose size or capacity stays below defined thresholds, if significant adverse environmental impacts are to be expected solely as a result of particular local conditions. Yet, no formal reference to extraordinary risks is made in Annex II (2) of the German EIA Act, either.

2.1.2.2 Legal requirements for risk assessment in EIA

EIA legislations of the 10 sample Member States have been reviewed for explicit references to the need for considering extraordinary hazards and risks in EIA procedures beyond the screening stage, i.e. as to the question whether there is a legal obligation to consider such risks throughout the EIA process, and, in particular, whether there is an obligatory requirement to identify, describe and assess them in the EIS, provided that risks are relevant and significant. Since at present there is no such explicit requirement in the EIA Directive, the question asked could be paraphrased as

follows: In how far are national legal implementation models more detailed, more explicit and more comprehensive in their requirements for risk assessment than the EIA Directive itself? Since the operation of domestic EIA systems in some Member States is more closely embedded in the wider national regulatory framework than in others, in particular in those Member States where EIA is a dependent part of other procedures under subject specific laws relevant EIA-related legislation has been included in the analysis.

In the 10 sample Member States where stakeholder interviews have been conducted, basically four types of legal implementation of the EIA Directive in terms of regulating the assessment of extraordinary risks may be identified. The formation of types of implementation to some extent requires abstraction from details as well as a certain amount of neglect of specific differences between national legal systems. However, some of these details are mentioned separately below.

Implementation type 1: Risk of accidents is a screening criterion, but no further obligatory legal requirement to consider extraordinary risks in the EIS and/or throughout the EIA process exists

In a number of Member States, the consideration of risks in legislative EIA systems is to a predominant part restricted to risk of accidents being a statutory criterion in case-by-case screening. Regardless of possible interpretations of what may be viewed as implicit meanings of certain wordings, and differences in details notwithstanding, in those countries no further obligatory requirements for risk assessment are stated explicitly in national EIA legislation. The majority of the Member States considered here fits into this category (Austria, Latvia, Poland, Sweden, UK, Portugal). To some extent, the situation in Portugal may be most divergent compared to the other countries in this group: first, because there is no case-by-case screening; second, although there is no reference to extraordinary risks in the main piece of national EIA legislation, a comparatively broad, albeit not necessarily binding reference exists on sub-legal level.

Apart from considering risk of accidents in screening procedures, the ***Austrian*** Federal Act on Environmental Impact Assessment 2000, as amended (*Umweltverträglichkeitsprüfungsgesetz 2000 idgF.*), does not foresee an explicit legal obligation to consider extraordinary risks in other stages of the EIA process, nor does it require to identify, describe and assess such risks in the EIS.

However, a certain reference to risk-related issues can be found in article 17 para. 2. There, additional requirements for decision-making are specified that make reference to health and environmental risks linked to exposure of humans, the environment, or properties to pollutants. While not specifically referring to risks due to non-standard conditions, these obligatory requirements have to be considered by the competent authority in its development consent decision. Significant immission loads due to concentrations of pollutants in the ambient environment have to be minimized to the extent possible, and exposure has to be prevented at any rate if it constitutes a threat to human health or lives, is capable of causing permanent harm to components of the receiving environment, or results into unacceptable nuisances to neighbours (Federal EIA Act, art. 17 para. 2).

To some extent, the ‘consolidated development consent procedure’ for projects subject to EIA, which is applied in Austria, may facilitate integration of risk-based considerations, as far as these are required under subject specific laws, into final decision-making (cf. chapter 2.1.2.4).

Similar to Austria, "*risk of accidents (from technological processes or substances used)*" (art. 11 para. 1. f) has to be applied as a screening criterion in the procedure for Initial Impact Assessment of a Proposed development, as laid down in the ***Latvian*** Law on Environmental Impact Assessment of October 14, 1998, as amended in 2001, 2003, and 2004.

Article 1 para. 1 of the EIA act introduces a comparatively broad definition of the term 'environmental impact' that makes, amongst others, reference to human health and safety risks, without, however, referring explicitly to extraordinary hazards due to non-standard conditions:

> "*Environmental Impact: direct or indirect changes to the environment caused by a proposed development, the results of which affect or may affect human health and safety, biological diversity, soil, air, water, climate, landscape, material assets, cultural and natural heritage values, as well as the interaction of these aforementioned areas*" (Art. 1 para. 1, EIA Act of Oct. 14, 1998).

However, no requirement to cover risks in the EIS can be identified in the Latvian EIA act.

In ***Poland***, the issue of extraordinary risks is not directly mentioned in the Act of 9 November 2000 on Access to Information on the Environment and Its Protection and on Environmental Impact Assessments, but a reference to "*emergency hazards*" is made in relation to assessment of alternatives. According to article 31 para. 4, the obligatory information that needs to be included in the Environmental Impact Report (EIS) requires

> *"an assessment of the expected environmental impact for the alternatives analysed, including the impact occurring should an emergency hazard to the environment arise, as well as the possible transboundary impact on the environment*" (Art. 31 para. 4, Act of November 9, 2000).

In ***Sweden***, neither the Environmental Code (1998:808) nor the Ordinance on Environmental Impact Statements (1998:905) contains a general legal requirement to consider extraordinary risks throughout EIA procedures or to describe and assess them in the EIS.

According to chapter 6, section 3, of the Swedish Environmental Code, for projects subject to both EIA and the Act on Measures to Prevent and Limit the Consequences of Major Accidents Involving Chemical Substances, safety-related aspects associated with the proposed activity and its environment shall be part of the EIA procedure, and the EIS has to be submitted along with the application for permit for hazardous activities (in particular, for Seveso II and IPPC projects). Similarly, special requirements for safety risk assessment apply for particular project types, such as nuclear power stations and genetically modified organisms. However, risk-related information is not explicitly required to be included in the EIS, and activities not related to chemical, radiological or biotechnological hazards are not covered by the Environmental Code.

In the ***UK***, EIA legislation has been integrated into the land use/spatial planning system (town and country planning regulations), but an independent EIA procedure is required for project authorisation. Regional EIA regulations are in place in England and Wales, Scotland, and Northern Ireland, with similar contents in material respects. '*Risk of accidents, having regard in particular to substances or technologies used*" has been adopted literally as a screening criterion, for instance in Schedule III, para. 1.f, of the Town and Country Planning (Environmental Impact Assessment) Regulations 1999, as amended, of England and Wales. Beyond screening, there is no further legal requirement to consider extraordinary risks in EIA in any of the regional EIA regulations. The official

interpretation of the EIA Directive in the UK implies that, while acknowledging that 'risk of accidents' is a screening criterion, the Directive does not contain any further obligation to cover risks 'under exceptional conditions'. On the contrary, as the explicit purpose of the Directive focuses on the assessment of 'likely significant effects', this is seen as excluding hazardous incidents on principle, because these are per definition not 'likely' (EC, 2003a; cf. chapter 3.3.2, 3.3.7).

However, in EIA practice competent authorities expect significant risks from flooding and landslides to be addressed in EIA, as well as seismic risks for installations prone to structural damage (EC, 2003a; cf. also chapter 3.3.7). In non-statutory guidance, it is recommended to indicate preventive measures against accidents, and to include reference to compliance with Seveso II-related regulations. For certain classes of projects, also the Health and Safety Executive (HSE) would tend to get involved as statutory consultee. Outside the direct scope of the EIA regime, established and advanced standards and procedures for risk assessment exist under project authorisation procedures subject to Control of Major Accident Hazards (COMAH) regulations, which implement the Seveso II Directive, and to the Health and Safety at Work Act 1974, which regulates occupational health and workplace safety issues (cf. chapter 2.1.2.4). However, the intensity and effectiveness of coordination between EIA and risk assessments under COMAH and health and safety-related regulations appears to depend to a large extent on case-specific factors (cf. chapter 3.3.7).

In Decree-Law No. 69/2000, which implements the EIA Directive in ***Portugal***, no mandatory or indicative requirement to cover extraordinary risks can be identified. The only explicit reference to the consideration of risk-related aspects in EIA legislation is made in Portaria No. 330/2001, which details on a sub-legal level how to implement Decree-Law No. 69/2000. In its Annex II, which provides technical guidance for structure and contents of an EIS, it is advised under the heading "Description of the impacts and mitigation measures", to include information on the following in the EIS:

> "*Identification of environmental hazards associated to the project, including those resulting from accidents, and the description of the preventive measures proposed by the applicant in order to avoid them*" (Portaria No. 330/2001).

Although being an official document, the guidelines proposed in Annex II are not a mandatory requirement under any circumstances, and their binding character in legal terms is restricted. Rather, it has the nature of a recommendation that should be considered by authorities when implementing Decree-Law No. 69/2000, according to each particular case. Although Portaria No. 330/2001 is explicit in mentioning accidents, no further definition or explanation concerning the rather broad expression "*environmental hazards associated to the project*" is provided. This would appear to leave considerable discretion and to allow for diverging interpretations, ranging from the release of all categories of hazards into the environment under extraordinary circumstances to adverse environmental impacts under standard operating conditions.

Apart from EIA, in Portugal separate legislation for industrial projects is in place, under which largely independent project licensing procedures are required that put markedly stronger emphasis on (safety) risk assessments than is done in EIA (cf. chapters 3.3.3, 3.3.6, and 3.3.7).

Implementation type 2: Risk of accidents has to be considered throughout the EIA process, including the EIS

Beyond the consideration of risk of accidents in the screening stage, in some new Member States risk of accidents is also the minimum requirement for risk assessment throughout the EIA procedures, including the EIS. With regard to potential receptors and consequences of risk events, a particular focus of EIA legislations in the respective countries is on risks to human health.

EIA legislation in the ***Czech Republic*** (Act No. 100/2001, Coll., on Environmental Impact Assessment, as amended by Act No. 93/2004, Coll.) contains explicit requirements to assess environmental risks in consequence of accidents and non-standard states of operation. In article 5 para. 3, which defines the scope of EIA, it is stated that in all phases of project development, including its preparation, implementation, operation and termination,

> "*(…) both normal operations and the possibility of accidents shall be assessed*" (§5 para. 3, Act No. 100/2001).

With regard to the information that is required to specify project outputs (emissions, waste, etc.), Annex No. 3 to the abovementioned Act also mentions

> "*(…) risks of accidents in relation to the proposed use of substances and technologies*" (Annex No. 3, *section* B, para. III, Act No. 100/2001).

According to Annex No. 4, the environmental documentation required to be submitted with the EIS requires

> "*III. Characteristics of environmental risks during potential accidents and non-standard states*" (Annex No. 4, section D, para. III, Act No. 100/2001).

Though not explicitly required by EIA legislation, in practice health risk assessment is standard for all projects types subject to EIA, regardless of project type or magnitude of potential adverse health effects. Corresponding to Act No. 258/2000, Coll., as amended, and a specific manual relating thereupon, the four-step model of health risk assessment according to the US EPA framework (cf. chapter 1.3.1.2) is applied, and assessments must be undertaken by a public health specialist who is the holder of a professional qualification in health risk assessment.

EIA procedures and project licensing procedures in the Czech Republic are conducted separately, with the final decision integrating the results of both processes. While EIA deals with the environmental impacts (including the health impacts and risks) of the proposed activities, the licensing procedures must cover (amongst others) the impacts of the environment on the proposed activity. Thus, the impacts of external hazards on the proposed project would formally have to be considered in licensing procedures.

Similar to the Czech Republic, the legal minimum requirements for risk assessment according to EIA legislation of the ***Slovak Republic*** (Act No. 127/1994 on Environmental Impact Assessment, as amended by Act No. 391/2000, Coll.) are the assessment of risks of accidents and of risks to human health in general, with some of the wordings used suggesting an even broader coverage of types of risks. Basically, it is required to examine all possible risks which may occur during construction, operation and termination of projects, including joint activities that are integral parts of developments. Annex 2a of Act No. 127/1994 requires the Preliminary Environmental Study to

present basic information on the presumed impacts of the activity on the environment and possible measures to mitigate them, including data on the following direct impacts:

> "*1.3. Assessment of the effects on health of the local population*.
> (…)
> *5. Other possible risks associated with the planned activity*" (Annex 2a, Act No. 127/1994).

Annex No. 3 of Act No. 127/1994 requires the EIS to investigate impacts of the proposed activity on the environment, including an estimation of their significance, in terms of

> "*1.2 health risks;*
> *(…)*
> 7. *operational risks and their possible impacts on the project environment (possibility of accidents)*"
> (Annex No. 3, Act No. 127/1994).

Occupational health and workplace safety assessments are largely outside the legal scope of the national EIA act and governed mainly by regional health authorities. However, both for Preliminary Environmental Studies and Environmental Impact Statements the competent health protection authorities (regional hygiene authorities) tend to get involved as advisory bodies.

Implementation type 3: Comprehensive requirements for risk assessment depend on applicable non-EIA legislation, with possible gaps in coverage of all potentially risk-relevant projects

In **France**, where EIA is not an independent procedure, but an integral part of other sectoral procedures that are carried out according to procedural provisions of applicable subject specific laws outside EIA legislation, the strength and extent of legal requirements for risk assessment in EIA depend strongly on the applicability of relevant sectoral regulations. As not all projects subject to EIA are simultaneously covered by other laws requiring risk assessment, this may cause gaps in the coverage of potentially risk-relevant projects.

EIA in France operates under nature conservation legislation, and in practice EIA is integrated into subject specific (sectoral) licensing procedures. EIA legislation itself does not contain any strong requirements for risk assessment. Neither in Law n° 76-629 of July 10th 1976 related to the Protection of Nature (Loi n° 76-629 du 10 juillet 1976 relative à la protection de la nature), whose article 2 provides basic framework regulations for EIA, nor in Decree n° 77-1141 of October 12th 1977 on Impact Studies (Décret n° 77-1141 du 12 octobre 1977 sur les études d'impact), which is a supporting regulation implementing article 2 of Law n° 76-629, an explicit legal obligation to consider extraordinary hazards and risks in EIA is present. Decree n° 77-1141 specifies that the Impact Study (EIS) shall contain, amongst others, the effects of a project on:

> "(*...) if the case arises, the comfort of the neighbourhood (noises, vibrations, smells, light emissions) or on hygiene, health, safety and public health*" (Decree n° 77-1141 of October 12th 1977 on Impact Studies).

However, the mentioned effects on (public) health and safety are not explicitly linked to hazardous incidents or extraordinary risks, but rather appear to relate to effects of a project under normal operating conditions.

While EIA legislation itself does not make strong reference to the consideration of risks, the major legal instrument of project-related risk assessment and risk management in France is the legislation on 'classified installations'. Classified installations amount to half of the projects for which an Impact Study (EIS) is prepared and include Seveso-type industrial installations, but the coverage of classified installations legislation goes beyond Seveso II projects. Important regulations are contained in Law n° 76-663 of July 19th 1976 related to Classified Installations for the Protection of the Environment (*Loi n° 76-663 du 19 juillet 1976 relative aux installations classées pour la protection de l'environnement*) as well as in the implementing regulation Decree n° 77-1133 of September 21st 1977, for the application of Law n° 76-663 of July 19th 1976 related to Developments Classified for the Protection of the Environment (*Décret n° 77-1133 du 21 septembre 1977. pris pour l'application de la loi n° 76-663 du 19 juillet 1976 relative aux installations classées pour la protection de l'environnement*). Projects subject to these regulations are defined in a list of classified installations, having been specified in Decree n° 77-1134 related to the List of Classified Installations, and are such projects that can generate serious dangers or disadvantages either for the convenience of the neighbourhood or for health, safety, public health, or for agriculture, the protection of nature and the environment, or for the preservation of sites and monuments. Project authorisation can only be granted if serious dangers and disadvantages are prevented by appropriate measures.

According to Article 3, para. 4 and 5, of Law n° 76-663, both an Impact Study (EIS) and a Hazard Assessment Study [*étude les dangers*] for risks of accidents have to be prepared for projects that are subject to classified installations regulations. This implies that for projects that are subject to both EIA and the classified installations regulations, some kind of risk assessment is mandatory, although the legal requirement for risk assessment does not derive from EIA legislation. The purpose of the Hazard Assessment Study is to identify sources of danger, to identify foreseeable accident scenarios, to evaluate consequences of an accident, and to justify measures for prevention and mitigation of effects.

Implementation type 4: Requirements for risk assessment are detailed in sub-legal EIA regulations, and comprehensive additional requirements for risk assessment depend on applicable non-EIA legislation, with possible gaps in coverage of all potentially risk-relevant projects

There is no explicit obligation in the ***German*** federal EIA Act to asses and describe the likely significant effects in case of an accident or under exceptional circumstances. However, the objective of the federal EIA Act is defined in Article 1 as

> "(...) *safeguarding effective preventive environmental protection by identifying, describing and assessing the impacts on the environment comprehensively and in good time*" (Art. 1, BGBl I 1990, 205).

Despite the absence of an explicit reference to risk assessment, Wende (1998) interprets this concept as being broad enough to imply an obligation to consider risks of adverse environmental consequences caused by non-routine operating conditions, such as disturbances of operation, events of fault and accidents, along with environmental impacts under standard operation, even if such risks are unlikely and might not necessarily result in environmental damage.

In fact, in the binding General Administrative Guidelines on the Implementation of the Federal EIA Act, 1995 (*Allgemeine Verwaltungsvorschrift zur Ausführung des Gesetzes über die Umwelt-verträglichkeitsprüfung – UVPVwV 1995*), the concept of 'impacts on the environment' introduced by the EIA Act is defined more closely in a wide manner so as to include various degrees of non-standard operation:

> "*Depending on the specific case, impacts on the environment can be consequences of the construction and the normal (planned) operation of a project, and of disturbances in operation, events of fault and accidents, as far as an installation has to be designed according to that or preventive protection measures must be taken*" (Art. 0.3b, UVPVwV 1995).

Thus, the possibility of different degrees of hazardous incidents linked to the construction and operation of a project is explicitly within the scope of EIA, and must be covered by the EIS, as far as a project is prone to accidents and their consideration is relevant for decision-making.

Similar to France, EIA in Germany is a dependent part of the project authorisation procedure under other relevant applicable laws. According to articles 2 and 4 of the national EIA Act (*Gesetz über die Umweltverträglichkeitsprüfung, BGBl I 1990, 205, idgF.*), EIA regulations in Germany are subsidiary to relevant sectoral laws, and EIA regulations are applied in particular when they go beyond consent requirements of those applicable other laws. Most substantial consent requirements are contained in sectoral laws, which in particular determine the need for, and extent of, risk assessment in EIA.

In relation to risk assessment for projects subject to EIA, the Federal Immission Control Act 1990, as amended (*Bundes-Immissionsschutzgesetz – BImSchG 1990 idgF.*), and in particular the 12th Statutory Order on Hazardous Incidents regarding the Federal Immission Control Act, 2000, as amended (*Störfallverordnung: 12. Verordnung zur Durchführung des Bundes-Immissionsschutz-gesetzes, BGBl I 2000, 603*) are the most important pieces of German legislation. For all projects that are subject to EIA and that at the same time fall under the regime of the 12th Statutory Order on Hazardous Incidents, all its comprehensive requirements for risk assessment have to be met within the project authorisation procedure under the Federal Immission Control Act. It applies to (existing and new) projects/installations with hazardous substances classified in the Annex to the Statutory Order if defined thresholds for amounts of those substances are exceeded (volume threshold concept).

The 12th Statutory Order on Hazardous Incidents requires consideration of various extraordinary risk categories, including internal risk sources (accidents caused by technological and human failure); external risk sources that may impact on the project (natural or environment-borne hazards, such as earthquakes, floods etc.); and interferences from unauthorised persons (sabotage).

The operator or developer has to take appropriate measures to avoid accidents, including application of technological state-of-the-art. In case an accident should actually occur, preventive measures have to be taken to contain its effects to the extent possible. The 12th Statutory Order is also the most important legislation for the assessment of health risks within EIA.

2.1.2.3 Concept of risk

In general, the concepts of risk that have been incorporated into national EIA legislation and the closely EIA-related regulatory framework are in compliance with that of the EIA Directive or, in some cases, exceed requirements of the Directive. Nevertheless, the concept of risk as explicitly expressed in EIA legislations of the large majority of the 10 Member States selected for in-depth investigation is a narrow one regarding coverage of hazard categories (risk sources). In some countries, more comprehensive, more explicit and wider concepts occur in other applicable legislation closely interrelated to EIA.

In the 10 sample Member States, basically four types of risk concepts may be identified in EIA legislation and related regulatory frameworks. Explicitly stated coverage of hazard categories and risk sources has been used as the main criterion to derive types. Of course, the formation of risk types requires a certain amount of abstraction from details. Different typologies may be generated as well, depending on the differentiating criteria applied.

Risk concept type 1: Restriction to risk of accidents

In terms of coverage of extraordinary hazard/risk categories, EIA regulations of all Member States have adopted the concept of *"risk of accidents, having regard in particular to substances or technologies used"* from Annex III.1 to the EIA Directive. However, in most of the 10 countries, explicitly stated references to the issue of extraordinary risks in national EIA regulations are restricted exclusively to the concept of risk of accidents, apparently mostly to accidents within the proposed project.

With regard to application to stages of the EIA procedure, in a number of Member States EIA legislation requires mandatory consideration of risk of accidents only in taking screening decisions through case-by-case examinations (Austria, Latvia, Poland, Sweden, UK). This model is opposed to the Czech Republic, Slovakia, and Germany, where the risk of accidents has to be dealt with alongside environmental impacts of normal operation in the entire EIA procedure, including description and assessment in the EIS as well as prevention and mitigation measures.

Risk concept type 2: Extended concept of risk of accidents, covering various degrees of non-routine conditions

In few Member States, the concept of 'risk of accidents' is more closely detailed in the national EIA Act or in supporting sub-legal regulations, so as to cover risks due to different degrees of non-routine conditions:

In ***Germany***, the understanding of risk as expressed in the federal EIA Act is narrow, because it is confined on the application of ‘risk of accidents’ in screening procedures. However, the broad term 'impacts on the environment' used in the national EIA Act is further defined in the General Administrative Guidelines on the Implementation of the Federal EIA Act, 1995 (*Allgemeine Verwaltungsvorschrift zur Ausführung des Gesetzes über die Umweltverträglichkeitsprüfung – UVPVwV 1995*). Article 0.3b explains that 'impacts' may include consequences due to various degrees of non-standard operation, including in particular disturbances, hazardous incidents, and serious accidents, "(...) *as far as an installation has to be designed according to that or preventive protection measures must be taken*." The Guidelines make clear that the principles of

precautionary environmental protection and of hazard prevention must be applied to projects subject to EIA, as far as a project is prone to accidents and their consideration is relevant for decision-making. Wende (1998) points out that the definition provided by article 0.3b comprises three degrees of intensity of hazardous incidents, which may also be viewed as having a temporal dimension:

- disturbances in operation ("near misses"): may, but do not necessarily need to cause release of a hazard;
- hazardous incidents (events of fault): connected to actual release of a serious hazard;
- accidents: connected to actual occurrence of adverse consequences (damage).

According to Wende (1998), this differentiated concept of 'risk of accidents' would de iure also cover hazardous incidents that are very unlikely, even if the magnitude of potential adverse consequences is expected to be below a level that would qualify as 'environmental damage'.

In a similar sense, albeit less detailed, Annex No. 4, section D, para. III to the national EIA Act of the ***Czech Republic*** (Act No. 100/2001) requires the environmental documentation in the EIS to assess "*characteristics of environmental risks during potential accidents and non-standard states*".

Risk concept type 3: No explicit restriction of hazard categories/risk types

In two Member States, provisions can be identified in EIA regulations that indicate that the risk concept is extended beyond the 'risk of accidents', suggesting that also other possible risks are within the legal scope of EIA:

While placing a strong emphasis on health risks, the EIA Act of the ***Slovak Republic*** requires the Preliminary Environmental Study to present, amongst others, also information on "*other possible risks associated with the planned activity*" (Annex 2a, Act No. 127/1994). It would appear that this broad formulation includes all categories of extraordinary risks that are of interest to this report.

In ***Portugal***, a supporting decree on sub-legal level, which details how to implement the Portuguese main piece of EIA legislation, states that the EIS shall identify "*environmental hazards associated to the project, including those resulting from accidents"*, and describe "*preventive measures proposed by the applicant in order to avoid them*" (Portaria No. 330/2001). Literally, the reference to project-related "*environmental hazards*" is broad and inclusive, and makes no restrictions in terms of the hazard categories addressed. However, in terms of the underlying conception of risk assessment, it may be noted that the emphasis of the quoted paragraph is on hazard identification and risk management, and virtually does not refer to *assessment* of risks. Moreover, the provision is subject to case-specific application, and the binding character of the decree in general appears to be limited.

Risk concept type 4: Wider and more detailed concept of risk in EIA-related applicable legislation

Much more detailed and comprehensive concepts of risk exist in Germany and France in legislation that is closely interrelated to EIA:

In ***Germany***, the 12th Statutory Order on Hazardous Incidents (*Störfallverordnung: 12. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes, BGBl I 2000, 603*) regarding the Federal Immission Control Act (*Bundes-Immissionsschutzgesetz – BImSchG 1990 idgF.*) is relevant to EIA if projects are both subject to EIA legislation and the Federal Immission Control Act. In the 12th Statutory Order, a wide risk concept is applied that covers various categories of extraordinary risks:

- technological risks within the proposed project, including accidents in consequence of technological and human failure;
- external risks, including natural hazards and accidents in other installations (e.g. spreading of fire) that may impact on the project; and
- sabotage, unauthorized interferences.

In terms of receptors of hazards and adverse consequences of hazardous incidents, onsite and offsite "serious effects" are covered, including human health, public health, material assets, and damage to the environment.

The following definitions are provided in the Statutory Order:

The term "hazardous incident/accident" [Störfall] is defined as:

> "*(…) an incident, such as emissions, fire, or explosion of larger extent, that results from a disturbance of normal operation in an installation classified in this Statutory Order, that immediately or subsequently leads to a serious hazard or material damage onsite or offsite, and that involves one or more hazardous substances*". (BGBl I 2000, 603).

The term "serious hazards" is defined as:

> "*(…) threat to human lives or severe threat to human health; threat to health of a large number of people; damage to the environment*" (BGBl I 2000, 603).

While ***French*** EIA legislation does not make explicit reference to extraordinary risks, for projects that are subject to the 'classified installations' regulations (*Loi n° 76-663; Décret n° 77-1133*) both an Impact Study (EIS) and a separate Hazard Assessment Study [*étude les dangers*] have to be prepared. In practice, about half of the projects that are subject to EIA are also subject to 'classified installations' regulations. The Hazard Assessment Study shall identify hazards and foreseeable accident scenarios, evaluate consequences and justify measures proposed for risk prevention and mitigation of effects.

Regarding coverage of hazard categories, the concept of risk that is expressed in the regulations on 'classified installations' may be regarded as rather narrow because it focuses mainly on technological risks (risk of accidents) caused by risk agents that may be released by industrial developments. On the other hand, the concept of risk is broad in terms of potential receptors because effects on humans, public health, material assets and various environmental compartments have to be considered.

2.1.2.4 Relationship with risk assessment under procedures subject to other risk-relevant Directives

The ways the IPPC and Seveso II Directives have been implemented in the 10 Member States are highly varied and diversified, as are the ways the licensing procedures under those Directives are organised in relation to EIA procedures. In general, models with a certain degree of integration of EIA procedures and IPPC/Seveso II procedures can be differentiated from models that practice separation of procedures. Requirements for risk assessment and risk management under the IPPC and Seveso II regimes are usually considerably stronger than under the EIA regime. A variety of further laws and regulations related to project authorisation and that require risk assessment to a greater or lesser extent is in place in most Member States, often with an emphasis on safety risks. Frequently occurring examples include separate legislations for nuclear projects and contaminated sites. Natural hazards appear to be much a matter of sectoral planning under specific laws.

However, integration mostly does not necessarily imply that the outcome of risk assessments under non-EIA regimes is fully integrated, or incorporated, into the EIS. Of course, legal or formal interfaces between procedures that may exist in legislation or procedural guidelines do not guarantee that there actually is intense and effective coordination in practice, nor do they automatically warrant integration of outcomes of different procedures into final decision-making. However, more indications concerning practical coordination of procedures can be found in chapter 3.3.7.

In the following paragraphs, an attempt has been undertaken to identify common patterns of how procedures under the EIA, Seveso II and IPPC Directives are organized and interrelated to each other, and to assign these patterns to types of relationships. Non-exhaustive country examples are used to highlight each type in an indicative manner.

Relationship type 1: Procedures integrated or coordinated to differing extents

Austria is one of the few Member States that has taken the opportunity granted by Article 2 para. 2a of the EIA Directive to implement a formal legal linkage in its EIA act providing for a single procedure to fulfil the requirements of both the EIA and the IPPC Directives. As EIA thresholds are usually higher than IPPC thresholds, one single procedure is applied for projects above EIA thresholds, while beneath EIA thresholds a stand-alone IPPC procedure is undergone for IPPC-relevant projects. The Seveso II Directive is implemented mainly by regulations in the Trade, Commerce, and Industry Regulation Act. The Austrian EIA Act provides for a 'consolidated development consent procedure' that shall ensure material integration of EIA procedures with all other licensing procedures that are required under applicable subject specific laws on federal and provincial level, including project authorisation procedures under the IPPC and Seveso II regimes. This implies that EIA procedures and all other relevant legal matters and licensing proceedings are governed by one authority, and that all permits are granted in one. This also implies that projects that are subject to the EIA Directive and one, or both, of the other two Directives must comply with requirements of all relevant legislations within a single licensing procedure. As far as project-related extraordinary risks are relevant to project licensing under subject specific laws, it should be assumed that the consolidated consent procedure for projects subject to EIA facilitates a certain degree of integration of risk-based considerations into final decision-making, including project modifications and mitigation measures. Coordination of procedures may compensate to some extent for the fact that a legal requirement for covering risks in the EIS is missing.

In ***Germany***, the IPPC Directive is implemented mainly by the Federal Immission Control Act 1990, as amended (*Bundes-Immissionsschutzgesetz – BImSchG 1990 idgF.*). The Seveso II Directive is implemented mainly by the 12th Statutory Order on Hazardous Incidents regarding the Federal Immission Control Act, 2000, as amended (*Störfallverordnung: 12. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes, BGBl I 2000, 603*). So, for IPPC-/Seveso II-relevant projects that are at the same time also subject to EIA, the EIA procedure is a dependent part of the project authorisation procedure under the Federal Immission Control Act/12th Statutory Order, and consent requirements of the respective laws have to be met within the given procedure.

The legal requirements of the 12th Statutory Order on Hazardous Incidents are by far more explicit and comprehensive in terms of risk assessment and risk management than the national EIA act. Internal accidents, natural hazards, and sabotage have to be considered.

Applying the technological state of the art, the operators of installations are required to take, amongst others, the following precautionary and preventive risk management measures:

- Avoidance measures: preventing fires (emergence, spreading, impact from off-site fires on installation); taking sufficient warning, alarm and safety provisions; providing technological equipment with sufficient safety provisions; protecting safety-relevant parts of installation from interferences of unauthorised persons; avoiding human failure through safety instructions and training of personnel, etc.
- Containment measures: technical and organisational safety precautions to limit the effects of hazardous incidents; support for authorities in case of emergency; making available emergency personnel, etc.
- Monitoring and surveillance; maintenance of equipment.
- Information of authorities and the public.
- Preparation of concepts for prevention of accidents; internal alarm and hazard aversion plans; safety management systems; preparation of safety reports on these measures, and updating them every 5 years.

In practice, for projects requiring both, EIA and risk assessment/management according to the Federal Immission Control Act/12th Statutory Order, usually separate documents have to be submitted and parallel procedures exist, but one competent authority is in charge of approval. There is no explicit obligation to incorporate information produced under the requirements of the Statutory Order into the EIS, and reciprocally. Good practice would mean that the outcome of risk assessment under the Immission Control Act is presented, annexed or at least referred to in the EIS.

Moreover, the scope of application of the 12th Statutory Order is restricted to certain classes of projects that bear an increased risk potential in relation to hazardous substances, including Seveso II project types. As there is not such a strong comprehensive requirement for risk assessment in EIA legislation, the application of risk assessment in EIA tends to be restricted to projects that are subject to both legislations (Wende, 1998) (cf. chapter 3.3.7).

In ***France***, legal requirements for risk assessment and risk management under the Seveso II Directive are mainly implemented by the 'classified installations' regulations, as described in chapter 2.1.2.2, and by the recently adopted Law no. 2003-699 on the Prevention of Technological

and Natural Risks and the Repair of Damage, which transposed the latest amendments to the Seveso II Directive.

According to Article 3, para. 4 and 5, of Law n° 76-663, both an Impact Study (EIS) and a Hazard Assessment Study [*étude les dangers*] for risks of accidents have to be prepared for projects that are subject to classified installations regulations. This means that for projects under the classified installations legislation risk assessment is procedurally integrated with EIA, although risk assessment itself is controlled not by EIA legislation. The Hazard Assessment Study focuses on technological risks (accidents), but consequences of accidents both on human health and on other environmental receptors in general have to be considered. According to Article 3 para. 5, it shall identify hazards in case of an accident and specify measures aiming at reducing risk of their occurrence and their effects. It shall also specify emergency measures (plans) to contain the effects of a potential accident. It detail, it is required to identify sources of danger, to identify foreseeable accident scenarios, to evaluate consequences of an accident, and to justify measures for prevention and mitigation of effects. Also, a note is required that refers to compliance with health and personnel safety regulations.

The Hazard Assessment Study has to be submitted as a separate document along with the Impact Study. In practice, rather than integrating Hazard Assessment Study and EIS by incorporating relevant information in the respective documents in a dual mode procedure, the Hazard Assessment Study is mostly annexed to, or referenced by, the EIS (cf. chapter 4.3.7.2).

Law no. 2003-699 concerning the Prevention of Technological and Natural Risks and the Repair of Damage applies to high-risk (top-tier) Seveso II installations involving chemical hazards. Preparation and updating of safety reports is required from operators. The land use planning requirements of the amended Seveso II Directive are implemented by technological risk prevention plans that must be prepared. Their purpose is to mitigate residual risk after prevention measures have been taken, and to limit exposure of the population to consequences of an accident by putting constraints on land use in the vicinity of the installation. Assessment of the consequences of an accident is the task of the hazard assessment study under the ‘classified installations’ regulations. The terms "hazardous" and "very hazardous" used in the Law have been defined referring to safety of people. The Law provides for more information of the public on industrial risk, and for consultation and participation of the public in the drafting of the risk prevention plans. In order to improve consistency of risk prevention, hazard studies and safety reports, which might lead to additional emergency plans and prevention measures, have to be prepared also for transport facilities of dangerous goods. Participation of employees and sub-contractors in workplace health and safety measures as well as provisions relating to training have been improved (on-site risk prevention). A new "technological disaster concept" has been introduced: compensation of victims and recovery of damage by insurance companies or by a national fund. In order to prevent major accumulated damage to the environment, now the operator is responsible for restoring the site after operation has stopped, to bear all costs, and to proof that he is able to bear all financial costs. This provision applies to IPPC and Seveso sites.

Classified installations amount to half of the projects for which an Impact Study (EIS) is prepared and include Seveso-type industrial installations, but the coverage of classified installations legislation goes beyond Seveso II projects. For projects for which an EIA is required but that are not subject to classified installations regulations, no legal requirement for assessment and management of extraordinary risks exists.

Relationship type 2: Independent procedures, but distinct risk management profile in procedures separate from EIA

In the ***United Kingdom***, most risk issues and most project related risk assessment work is covered by legislation other than EIA. Requirements for risk assessment under the Seveso II and IPPC regimes are much stronger than under the EIA regime. Requirements under both the Seveso II Directive and the IPPC Directive are administered in licensing regimes independent from EIA. No formal integration of IPPC/Seveso II procedures and EIA procedures exists.

While EIA is implemented within the land use planning system, IPPC is regulated by Environmental Protection Legislation, which is administered by the Environment Agency. It acts as a statutory advisory body for planning authorities, including those in charge of EIA procedures, and advises them on off-site environmental risks of developments, including risks from accidents. EIA thresholds and criteria are mostly not the same as those laid down in Annex I of the IPPC directive. EIA exclusion thresholds are in general lower than IPPC thresholds.

Most Health and Safety requirements flow from the Seveso II Directive, which is implemented by regulations under the Act on Health and Safety at Work 1974, and the Control of Major Accident Hazards (COMAH) legislation and regulations, which comprise the following town and country planning regulations:

- The Planning (Hazardous Substances) Act 1990;
- The Planning (Control of Major Accidents Hazards) Regulations 1999 (SI 1999 No 981), which amended The Planning (Hazardous Substances) Regulations 1992 (SI 1992 No 656) to give effect to the land use requirements of art. 12 of Seveso II Directive;
- The Town and Country Planning (General Development Procedure) Order 1995 (SI 1995 No 419);
- The Town and Country Planning (Development Plan) Regulations 1999 (SI 1999 No 3280);
- The Town and Country Planning (Regional Planning) (England) Regulations 2004 (SI 2004 No 2203); and,
- The Town and Country Planning (Local Development) (England) Regulations 2004 (SI 2004 No 2204).

A consultation paper on further amendment of The Planning (Control of Major Accident Hazards) Regulations has been circulated by ODPM (Office of the Deputy Prime Minister) recently; its focus is mainly on technical contents (ODPM, 2005). Under SI 1999 No 981, hazardous substances consent has to be obtained for hazardous substances used or stored above quantities specified in the Directive for the siting of new establishments, modifications to existing establishments, and new developments in the vicinity of existing establishments. Granting of hazardous substances consent triggers establishment of a consultation zone that helps control future development within vicinity of the site. Before granting development consent, planning authorities have to consult with the Health and Safety Executive (HSE). HSE also advises planning authorities on off-site risks to people, whereas the Environment Agency advises on risks to the environment. According to the Seveso II Directive, COMAH regulations require operators to prepare accident scenarios and to submit them to HSE. No need is seen in UK to replicate this in EIA, but non-statutory guidance recommends that the EIS should include indications of preventive measures and reference to compliance with

Seveso II. An informal administrative link between EIA and Seveso II exists in so far as the HSE also acts as an advisory body on health and safety issues to local planning authorities that govern EIA procedures. The HSE has much experience in applying risk assessments, mostly to industrial projects.

In the UK, occupational health and safety is outside the scope of EIA; it is mainly regulated by the Health and Safety at Work Act (1974). This act places a responsibility on employers to reduce the health and safety risks to their employees and the public as far as is reasonably practicable (SFAIRP). This, combined with the idea that there is a level of risk that is unacceptable and, possibly, one that is so small that it is negligible, provides a framework on which risk criteria can be set. The region in between the unacceptable and the broadly acceptable level of risk is where the risks need to be reduced as low as reasonably practicable (ALARP) (Gould, 1998). For (on-site) health and safety of risk-prone projects, ALARP standards are applied by the HSE, based on cost-benefit analyses of risk reduction measures. The terms SFAIRP and ALARP are not interchangeable: SFAIRP is a term qualifying a legal duty; ALARP is a risk management concept that would consider more factors than and should also exceed the legal duties of SFAIRP (Gould, 1998). Based on SFAIRP requirements, industrial safety risk assessments have been formalised and risk criteria have been developed. These are mainly based on principles detailed in the HSE document “The Tolerability of Risk from Nuclear Power Stations” (HSE, 1992), which has put into risk assessment terms the principles laid down in the Health and Safety at Work Act (1974).

A variety of further specific regulations and consent procedures outside EIA is in place in the UK, e.g. for radioactivity with regard to nuclear installations, for airports, for removal and disposal of asbestos, for contaminated land, for waste disposal licensing, etc.

The following conclusions can be drawn: There is no legal obligation to consider extraordinary risks in EIA in the EIA regulations of the UK (beyond risk of accidents in screening), and there are only comparatively weak recommendations to indicate preventive measures in EIA guidance. However, there are strong requirements for risk assessment by various regulations outside EIA; these are mainly requirements for safety risk assessments for industrial projects of the Seveso II type, but also for project types outside the Seveso II regime, such as nuclear installations. There is also a wealth of experience in dealing with health and safety risk issues on part of competent authorities, which apply formalised risk reduction strategies, relying much on a risk management approach. Coordination between EIA procedures and risk assessment under other control regimes has only a weak legal backup and is done mainly on an informal level through consultations between competent authorities. Due to discrepancies in the fields of application of relevant legislation under different Directives, gaps in risk assessment may occur for projects that are only subject to EIA, but are not at the same time subject to Seveso II or IPPC requirements.

Relationship type 3: Sequence of separate consecutive procedures, with most risk assessment done subsequent to EIA

In the new Member States ***Czech Republic***, ***Latvia***, ***Poland***, and ***Slovakia*** as well as in ***Portugal***, both IPPC and Seveso II procedures are processes separate from EIA. Usually, more detailed risk assessments are undertaken under IPPC and Seveso II requirements. In general, the respective procedures follow a temporal sequential order. The general pattern is that EIA procedures are carried out first, and then IPPC and Seveso II procedures follow. For example, project-related licensing procedures in Slovakia are normally conducted in the following chronological order: SEA

– EIA – Seveso II – IPPC. In most of the abovementioned countries it is either required or advised that the output of the EIA process serves as an input for the IPPC/Seveso II process. However, e.g. in the Czech Republic, the outcome of the EIA procedure is not binding, which means that ins subsequent permitting procedures the authorities are not obliged to follow a negative statement or unconditionally accept suggested conditions, albeit they should take account of it formally.

IPPC in the Czech Republic is regulated by Act 76/2002 Coll. on integrated pollution prevention and control, on the integrated pollution register and on amendment to certain laws (the Act on Integrated Prevention), as amended. The Seveso II Directive is implemented by Act 353/1999 Coll. on the prevention of major accidents caused by selected dangerous chemical substances and chemical preparations and on amendment to Act 425/1990 Coll., on district authorities, their jurisdiction and other related measures, as amended (the Major Accidents Prevention Act), and the related implementing regulations.

Integrated Pollution Prevention and Control in Latvia is carried out in accordance with the provisions stipulated in the Law on Pollution, passed on 15 March, 2001. Legal provisions resulting from the Directives 96/61/EC, 2003/35/EC, 91/676/EEC, 2002/49/EC, and 2003/87/EC have been incorporated. Seveso II is implemented by the regulations on Procedures for Industrial Accident Risk Assessment and Risk Reduction Measures (2001).

In Slovakia, the IPPC Directive is implemented by Act No 245/2003 on Integrated Environmental Pollution Prevention and Control. The Seveso II directive is implemented by regulations under the Act No 261/2002 on the Prevention of Major Industrial Accidents and supported by implementing decrees.

The model of coordinating different procedures in sequential order – one after another – in the abovementioned countries may cause special coordination problems with particular regard to risk assessment. Most risk assessments in those countries are not done in EIA, but in Seveso II/IPPC procedures subsequent to EIA. As the field of application of the three Directives in terms of project types is not identical, a considerable share of total projects that is only subject to EIA might not be examined as to possible risks. Moreover, the focus of the Seveso II and IPPC Directive is on technological safety hazard assessment and risk management, but much less on environmental risk assessment and the adverse environmental consequences. If projects subject to EIA *and* one or both of the other two Directives are connected to significant risks, their environmental consequences might yet stay unrecognized, and risk management measures might be taken without appropriate information on the nature, likelihood, magnitude and significance of environmental risks.

2.1.2.5 Reference to social and socio-economic impacts

Broad references to impacts on human beings, the population, or human health in general are made in most EIA acts. Apart from that, socio-economic impacts are never mentioned at all. ‘Social risks’ appear to be completely out of the legislative scope of the EIA systems reviewed here.

2.1.2.6 EIA legislation in non-EU countries

Canada

As in the USA, Environmental Assessment in Canada concerns those projects developed by Federal Agencies or under their jurisdiction or funding. It is a decentralized process led by the Federal and provincial governments and laterally by emerging new indigenous constitutional entities (Clark & Richards, 1999; Paci *et al.*, 2002). Since the mid-1990's the scope of EIA process has broadened to include cumulative effects, follow-up monitoring and related health and other social considerations.

All federal Departments and agencies are subject to the ***Canadian Environmental Assessment Act 1992, c.37 from the 23rd June 1992***, replacing the previous *Environmental Assessment Review Process* (EARP) *Guidelines Order*, as well as to its implementing regulations.

There are several legal instruments underlying EIA practice in Canada: Bilateral Agreements between the federal and provincial governments to coordinate and harmonize EA practice, International Agreements containing EA provisions to which Canada is signatory, varying regulations for those projects outside Canada's jurisdiction, federal coordination regulation intended to coordinate federal authorities' activities regarding EA, and specific regulations under the Act (Clark & Richards, 1999).

EIA practice is administered at federal level by the Canadian Environmental Assessment Agency (CEAA), established by section 61 of the Act. It is up to the CEAA to provide legal, procedural and policy advice to the Minister of the Environment on the Minister's responsibilities under the Act, to ensure public participation in the Federal EA process, and to guarantee sound environmental assessment (EA) practices (Clark & Richards, 1999; Paci *et al.*, 2002).

According to section 5 of the Canadian Environmental Assessment Act, an EA is required for those projects included in the Law List for which a federal authority (a) is the proponent, (b) provides the financial means for its development, (c) owns the land on which the project is to be implemented or (d) is responsible for the assignment of a permit or licence (CEAA, 1992, Clark & Richards, 1999).

There are four types of assessment recognized under the Act: *screening*, *comprehensive study*, *panel review* and *mediation*[3].

The concept of "environmental effects" according to the Canadian Environmental Assessment Act comprises the following:

- *"any change that the project may cause in the environment (...);*
- *the effects of these environmental changes on:*
  - *health and socio-economic conditions,*
  - *physical and cultural heritage,*
  - *current use of lands and resources for traditional purposes by aboriginal persons,*

[3] According to No.2 [Definitions] of the Act,

– *any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and*

- *any change to the project that may be caused by the environment (...)"* (CEEA, 1992).

This concept differs from that of many European EIA acts and may be regarded as wider and more comprehensive in several respects:

- External impacts on the project caused by the environment, e.g. due to exposure of the project to natural hazards or disasters, are unambiguously defined as being within the scope of EIA. This implies that an increase in the damage potential (vulnerability) as a consequence of the existence of a project is understood as a potentially significant effect on the environment.
- Health effects and adverse socio-economic, cultural and socio-cultural impacts are explicitly mentioned. This approach is much more explicit in including socio-economic and socio-cultural effects in the legal scope of EIA than is, e.g., the European Community Directive. However, these effects are mainly relevant to EIA if they are caused by changes to the environment, which must in turn be a consequence of the project. In practice, due to division of competencies between the federal government and the provinces, social impacts are more often assessed on provincial level than on federal level.

USA

The National Environmental Policy Act (NEPA), first enacted in 1969, was the first environmental law assigning the Environmental Assessment (EA) of projects as an innovative tool for environmental management and protection. The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet this requirement, federal agencies prepare a detailed statement known as an Environmental Impact Statement (EIS)[4]. The obligation for preparing an EIS derives from NEPA: *"(...) whenever the U.S. Federal Government takes a major Federal action significantly affecting the quality of the human environment, it must first consider the environmental impact in a document called an Environmental Impact Statement (EIS) (...)".* The Environmental Protection Agency (EPA) reviews and comments on EISs prepared by other federal agencies, maintains a national filing system for all EISs, and assures that its own actions comply with NEPA (Wood, 1995).

NEPA is a federal law covering actions done under federal regulations. The same approach has since been followed by several U.S. state governments that have adopted 'little NEPAs', i.e., state laws imposing EIS requirements for particular state actions. In particular, California, Montana, Washington, B.C., Massachusetts, and New York have a comprehensive approach on EIA covering public and private actions that affect the environment.

NEPA does not contain an explicit legal requirement to describe and assess extraordinary risks in EIS, but States are allowed to adopt regional EIS regulations that go beyond the minimum requirements of NEPA.

[4] In the USA, the term "EIS" is usually used instead of "EIA".

2.2 Relevant guidelines

The existence of requirements for risk assessment and management in EIA legislation and the EIA-related regulatory framework is an important prerequisite for the integration of risk-based consideration into EIA practice. However, on account of a several reasons legislative provisions are not sufficient to ensure good practice. In the first place, implementation deficits are due to occur at various stages of the process of implementing, applying and enforcing legislation. Second, stakeholders that are addressed by laws need to be supplied with the capacity to apply legal provisions and with the knowledge on how to do it. Third, advice and recommendation is often needed to explain, interpret and detail regulations, and supporting information facilitates good application of legal provisions by stakeholders involved in implementation of laws beyond the minimum requirements contained in legislation.

Guidance on good application of laws tackles these problems and offers the opportunity to give recommendations exceeding legal obligations. Besides, non-regulatory, indicative approaches are often more readily accepted by stakeholders than statutory provisions, and may thus often be more effective in influencing practical and cognitive behaviour of stakeholders.

As part of the desk research, relevant guidance documents on EIA on the European and national/sub-national level have been gathered, screened and reviewed with regard to contents relevant to risk assessment in EIA.

2.2.1 European level

2.2.1.1 Guidance on EIA

The European Commission has published a series of guidance materials on EIA:

- Guidance on EIA: Screening (EC, 2001a)
- Guidance on EIA: Scoping (EC, 2001b)
- Guidance on EIA: EIS review (EC, 2001c)
- Guidance for the assessment of indirect and cumulative impacts as well as impact interactions (EC, 1999)

The three pieces of guidance for screening, scoping and EIS review have been prepared by Environmental Resources Management (ERM) under a research contract with the Directorate General for Environment of the European Commission. They are designed principally for use by competent authorities, developers and EIA practitioners in the European Union Member States and Accession Countries. The guidance booklets have been designed to be useful across Europe. They cannot reflect all the specific requirements and practice of EIA in different countries. They also cannot substitute for Member State guidance on EIA which should always be referred to first (EC, 2001a, 2001b, 2001c).

Basically, all three guidance books consist of checklists to be applied in the respective stages of the EIA process. Explicit references to the consideration of extraordinary risks are made repeatedly in all three checklists. The quotations presented below are examples that highlight the wide understanding of risk that is expressed in EC's guidance; the quoted examples are not exhaustive.

Both the screening and scoping checklists make reference to the exposure of the project to natural hazards, disasters, or abnormal natural conditions:

> *"Is the project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions, e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?"* (EC, 2001a, 2001b).

The scoping checklist emphasizes that that effects may occur just temporarily as a result of a abnormal events (underlined terms transposed from publication) :

> *"Users should also remember that effects can occur not only permanently and over the long term but also temporarily (…) or may occur only intermittently, for example (…) as a result of abnormal events affecting the project (accidents, freak weather conditions, earthquakes, etc.)"* (EC, 2001b).

Both the screening and scoping checklists refer to the risk of accidents. In addition, the scoping checklist continues with a list of follow-up questions that details various risk sources and that, remarkably, is all-inclusive because it makes reference to "*any other causes*" of risks:

> *"Will there be any risk of accidents during construction or operation of the project which could affect human health or the environment?"* (EC, 2001a, 2001b)
> – *From explosions, spillages, fires etc., from storage, handling, use or production of hazardous or toxic substances?*
> – *From events beyond the limits of normal environmental protection e.g. failure of pollution control systems?*
> – *From any other causes?*
> – *Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslip, etc.)?* (EC, 2001b)

Under "description of the project", the checklist for EIS review contains a number of questions related to risk of accidents and hazards that shall be dealt with in an EIS, when relevant. A further question recommends checking the EIS for risk prevention and response measures:

> *"Risk of accidents and hazards:*
> *Are any risks associated with the project discussed?*
> – *risks from handling of hazardous materials*
> – *risks from spills, fire, explosion*
> – *risks of traffic accidents*
> – *risks from breakdown or failure of processes or facilities*
> – *risks from exposure of the project to natural disasters (earthquake, flood, landslip, etc.) (EC, 2001c).*
>
> *Are measures to prevent and respond to accidents and abnormal events described?"* (EC, 2001c).

According to the EC EIS review checklist, all categories of extraordinary risks are relevant to the "*prediction of secondary, temporary, short term, permanent, long term, accidental, indirect, cumulative effects*" in the EIS:

> *"Are effects which could result from accidents, abnormal events or exposure of the project to natural or man-made disasters described and where appropriate quantified?"* (EC, 2001c).

Furthermore, all three checklists make explicit references to the assessment of human health effects, including "health risks arising from major hazards associated with the project" (EC, 2001c).

Besides mentioning public health impacts, the checklists are also remarkably explicit and detailed in including questions related to various types of major social and socio-economic impacts, including, e.g., changes in social structure, social groups, resettlement of people, in-migration of new residents, increased demands on local facilities or services (housing, education etc.), employment and quality of employment, community cohesion and identity, individual's sense of personal security, minority rights, vulnerable social groups, etc.

The Guidance for the assessment of indirect and cumulative impacts as well as impact interactions (EC, 1999) is meant to assist the application of all EC Directives that require environmental assessment, including the EIA and IPPC Directives. The issue of abnormal risks is not mentioned explicitly therein.

EC's guidance on EIA (2001a, 2001b, 2001c) reflects a wide concept of risk in the EIA context. It highlights that the Commission's understanding of the scope of the EIA Directive in terms of coverage of extraordinary risks is a comprehensive and broad one. The guidance materials demonstrate that good application of the Directive that is in compliance with the interpretation of the Commission should cover most of the hazard categories and risk types that are of interest in the given report in the major stages of the EIA process (screening, scoping, EIS): natural hazards, internal accidents with various causes, exposure to external accidents. Only sabotage is not mentioned explicitly. Also, effects of abnormal events on human health and all relevant environmental receptors should be considered and, where appropriate, quantified. Moreover, guidance recommends addressing various categories of major social and economic impacts in EIA.

2.2.2 National and sub-national level

2.2.2.1 EU Member States

Review of national guidance focused on relevant documents that were available in languages accessible to the (IMP)3 project team. Therefore, the set of national documents screened and reviewed is by no means exhaustive. Country-specific examples are used to illustrate and highlight major findings, and are not meant to be exhaustive, either. A list of the guidance documents reviewed is to be found in chapter 6.2.

Austria

All of the Austrian guidance documents having been reviewed contain explicit and repeated recommendations to address various hazard categories and risk types in different stages of the EIA process (screening, EIS, EIS review). The risk concept expressed is wide and comprehensive and

covers natural hazards, accidents and different degrees of abnormal modes of operation that should be taken into account in each technical part of the EIS. It is recommended that adverse consequences on human health, all relevant components of the receiving environment and workplace safety shall be considered. References to the vulnerability and damage potential of the project environment are made. Social impacts are addressed by indicating that broader issues of human wellbeing are relevant to EIA. However, apart from checklists no guidance on methods and on how to apply risk assessment in EIA is provided. There is no specific guidance on risk assessment in EIA in Austria.

In the Austrian ***Guidance on Environmental Impact Statements: Technical aspects*** *(UVE-Leitfaden: fachliche Aspekte)* it is in recommended in principle to divide the description of a project into construction phase, operation phase and accidents/abnormal operating conditions. Abnormal conditions should be considered in each technical chapter of the EIS. The description of the project should include accident scenarios. A detailed description and assessment of accidents (kind of accident, potential causes, detection, possible consequences, avoidance, containment or counter-measures) should be done as part of description of the safety management. For identified accident scenarios expected emissions should be indicated. Impacts of accidents on components of the receiving environment should be considered as part of impact prediction, whenever relevant. Accidents are understood as special cases of the operating phase of a project. Significant effects due to accidents shall be described and assessed in the same way as the effects of a project during normal modes of operation, even if the probability of accidents occurring is low. Consequences on all subjects of protection should be covered in EIS. If no impacts from accidents are expected, this assumption has to be justified. Impacts of projects on natural hazards pre-existent on the site (e.g. avalanches, torrents, floodings, debris flows, landslides, rockfall) shall be taken into account, in particular with regard to human safety, infrastructure, and material assets. Natural hazards shall be a criterion for defining the area of investigation. Also, inferences of projects with natural protective functions, e.g. the protective function of forests, should be considered. If relevant, risks of soil erosion shall be assessed. Human health and workplace safety are explicitly addressed. A reference to dealing with accidents in conjunction with the Seveso II Directive is provided.

Some explicit definitions of risk-relevant terms are provided. 'Accidents' are defined as

> *"(...) unforeseen incidents which cause disturbances of, or deviations from, normal operation and cause effects on the environment"*.

With reference to the 'Trade and Industry Code', 1994, as amended, a 'serious accident' is defined as

> *"(...) an incident occurring due to uncontrolled processes within an installation (fire, emissions, explosions), and that directly or subsequently leads, on-site or off-site, to a serious hazard to human health or the environment, in which one or more dangerous substances are involved".*

The ***Checklist for Environmental Impact Statements*** *(Checkliste für Umweltverträglichkeits-erklärungen)* is a checklist for EIS review. Among the criteria for the description and assessment of expected significant impacts on the environment, the following items are included:

- *"Have effects been considered that may occur in cases of disturbances of normal operation (e. g., due to technological failure or exceptional environmental conditions, such as floods), events of fault and emergency situations?"*

– *"If hazardous incidents with severe environmental damage cannot be excluded, has an estimation of the probability of these incidents and their potential consequences been provided?"*

Making reference to the Ordinance on Accidents, which is not in force any more, the criteria to be applied to mitigation measures include:

– *"Does the EIS include information on measures for containment or avoidance of accidents, in order to avoid or mitigate significant adverse consequences to the environment (Has a safety analysis according to the ordinance on accidents been submitted?)."*

A ***Circular on the Application of the Federal EIA Act*** *(Rundschreiben zur Durchführung des UVP-G 2000)* provides guidance in particular to authorities on how to interpret and implement the EIA Act. In accordance with the Act, 'risk of accidents' is mentioned as a criterion in case-by-case examinations. Effects on human health are explicitly included in the definition of environmental impacts; here, the Circular is more explicit than the Act itself, which refers more broadly to effects on human beings in general.

According to the EIA Act, the ***Guidance on case-by-case examinations*** *(Leitfaden Einzelfallprüfung)* points out that risks of accidents have to be considered in screening as part of characteristics of the project. The document also makes reference to vulnerability and damage potential of the project environment, albeit without using these terms explicitly: In sensitive areas, which include settlement areas, a case-by-case examination shall be conducted for certain project types. This is justified by protection of human health and quality of life. Also, accidents close to human settlements should be considered. In general, population densities of settlement areas should be considered as a criterion for sensitivity of the project location. In particular case-by-case examinations of certain project types in the alpine region should consider natural hazards, such as threats of avalanches, landslides, rockfall, etc.

The probability of effects is a criterion for determination of the significance of potential effects. Here, a differentiation is made between effects with high probability of occurrence (e.g., emissions during normal operation) and more or less unlikely effects, e.g. accidents or non-standard operating conditions.

No particular method of assessing risks is presented, but general qualitative methods are recommended to conduct case-by-case screenings, including: expert judgements; checklists for significance of impacts; and a set of matrices to estimate magnitude of impacts, sensitivity of the environment affected, and significance of impacts (by linking the former two matrices).

Several guidance documents for certain classes of project types exist, among them one for accident-prone project types. ***Guidance on EIA for trade and leisure facilities, industrial and business parks: EIS, case-by-case examination*** (Leitfaden UVP für Handels- und Freizeiteinrichtungen, Industrie- und Gewerbeparks) provides explicit recommendations to consider risk of accidents and natural hazards, and to take into account effects of potential accidents (fire, explosion, leakage, traffic accidents, etc.) and abnormal modes of operation in both construction and operation phases, where this is relevant. The description of the project in the EIS shall include information on possible accident-scenarios and disturbances of operation, information on safety-relevant substances and project components, sources of hazards, and preconditions for occurrence of events of fault. Information on flood and other safety and protection measures and

on storage of hazardous substances shall be supplied. Emissions into the air in case of fires should be described. Natural hazards (mountain torrents, floods, avalanches, rockfall etc.) shall be described and resulting threats to humans in consequence of the project should be covered. Measures for avoidance and limitation of accidents shall be taken, including alarm and fire protection plans. Examples for safety-related risk management measures, with special regard to human beings, are given that cover: sufficient protection from natural hazards, fire protection, safety from traffic accidents, access for emergency vehicles, workplace safety. Assessment of impacts on human beings (health, wellbeing) shall include emissions (air pollutants, noise, odour, light, radiation, heat, vibrancies etc.), including in cases of accidents and abnormal modes of operation. For assessment of interactions and cumulative effects, a matrix is recommended that explicitly includes cases of accident and events of fault.

Czech Republic

General guidance on EIA in the Czech Republic recommends considering the risk of accidents in screening procedures. Apart from providing a checklist, it does not give any further procedural or methodological guidance on how to assess risk of accidents. In practice, the US EPA model of health risk assessment has been established as best practice for all projects.

Guidelines on Environmental Impact Assessment in the Czech Republic (Schrader et al., 2004) have been elaborated in 2004 in the frame of the Twinning Project CZ/2002/IB/EN/02 on Implementation of the Council Directive on Environmental Impact assessment. Risk-relevant aspects mainly focus on the assessment of risks of accidents in screening procedures. Risk-relevant terms and concepts like hazard, risk and risk assessment have been not defined or elaborated further. The recommended method to consider accidents in screening is a form of checklist. The guideline also suggests carrying out a health risk assessment, but does not provide any detailed guidance on how to perform it.

However, in practice a methodical procedure for health risk assessment in the Czech Republic has been developed and adopted in the EIA process. The health risk assessment process follows the four-step US EPA model, which consists of: risk identification, assessment of the dose-effect relationship, exposure assessment and risk characterisation. Health risk assessment is required routinely for all kinds of projects.

France

French ***Guidance on preparation of the Impact Study*** *(L'étude d'impact sur l'environnement)* states that risks of accidents, their potential consequences, and preventive measures shall be included in the EIS. The concept of 'risk of accidents' includes technological and natural risks as well as risks from the existence of dangerous installations in the surroundings. Regarding potential receptors of hazards released by accidents, the focus appears to be on risks to human health and safety, including occupational health and safety:

> *"The impact study must take into account a wide range of environmental concerns. As a prospective analysis, there will be an analysis of the risks of accidents likely to affect the safety of the residents and the users of the equipments achieved. This concerns natural and technological risks resulting from the building, the implementation and the maintenance of a project. But it also concerns risks revealing, for the project, the existence of dangerous*

installations in its surroundings. The study will present the nature and the scope of the consequences that an accident could trigger and will present the measures aiming at reducing its probability or the effects."

Among the four general principles that are to be applied to environmental assessment, particularly three principles may be relevant to a risk-based approach in EIA:

- *"The precautionary principle: The absence of certainty, taking into account the present scientific and technical knowledge, should not impair efficient and suitable measures to be adopted if they aim at preventing serious and irreversible damage from occurring to the environment at an acceptable economic cost;*
- *The principle of preventive action*

(...)

- *The principle of participation: Every citizen has the right to get information related to the environment including the information related to hazardous substances and activities."*

Germany

Mainly one guidance document that is valid on a national level has been reviewed in Germany, namely the ***Guidance on case-by-case examinations in screening decisions*** *(Leitfaden zur Vorprüfung des Einzelfalls im Rahmen der Feststellung der UVP-Pflicht von Projekten)*. Basically, the application of risk of accidents, in particular concerning used substances and technologies, in case-by-case examinations is replicated from the Federal EIA Act and the EIA Directive. No further category of risk that should be considered in the screening stage is mentioned. An implicit reference to vulnerability of the location to hazards is made by highlighting the requirement of the EIA Act that areas with high population density are a criterion in case-by-case examinations.

Support for execution of the Statutory Order on Hazardous Incidents *(Vollzugshilfe zur Störfallverordnung)* provides comprehensive guidance for projects under the regime of the Federal Immission Control Act (cf. chapter 2.1.2). It is relevant for projects that require EIA and at the same time are subject to the Statutory Order. The document has originally been intended to be enacted as General Administrative Guideline for the Statutory Order on Hazardous Incidents, but did not pass the parliament. Instead, it has recently been published as guidance.

Latvia

In the Latvia, part of the ***Guidance on Environmental Impact Assessment*** *(Letekmes uz vidi Novertejusms)* deals with risk analyses. However, no further statements can be made because the document is not available in accessible language.

Poland

Guidance on EIA in Poland recommends considering mainly risks posed by natural hazards in screening procedures. Effects on human health and damage to material assets are referred to.

Annex II of the ***Handbook on Environmental Impact Assessment Procedure in Poland*** (Wiszniewska et al., 2000) presents supplementary registers of impacts which should be used during the screening stage. Among the questions that should be considered in estimating the likely impacts of projects on local environmental conditions, in particular one question refers to natural hazards:

> *"Is the project location characterized by an increased risk of sedimentation, sliding, erosion, floods, extreme or harmful climatic conditions, e.g. temperature inversion, fogs, or turbulent winds, due to which the project may cause environmental problems?"*

To identify possible significant impacts of the project on the environment and to determine their magnitude and significance, a checklist is provided. The checklist requires brief verbal descriptions of impacts and justification of their significance.

Portugal

Portaria 330/2001, which is an official document supporting the implementation of Portuguese EIA regulations, in one paragraph makes broad and rather imprecise reference to "*environmental hazards associated to the project*" (cf. chapter 2.1.1). Although being an official document with legal relevance, its binding effects in legal terms are limited. Apart from that, no explicit recommendations on applying risk assessment to EIA appear to exist.

Slovakia

In the Slovak Republic, several methodical manuals provide guidance on EIA for specific project types (chemical technologies, landfills and waste management installations, settling pits, incineration plants, and others). As these project types bear an increased risk potential, particular emphasis of the guidelines is placed on risk-related issues. It is advised that human health risk assessment should be included in EIA for the respective projects. The four-step risk assessment model according to the US EPA approach is recommended, which comprises the key steps of risk identification, dose-effect analysis, exposure assessment and risk characterization (cf. chapter 1.3.1.5). However, the manuals tend to focus on air pollution and chemical hazards and do not provide detailed guidance on the technical procedure that should be used to assess health impacts. All manuals of the set of guidebooks recommend considering internal accidents due to technological failure and accidents in other existing installations. In terms of receptors and nature of consequences, human health impacts are focused on. In some of the manuals, an indicative list of positive and negative examples of socio – economic impacts is presented, but no technical guidance on their assessment is provided.

In contrast to the Czech Republic, health risk assessment is not obligatory for the EIA process in Slovakia, and in practice it has been carried out only for selected high risk projects (e.g. incineration plants, chemical technologies).

The scope of ***EIA guidance for chemical technology*** comprises mainly nuclear power plants, major chemical and petrochemical installations, and metallurgical complexes. The focus is on accidents in the submitted project due to technological failure, accidents in other existing installations, and risks to human health. Health risk assessment and ecological risk assessment are introduced and key steps of the assessment process are indicated, but the manual does not set

out a precise technical procedure. However, a good practice example is presented that describes the procedure of health risk assessment and the HAZOP (Hazard Operability Studies) method for safety risk assessment as applied to a chemical establishment. It is recommended to involve risk assessment experts in the EIA process.

The focus of ***EIA guidance for waste incineration installations*** is on human health risks and risks of internal and external accidents. A four-step risk assessment process is recommended (1. hazard identification, 2. dose – effect analysis, 3. exposure assessment, and 4. risk characterization).

In addition, general ***Methodical Guidelines for the Risk Assessment and Management Procedure*** exist in Slovakia. They define general principles for assessment and management of risks to public health and the environment. Again following the procedures used by US EPA, the guidelines describe a four-step process of health risk assessment and a three-step process of ecological risk assessment (1. hazard identification, 2. exposure – response assessment, and 3. risk characterization).

Sweden

No explicit references to risk assessment could be identified in Swedish Guidance on EIA. However, though not particularly aiming at EIA, the ***Ordinance concerning Environmentally Hazardous Activities and the Protection of Public Health*** *(1998:899)*, regarding chapter 9 of the Swedish Environmental Code, contains some more specific guidance on environmental risk assessment. In the Ordinance, activities, that must be environmentally reported or require authorization are listed. Environmentally hazardous activities are defined through a list of activities or through hazardous substances involved in the activity (via threshold values).

The concept of environmental risk applied in the Ordinance is defined through “environmentally hazardous activities”:

- *"the discharge of wastewater, solid matter or gas from land, buildings or structures onto land or into water areas or groundwater;*
- *any use of land, buildings or structures that entails a risk of detriment to human health or the environment due to discharges or emissions (...); or*
- *any use of land, buildings or structures that may cause a detriment to the surroundings due to noise, vibration, light, ionizing or non-ionizing radiation or similar impacts".*

Health and environmental risks at a contaminated site are related to the hazards posed by pollutants, levels of the pollutants in question, their migration potential, the site’s sensitivity and its protection value. These factors provide the basis of a four-level scale to evaluate risk, comprising the grades: very great risk, great risk, moderate risk, slight risk.

More detailed guidelines for contaminated sites assessment are provided in the printed report on environmental quality criteria for contaminated sites, which is now in press.

The Swedish National Board of Health and Welfare (2001) suggests a three-step model for assessing health impacts in EIA:

- Describe the activities with focus on human health
- Describe the environment
- Describe the influence on human health

United Kingdom

In the UK, the EIA Directive has been implemented through a large number of basic sets of different regulations, plus a number of amending regulations and associated measures. Sectoral EIA regulations have been issued for project types outside the scope of the planning system. In addition, regional legislation implementing the EIA directive exists in England and Wales, Scotland, and Northern Ireland, albeit the content of many regulations is similar in material respects. Reflecting the differentiated legal EIA system, also a large number of guidance documents have been published in the UK, many of them for project types under subject specific regulations.

The UK's official opinion on the issue of extraordinary risks in EIA is clearly expressed by respective references in its general guidance. These references state that risk of accidents is neither within the scope of the EIA Directive nor is it directly within that of domestic EIA regulations. However, in cases where significant risks exist, it is recommended that the EIS should indicate preventive measures. Coverage of risks in guidance on EIA is mainly restricted to risk of accidents, and a risk management rather than a risk assessment approach is indicated. While coordination between EIA and other licensing procedures is encouraged, building in particular on the advisory role of the Health and Safety Executive (HSE), it is also put straight that EIA and procedures under the IPPC and Seveso II Directive are independent regimes. Specific guidance on risk assessment in EIA could not be identified, but according to (IMP)3 interviews and questionnaire results with government officials, research on this issue is said to be under way. However, a number of unspecific guidance documents on environmental risk assessment in environmental planning do exist (e.g., DOE, 1995; DEFRA, 2000).

The guidance document ***Environmental Impact Assessment: Guide to procedures***, which is intended primarily for developers and their advisers, explains how EC requirements for the environmental impact assessment of major projects have been incorporated into consent procedures in the UK. Appendix 5 contains a checklist of matters to be considered for inclusion in environmental statements (EIS). In section 5 of the appendix on the "risk of accidents and hazardous development", the UK's official position towards the coverage of risk of accidents in EIA is pointed out:

> *"5.1 Risk of accidents as such is not covered in the EIA Directive or, consequently, in the implementing Regulations. However, when the proposed development involves materials that could be harmful to the environment (including people) in the event of an accident, the environmental statement should include an indication of the preventive measures that will be adopted so that such an occurrence is not likely to have a significant effect. This could, where appropriate, include reference to compliance with Health and Safety legislation.*

5.2 There are separate arrangements in force relating to the keeping or use of hazardous substances and the Health and Safety Executive provides local planning authorities with expert advice about risk assessment on any planning application involving a hazardous installation.

5.3 Nevertheless, it is desirable that, wherever possible, the risk of accidents and the general environmental effects of developments should be considered together, and developers and planning authorities should bear this in mind" (ODPM, 2006a: Appendix 5, Section 5).

As one of three criteria for determining significance of effects in screening decisions, the guide suggests:

"developments with unusually complex and potentially hazardous environmental effects" (ODPM, 2006a: item 12 iii)

Furthermore, developers are recommended to take care of efficient coordination of EIA with other procedures by considering at an early stage whether an assessment of environmental effects may also be required under another European Community Directive, such as the IPPC Directive or the Seveso II Directive.

"Although the requirements of these [other Directives] and of the EIA Directive are all independent of each other, there are clearly links between them. Where more than one regime applies, developers could save unnecessary time and effort if they identify and co-ordinate the different assessments required" (ODPM, 2006a: para. 35).

Advice on the links between the EIA system and the IPPC authorisation system is provided in PPG 23 on Planning and Pollution Control.

A reference to consideration of socio-economic impacts is made by advising to take into account the "*change in population arising from the development, and consequential environment effects*."

Touching also on the coordination between EIA and IPPC procedures, ***DETR Circular 2/99*** states that the EIA regulations do not alter the relationship between authorities' planning responsibilities and other pollution control bodies under pollution control legislation, but that they do strengthen the need for appropriate consultations with the relevant bodies.

Using wordings and arguments very similar to the Guide on Procedures, ***Planning Advice Note PAN 58: Environmental Impact Assessment*** (Scottish Executive Development Department, 1999) suggests, amongst others, the following question for EIS review:

"Risks and Hazardous Development: Have any risks or hazards been identified and if so what preventative measures are proposed?" (Scottish Executive Development Department, 1999: appendix 5, section 5).

PAN 58 encourages inclusion or attachment of information produced for EIA to the application for IPPC permit. The Health and Safety Executive (HSE) is identified as a "consultation body" responsible for accident-prone developments: hazardous installations; Control of Major Accident Hazard Regulations (COMAH) sites; licensed explosives factories, magazines and ports; licensed nuclear sites.

2.2.2.2 Non-EU countries

Canada

A large number of guidance materials on EIA are available in Canada; on a national level, these are issued by the Canadian Environmental Assessment Agency.

In the guidance document **Canadian Environmental Assessment Act: An overview** (Canadian Environmental Assessment Agency, 2003), one of the benefits justifying EIA that is identified is:

> *"minimized risks of environmental disasters"* (CEAA, 1999).

The ***Reference Guide: Determining Whether A Project is Likely to Cause Significant Adverse Environmental Effects*** (CEAA, 1994) points out that the concept of "environmental effects" of the Canadian Environmental Assessment Act comprise not only changes to environment caused by the project, but also "*any change to the project that may be caused by the environment*" (CEAA, 1992). This implies that:

> *"Potential effects of the environment on the project must be examined using the same criteria for significance as used in the assessment of effects of the project on the environment"* (CEAA, 1994).

This concept of environmental effects is more comprehensive than that of many European EIA legislations. It implies that effects of natural hazards on a proposed project are explicitly within the scope of EIA.

Moreover, if risks of adverse socio-economic, cultural and socio-cultural impacts are caused by a change in the environment, which is in turn caused by the project, then these impacts are also covered by the EIA system (CEEA, 1994).

The Guide introduces quantitative risk assessment as an often used method to determine the significance of adverse consequences, in particular of human health risks, by determining "acceptable" levels of risk, provided that quantitative risk assessment is applied to risk agents, such as ionizing radiation or carcinogenic chemicals, that have predictable dose-response, or exposure-effect, relationships. As well as determining significance, quantitative risk assessment is also described as an often used method to determine the probability of occurrence of significant environmental effects, i.e., likelihood (CEEA, 1994).

Apart from EIA, environmental risk assessment methods, including such for ecological and health risk assessment, have been developed and published for various applications, such as contaminated site risk assessment and agent-specific health risk assessments.

Canada is also advanced in health impact assessment (HIA), and it was one of the first countries in the world to develop a standardised national approach to HIA (Kwiatkowski, 2004). A task force on HIA was established in 1995 in order to better address health aspects within EIA, to increase awareness about HIA and EIA as well as on the linkages between human health and the environment, and to provide a more systematic approach to HIA. The key guidance for HIA in Canada is the ***Canadian handbook on health impact assessment*** (Health Canada, 1999).

USA

The US National Environmental Policy Act (NEPA) does not contain an explicit legal requirement to describe and assess extraordinary risks in EIS. Guidelines that deal with risk assessment have been developed on regional level in some States, which are allowed to go beyond the minimum requirements set by NEPA. However, no specific guidance on applying risk assessment in EIS could be identified.

However, the USA are probably the most advanced country in terms of developing and applying environmental risk assessment methodology, including in particular ecological risk assessment. US EPA has published comprehensive sets of guidelines for various applications of environmental risk assessment, including the following selections of basic guidance on health and ecological risk assessment:

- Guidelines for Carcinogen Risk Assessment,
- Guidelines for Chemical Mixtures Risk Assessment,
- Guidelines for Ecological Risk Assessment,
- Guidelines for Neurotoxicity Risk Assessment,
- Guidelines for Reproductive Toxicity Risk Assessment,
- Guidelines for Exposure Assessment,
- Guidelines for Developmental Toxicity Risk Assessment,
- Guidelines for Mutagenicity Risk Assessment,
- Guidelines for Exposure Assessment,
- Guidance on Cumulative Risk Assessment,
- Radiation Risk Assessment Guidance.

Most commitments to perform risk-based studies result from requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which is a central part of the legislative framework for environmental protection and also known as Superfund. A series of manuals for risk based approaches to contaminated sites assessment and management under CERCLA is available.

Risk assessment has also been promoted politically as an instrument to make environmental policy more effective and cost-efficient. In recent years, several bills have been introduced by the U.S. Congress mandating that agencies use risk assessment to set priorities and budgets (e.g., Environmental Risk Reduction Act) (Sunstein, 2002).

2.3 Experiences from previous research

2.3.1 EC evaluation of the implementation of the EIA directive in MS

The last **five-year review** of the European Commission on the implementation of EIA in the Member State has revealed a number of shortcomings and weaknesses regarding the application of risk assessment in EIA practice. In particular, the report indicated the following inconsistencies between Member States (EC, 2003a: pp. 84-86):

- Risk is dealt with in a wide variety of ways across Member States, in particular with regard to:
  - presence of explicit legal obligations to consider likely significant effects of hazardous incidents,
  - coverage of hazard categories,
  - coverage of project types to which risk assessment is being applied,
  - depth, intensity and detailedness with which risk assessment is being conducted,
  - application of risk assessment techniques and methods,
  - standards and procedures of risk assessment.
- Risk assessment is often seen as separate from the EIA process and applied under other environmental control regimes, which often leads to:
  - a lack of co-ordination,
  - possible duplication of work,
  - patchiness in national coverage of risk-relevant activities.

The main findings of the five-year report were summarized as follows:

> "*Risk is dealt with in a wide variety of ways and at very different levels across the EU, partly in response to the variety of geographical, geological, climate and other conditions. Risk is a screening criteria in Annex III and risk assessments appear in many EIS and yet for most Member States risk is seen as separate from the EIA process as it is often handled by control regimes to which the EIA Directive is not applied. Relationships between EIA and national environmental control regimes are complex and there appears to be little real co-ordination between the EIA Directive and other Directives such as IPPC and the Habitats Directive*" (EC, 2003a: p. 86).

2.3.2 Existing evaluation studies on national/regional level

Among the empirical evaluations of EIA performance on national or sub-national level, only one could be identified that has investigated the consideration of extraordinary risks in EIA.

Focussing on the German EIA system, Wende (1998) has examined the consideration of environmental effects caused by hazardous incidents in EIA. The study contains the results of a case study based on a limited sample size. While the focus of the study is on various degrees of accidents, comprising disturbances of operation ("near misses"), potentially hazardous events of fault and accidents causing actual damage, a sample of 10 German and one Dutch case studies has also been examined as to the extent various extraordinary hazards that could act as causes of

'accidents', i.e. as risk sources, have been considered in the EISs. Relying on detailed review of the EIS documents, the main results of the empirical study imply that abnormal hazards have been considered only to a very modest extent.

Of nine cases where natural hazards were relevant, they were assessed only in one case and recognized as relevant, but not assessed in another case. Fatigue of material (technological failure) was assessed in three cases and recognized in one further case of 11 cases where it would have been relevant. Human failure as a potential cause of accidents was assessed in two cases and recognized in two further cases of 10 cases where it would have been relevant. Sabotage was assessed in only one case and recognized in three further cases of 11 cases where it would have been relevant. There was only one case where all of the mentioned hazards where actually assessed, and another case where two hazard types were deliberately addressed (Figure 27). Wende (1998) concludes that hazards have only seldom been investigated sufficiently. In most cases they are only mentioned briefly, without understanding them as the starting point of assessing accident scenarios. It is worth mentioning that out of 80 German EISs that have been further screened for consideration of accident effects, in only nine cases EIS authors had actually recognized risks as being within the scope of EIA.

Requirements for consideration of accident effects	Waste processing/ Welsen	Waste incineration/ Stapelfeld	Recycling of residual materials/ Seelze	Landfill/ Dresden	Sewage processing/ Weiße-Elster	Sewge treatment plant/ Grevenbroich-Noith.	Airport/ Berlin-Brandenburg-Intern.	Airport/ Schiphol Amsterdam, Netherlands	Natural gas pipeline/ Folmhusen-Wardenb.	Commercial transport centre/ Osnabrück	110kV powerline/ Emden-Rysum
Potential causes											
Fatigue of material	N	N	N	A	A	N	A	N	R	N	N
Human failure	N	N	R	N	A	N	A	N	n.r.	N	R
Planning/constructional defects	N	N	N	N	A	N	N	N	R	N	N
Sabotage	R	N	N	N	A	R	N	N	N	N	R
Natural hazards	N	N	N	n.r.	A	n.r.	N	N	N	N	R
Anthropogenic earthquakes	N	N	N	n.r.	N	N	n.r.	n.r.	N	N	N

Legend: **A** … aspect assessed; **R** … aspect recognized; **N** … aspect not considered; n.r. …aspect not relevant

Figure 27 Consideration of risk sources in EISs of 11 case studies (Wende, 1998).

The reviewed case studies suffered from a number of methodological shortcomings, including:

- a lack of systematic approaches;
- the consideration of the adverse consequences of potential accidents is restricted on human health effects, whereas effects on other biotic components of the receiving environment are largely neglected;
- while sources and probabilities of accidents may be analysed, their environmental impacts are often not assessed;

- potential effects of hazardous events are often described only in a qualitative way; often no probabilistic analyses of serious risks are undertaken (Wende, 1998)

2.3.3 Further literature

Only a few further publications have been identified that have explicitly dealt with the application of risk assessment and EIA. Given the wealth on literature that exists in both fields, the paucity of publications dealing with the relationship between EIA and risk assessment is surprising.

Each of the following handbooks on EIA contains a separate chapter on risk assessment:

- ADB (Asian Development Bank) (1997): Risk and uncertainty in EIA. – In: Lohani, B.N. et al. (1997): EIA for Developing Countries in Asia, Volume 1, Overview: 5-1 – 5-45. Asian Development Bank, Manila.
- Brookes, A. (2001): Shared and integrative methods: Environmental risk assessment and risk management. In: Morris, P. & Therivel, R. (2001): Methods of Environmental Impact Assessment. 2nd edition. Spon press, London: 351-364.
- Erickson, P.A. (1994): A practical guide to Environmental Impact Assessment. Academic press, San Diego, CA.
- Munier, N. (2004): Multicriteria environmental assessment: a practical guide. Kluwer Academic Publishers, Dordrecht.

2.4 Summary and conclusions

In this chapter, selected key findings of the desk study are summarized and some conclusions are drawn.

EU level

The ***EIA Directive*** – Council Directive 85/337/EEC as amended by Directive 97/11/EEC – is a key instrument of European Union environmental policy (EC, 2001c) and one of the principal pieces of European Union environmental legislation (EC, 2003a). As part of EU's wider environmental policy and territorial cohesion objectives, EIA shall contribute to achieving equal levels of environmental protection and safety of citizens across all Member States. This requires that the EIA Directive must be applied as consistently as possible across the EU as a whole. However, there is much evidence that considerable inconsistencies in implementing the Directive between Member States persist (EC, 1993a; 1997; 2003a).

The concept of risk is inherent to the EIA Directive, and EIA itself is rooted in a risk-based concept. But while the Directive explicitly refers to impacts under normal conditions and during routine operation of a proposed project, its scope with regard to extraordinary risks under non-standard conditions is much less clear. Close material interrelationships between the Directive and risk assessment do exist, and there is a number of arguments that suggest that consideration of extraordinary risks is within the material scope of the Directive. However, explicit and manifest reference to this issue is restricted to Annex III.1 to the Directive, which requires to apply "*the risk of accidents, having regard in particular to substances or technologies used*" to screening

decisions. No further explicit mentioning is made of extraordinary hazards or risks in the Directive, and there is no obligation to consider risk of accidents, or any other risk type, throughout the EIA process and in the EIS. Risk-related concepts like the hazard potential and the vulnerability (damage potential) of the project environment are implicitly touched upon in Annex III.2, but not mentioned directly. Therefore, on an explicitly verbalised level the concept of extraordinary risks in the Directive appears to be restricted to applying "*risk of accidents*" as a screening criterion.

The ***Seveso II Directive*** – Council Directive 96/82/EC on the Control of Major-Accident Hazards – was last amended in 2003 by Directive 2003/105/EC, responding to recent disastrous industrial accidents (Toulouse, Enschede). It aims at the prevention of major-accident hazards involving dangerous substances and at the limitation of the consequences of such accidents. Amongst others, the Directive requires operators of certain establishments and/or public authorities to establish a major-accident prevention policy, to prepare a safety report, to establish a safety management system, to prepare internal and external emergency plans, and to control land use planning in the vicinity of existing establishments. Risk of accidents is at the very center of the Directive. Nevertheless, the scope of the Directive is restricted in several respects – field of application, covered hazard categories and risk types, safety risk management approach instead of complete environmental risk assessment:

- it applies to a limited number of (large-scale) industrial project types involving hazardous chemical substances above defined volume threshold levels;
- important areas involving accident-prone project categories are excluded from the scope of the Seveso II Directive, including nuclear safety and the transport of dangerous substances;
- most of the more comprehensive risk prevention and management requirements apply only to upper tier establishments;
- it is restricted to technological risks involving dangerous substances, whereas other hazard categories and risk types are not explicitly covered;
- its focus is on safety hazard identification and on risk control measures, and much less on assessment of adverse environmental consequences.

The ***IPPC Directive*** – Council Directive 96/61/EC on Integrated Pollution Prevention and Control – sets out a framework of common rules on permitting for certain industrial installations. It pursues an integrated approach to pollution control, which aims at prevention of emissions into the environment wherever this is practicable, and where it is not, at minimizing emissions in order to achieve a high level of protection for the environment as a whole. The whole environmental performance of a plant and effects on the environment as a whole has to be taken into account. To achieve these aims, the Directive relies strongly on the concept of Best Available Techniques (BATs) and emission limit values based thereupon.

The IPPC Directive requires taking measures to prevent accidents and limit their consequences for the environment. Measures must relate also to conditions other than normal operating conditions. Thus, the risk concept reflected in the Directive focuses on accidents and abnormal modes of operation that might cause industrial installations to release increased emission levels. Environmental effects of such releases have to be assessed, but the Directive puts stronger emphasis on technological risk reduction measures through process optimization (BATs).

The ***SEA Directive*** – Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the Assessment of the Effects of certain Plans and Programmes on the Environment – shall ensure that an environmental assessment is carried out for certain plans and programmes, during their preparation and before their adoption, which are likely to have significant effects on the environment. Likewise to the EIA Directive, there are strong material interrelationships between its objectives and risk assessment. In Annex II, *"risks to human health or the environment"* and the "*vulnerability of the area likely to be affected"* are defined as criteria for determining the likely significance of effects. This risk concept is more inclusive and comprehensive than that of the EIA Directive because it is more explicit in going beyond "*risk of accidents*". Greiving (2004) has argued that the SEA Directive provides an appropriate procedural framework for the integration of the assessment and management of disaster risks.

All abovementioned Directives are highly relevant to the issue of risk assessment on project-level or on more strategic level. Regarding their ***interrelationship***, the fields of application and the material scopes of the four Directives have both overlaps and discrepancies. The EIA Directive has the broadest field of application and it essentially covers all the categories of projects likely to have significant effects on the environment. The focus of its scope is on prediction and evaluation of environmental impacts as well as on mitigation measures. The Seveso II and IPPC Directives are stronger biased towards a risk management approach, rather than an environmental risk assessment approach.

EC's guidance on EIA (2001a, 2001b, 2001c) reflects a wide concept of risk in the EIA context. It highlights that the Commission's understanding of the scope of the EIA Directive in terms of coverage of extraordinary risks is a comprehensive and broad one. In all three checklists, explicit references to the consideration of extraordinary risks are repeatedly made. It is recommended to consider impacts of various kinds of natural hazards and exceptional external conditions on the project, accidents and hazardous incidents during construction and operation, and exposure of projects to external accidents. Only sabotage is not mentioned explicitly. Effects of abnormal events on human health and all relevant environmental receptors should be considered and, where appropriate, quantified. The guidance materials demonstrate that good application of the Directive that is in compliance with the interpretation of the Commission should cover most of the hazard categories and risk types that are of interest to the given report during the major stages of the EIA process (screening, scoping, EIS, mitigation measures). Moreover, guidance recommends addressing various categories of major social and economic impacts in EIA, such as changes in social structure, resettlement of people, in-migration of new residents, employment and quality of employment, etc.

National level

A comparative analysis of ***national EIA legislations*** and closely interrelated regulations has been conducted along a number of key themes for the 10 Member States where in-depth expert interviews have been carried out.

Most countries have adopted the screening criterion 'risk of accidents' in an identical way from Annex III.1 to the EIA Directive. Only one Member State uses a wider risk concept that goes beyond the minimum requirements of the Directive. Basically three types of implementation could be identified:

- Type 1 – No case-by-case screening:
  In the EIA systems of two Member States (Portugal, France), no case-by-case examinations are in operation. Thus, the screening criteria of Annex III have not been transposed.
- Type 2 – Adoption of the risk concept in compliance with Annex III to the EIA Directive:
  Domestic EIA legislations of most Member States under consideration here (including Austria, Czech Republic, Germany, Latvia, UK) have adopted "*risk of accidents, having regard in particular to substances or technologies used*" as a screening criterion from Annex III.1, mostly literally or in very similar wordings.
- Type 3 – Implementation of an extended risk concept that exceeds requirements of Annex III to the EIA Directive:
  Only one Member State could be identified that has laid down a markedly wider concept of risk that exceeds the explicit requirement of the EIA Directive. In the Slovak Republic, *"other possible risks connected to implementation of an activity"* have to be considered in screening decisions in addition to *"risk of accidents"* (Annex 2a, Act No. 391/2000, Coll.).

An explicit reference to site related risk aspects, such as hazard potential, vulnerability, exposure to natural hazards, etc., has not been established in those screening criteria that relate to the environmental sensitivity of the project location in any of the Member States that have been reviewed.

In most of the sample countries, there is no legal requirement to consider extraordinary risks in EIA apart from risk of accidents in screening. In a smaller number of countries, relevant risks caused by non-standard modes of operation have to be identified, described and assessed throughout the EIA procedure, including in the EIS. In one Member State, such an obligation is missing in the national EIA act, but detailed in a binding sub-legal regulation. In two Member States, comparatively far-reaching requirements for risk assessment arise from applicable sectoral legislation, but these legal requirements do not apply to all projects subject to EIA, which might cause gaps in the coverage of potentially risk-relevant projects. Four types of implementation may be identified:

- Type 1 – Risk of accidents is a screening criterion, but no further obligatory legal requirement to consider extraordinary risks in the EIS and/or throughout the EIA process exists:
  In a number of Member States (Austria, Latvia, Poland, Sweden, UK), the consideration of risks in legislative EIA systems is to a predominant part restricted to risk of accidents being a statutory criterion in case-by-case screening. Apart from fulfilling that minimum requirement of the Directive, no further obligatory requirements for the consideration of extraordinary risks in other stages of the EIA procedure and/or in the EIS are stated explicitly in national EIA legislation (including Portugal).
- Type 2 – Risk of accidents has to be considered throughout the EIA process, including the EIS:
  In addition to risk of accidents being a screening criterion, the EIA acts of a few new Member States (Czech Republic, Slovakia) require consideration of environmental risks in

consequence of accidents and non-standard states of operation throughout the EIA procedures, including the EIS. A particular focus of EIA legislations in the respective countries is on risks to human health; in the Czech Republic, health risk assessment according to the four-step US EPA model is in practice standard for all projects types subject to EIA, regardless of project type or impact magnitude.

- Type 3 – Comprehensive requirements for risk assessment depend on applicable non-EIA legislation, with possible gaps in coverage of all potentially risk-relevant projects:
  In France, where EIA is not an independent procedure, but an integral part of other sectoral procedures, the strength and extent of legal requirements for risk assessment in EIA depend strongly on the applicability of relevant subject specific laws outside EIA legislation. For projects that are subject to classified installations regulations, both an Impact Study (EIS) and a Hazard Assessment Study [*étude les dangers*] have to be prepared. Classified installations amount to half of the projects for which an Impact Study (EIS) is prepared and include Seveso-type industrial installations.

- Type 4 – Requirements for risk assessment are detailed in sub-legal EIA regulations, and comprehensive additional requirements for risk assessment depend on applicable non-EIA legislation, with possible gaps in coverage of all potentially risk-relevant projects:
  There is no explicit obligation in the federal EIA Act to asses and describe the likely significant effects in case of an accident or under exceptional circumstances in Germany. However, in a binding sub-legal regulation the concept of 'impacts on the environment' is defined more closely in a wide manner so as to include various degrees of non-standard operation of a project. Thus, disturbances in operating conditions, hazardous incidents and accidents are explicitly within the scope of EIA and must be addressed in the EIS, as far as relevant. Moreover, as EIA in Germany is a dependent part of other procedures, more comprehensive requirements for risk assessment may arise from applicable sectoral laws. For all projects that are subject to EIA and that at the same time fall under the authorisation regime of the 12th Statutory Order on Hazardous Incidents, various extraordinary risk categories have to be considered, including internal accidents caused by technological and human failure, exposure of projects to external accidents and natural hazards, and sabotage.

The concepts of risk that have been incorporated into national EIA legislation and the closely related regulatory framework are in most cases narrow, albeit in compliance with the EIA Directive. Only in a few countries, risk concepts are markedly wider than in the Directive. In a small number of the countries, more comprehensive, more explicit and wider concepts occur in other applicable legislation closely interrelated to EIA. With very few notable exceptions, the risk-related terms used are rather vague and unspecific and no definitions are provided. Four types of legislative risk concepts may be identified in the sample countries:

- Type 1 – Restriction to risk of accidents:
  In the majority of the ten sample countries (including Austria, Latvia, Poland, Sweden, UK) explicitly stated references to the issue of extraordinary risks in national EIA regulations are restricted exclusively to the concept of risk of accidents within the proposed project.

- Type 2 – Extended concept of risk of accidents, covering various degrees of non-routine conditions:
  In few Member States (Germany, Czech Republic), the concept of 'risk of accidents' is

extended or more closely detailed in the national EIA Act or in supporting sub-legal regulations, so as to cover risks due to different degrees of non-routine conditions.

- Type 3 – No explicit restriction of hazard categories/risk types:
  In two Member States (Slovakia, Portugal), provisions can be identified that indicate that the risk concept is expanded beyond the 'risk of accidents', suggesting that also other possible risks are within the legal scope of EIA. However, such references in the EIA regulations of these countries are very scarce and not necessarily binding.

- Type 4 – Wider and more detailed concept of risk in EIA-related applicable legislation:
  The risk concept incorporated in the German Statutory Order on Hazardous Incidents covers a broad range of hazard/risk categories: internal accidents, external natural and man-made risks, and sabotage. Effects on (public) health, environmental compartments, and material assets are to be considered. Inclusive definitions of key terms are provided. The Statutory Order applies to a subset of all projects subject to EIA. The risk concept expressed in French 'classified installations' regulations is more narrow because it focuses mainly on technological risks (accidents) posed by industrial developments, but it is similarly broad in terms of potential receptors.

Relationships with risk assessment under procedures subject to other risk-relevant Directives are complex and multiform. The ways the IPPC and Seveso II Directives have been implemented in the 10 Member States are highly varied and diversified, as are the ways the licensing procedures under those Directives are organised in relation to EIA procedures. In general, models with a certain degree of integration of EIA procedures and IPPC/Seveso II procedures can be differentiated from models that practice separation of procedures. Requirements for risk assessment and risk management under the Seveso II and IPPC regimes are usually considerably stronger than under the EIA regime. A variety of further sectoral regulations related to project authorisation and that require risk assessment to a greater or lesser extent is in place in most Member States, often with an emphasis on safety risks. Frequent examples include separate legislations for nuclear projects and contaminated sites. Natural hazards appear to be much a matter of sectoral planning under specific laws. The following indicative patterns may be discriminated:

- Type 1 – Procedures integrated or coordinated to differing degrees:
  The Austrian EIA Act provides for a 'consolidated development consent procedure' that shall ensure material integration of EIA procedures with all other licensing procedures that are required under applicable subject specific laws, including procedures under the IPPC and Seveso II regimes. It also provides for a single procedure to fulfil the requirements of both the EIA and the IPPC Directives. Such formal linkages may facilitate, albeit not guarantee a certain degree of integration of risk-based considerations into final decision-making. In Germany, for projects requiring both, EIA and risk assessment/management according to the Federal Immission Control Act/12th Statutory Order on Hazardous Incidents, usually separate documents have to be submitted and parallel procedures exist, but one competent authority is in charge of approval. There is no explicit obligation to incorporate information produced under the requirements of the Statutory Order into the EIS, and reciprocally. The Hazard Assessment Study under the French classified installations regulations has to be submitted as a separate document along with the Impact Study (EIS). In both, Germany and France, rather than integrating the outcome of risk assessment and EIS by mutually incorporating relevant information in the respective documents, the risk assessment studies are mostly annexed to, or referenced by, the EIS.

For projects that require EIA and are not at the same time subject to risk-focussed other legislation, no or less extensive legal requirements for assessment and management of extraordinary risks exist.

- Type 2 – Independent procedures, but distinct risk management profile in procedures separate from EIA:
  There is no legal obligation to consider extraordinary risks in EIA in the UK (beyond screening), and most project related risk assessment work is done under legislation other than EIA. However, there are strong requirements for risk assessment by various regulations outside EIA; these are mainly requirements for safety risk assessments for industrial projects of the Seveso II type, but also for project types outside the Seveso II regime, such as nuclear installations. There is a wealth of experience in dealing with health and safety risk issues on part of competent authorities, which apply formalised risk reduction strategies, relying much on a risk management approach. Requirements under both the Seveso II Directive and the IPPC Directive are administered in licensing regimes independent from EIA. Coordination between EIA procedures and risk assessment under other control regimes has only a weak legal backup and is done mainly on an informal level through consultations between competent authorities. Due to discrepancies in the fields of application of relevant legislation under different Directives, gaps in risk assessment may occur for projects that are only subject to EIA, but are not at the same time subject to Seveso II or IPPC requirements.

- Type 3 – Sequence of separate consecutive procedures, with most risk assessment done subsequent to EIA:
  In a number of Member States (Czech Republic, Latvia, Poland, Slovakia, Portugal), both IPPC and Seveso II procedures are processes separate from EIA. Usually, more detailed risk assessments are undertaken under IPPC and Seveso II requirements. In general, the respective procedures follow a temporal sequential order. The general pattern is that EIA procedures are carried out first, and then IPPC and Seveso II procedures follow. For example, project-related licensing procedures in Slovakia are normally conducted in the following chronological order: SEA – EIA – Seveso II – IPPC. In all of the abovementioned countries is either required or advised that the output of the EIA process serves as an input for the IPPC/Seveso II process. This model may cause special coordination problems with particular regard to risk assessment. As the field of application of the three Directives in terms of project types is not identical, and most risk assessments in the given countries are not done in EIA, but in Seveso II/IPPC procedures subsequent to EIA, a considerable share of total projects that is only subject to EIA might not be examined for possible risks.

General ***guidance on EIA procedures*** and/or on case-by-case screening exists in all countries. In most of the Member States having been examined references to risk assessment could be identified. In the majority of these countries, albeit not in all, recommendations to deal with extraordinary risks in EIA go beyond the legal requirements laid down in national legislation, and the risk concept put forward is often more comprehensive in terms of hazard/risk categories mentioned and receptors of adverse effects addressed. For example, while the Austrian EIA act remains silent about that issue, guidance in Austria advises that risks in consequence of accidents and abnormal operating conditions should be considered in each technical chapter of the EIS, and significant effects due to hazardous incidents shall be described and assessed in the same way as the effects of a project during normal modes of operation, even if the probability of accidents occurring is low. Adverse consequences on human health, all relevant components of the receiving

environment and workplace safety shall be considered. If no impacts from accidents are expected, this assumption should be justified.

However, there is no specific guidance on how to apply risk assessment in EIA. While many guidance materials contain recommendations *that* various kinds of risk should be dealt with, they do not tell *how* it could be done. To some extent, there is one exception to the general rule: In the Slovak Republic several methodical manuals provide guidance on EIA for specific sectoral project types that bear an increased risk potential (chemical technologies, landfills and waste management installations, etc.). These guidebooks recommend application of health risk assessment and ecological risk assessment methods and indicate key steps of the assessment process according to the US EPA model, but they do not give precise technical guidance, either.

Non-EU countries

The risk concept expressed in the Canadian Environmental Assessment act may be regarded as wider and more comprehensive than that of many European EIA systems: First, external impacts on the project caused by the environment, e.g. due to exposure of the project to natural hazards, are unambiguously defined as being within the scope of EIA. Second, health effects and adverse socio-economic, cultural and socio-cultural impacts are explicitly covered, if they are caused by changes to the environment, which must in turn be a consequence of the project. Canadian guidance on EIA describes quantitative risk assessment as one method to determine the probability of occurrence and the significance of adverse consequences, in particular with regard to human health risks.

The US National Environmental Policy Act (NEPA) does not contain an explicit legal requirement to describe and assess extraordinary risks in EIS, but States are allowed to adopt regional EIS regulations that go beyond the minimum requirements of NEPA.

Both Canada and the USA are highly advanced in environmental risk assessment and have published a large number of guidelines. However, no official guidance material dealing specifically with risk assessment in EIA could be identified.

Brief synopsis

The overall results of the desk research provide strong evidence that there are considerable inconsistencies in the ways the Directive has been implemented and interpreted by Member States in terms of risk. Both, national EIA legislation and EIA guidance reflect a variety of concepts and approaches to dealing with extraordinary risks in EIA. The risk categories covered fluctuate along a broad spectrum, ranging from risk of accidents as a screening criterion to virtually all risk categories that are of interest within this report. Albeit being in compliance with or sometimes exceeding the EIA Directive, in general rather narrow concepts of risk focussing on accidents predominate; sabotage is only mentioned once in one single country. In none of the EIA legislations reviewed, social and socio-economic impacts are ever mentioned. In general, the wide understanding of the Directive's scope put forward in EC's guidance on EIA appears to have had little impact on Member States.

3 APPLICATION OF EIA IN TERMS OF RISK ASSESSMENT – EMPIRICAL RESULTS AND ANALYSIS

3.1 Introduction

In an introductory part to the questions on risk assessment, both in the questionnaire and at the start of the interviews the term ‘hazard’ has been defined as a threatening event or situation that could lead to damage or harm. Presence of a hazard therefore represents a source of risk. The term ‘risk’ has been defined as the possibility of significant adverse effects to the natural or man-made environment, including human beings, that could result from the potential occurrence of extraordinary or abnormal hazardous events (natural disasters, accidents, etc.). Risk has been characterised as the combination of the probability of occurrence of a hazardous incident and the magnitude of expected negative effects. A clear distinction has been made between environmental risks in consequence of extraordinary hazardous incidents and project-related risks of negative environmental impacts that are connected to a project's normal, controlled or standard mode of operation. It was clearly stated that questions on 'extraordinary risks' did not refer to the latter meaning of ‘environmental risks’.

On request of the contracting authority of the project (IMP)3, the issue of 'major social risks' was introduced and included in the questionnaire design and in the interview guide. In the questionnaire, a second part was added to questions No. 10 and No. 13 that referred to the risk of substantial social and socio-economic impacts of a project. The expression 'social risks' has been defined in general terms as the risk that a project may cause major social changes to communities, families, certain population groups etc. This category of impacts does not refer to extraordinary circumstances or hazardous events, but results from standard operation of a project. The concept of risk applied here differs fundamentally from the concept of risk applied to extraordinary hazards and risks. This discrimination has been made clear in the introductory part of the questionnaire and visually by means of the layout of the respective questions, as well as at the start of the interviews.

3.2 Questionnaire Results

3.2.1 General remarks

Analysis of the questionnaire data was done on EU-level and in a comparative way on country-level. All empirical data are based on perceptions of stakeholders. They are not representative in statistical terms.

The response rates from the following Member States have been too low to allow for meaningful interpretation: Spain, France, Greece, Hungary, Italy, Lithuania, and Luxemburg. These countries have not been included in the analysis.

Return rates from two Member States (Slovakia, United Kingdom) were significantly higher than from other countries. Results to each question on EU-level have been checked for possible biases caused by overrepresentation of these two countries; this issue is briefly discussed for each question below.

3.2.2 Extraordinary hazards and risks considered in EIA

Question No. 10A asked to what extent different types of extraordinary hazards, whose occurence could affect a project or that could be caused by a project, and resulting significant risks to the environment are considered in EIAs in Member States. The multiple choices offered to respondents characterised different grades of regularity or frequency by which each category of hazards is addressed in EIAs. The wording of the question is reproduced below.

Which types of extraordinary hazards that could affect a project are addressed in EIAs in your country? (tick one per row)

A	Type of hazard	Standard	Often	Seldom	Not at all	Don't know
	Natural hazards (e.g. flood, earthquake,…)	☐	☐	☐	☐	☐
	Accidents in the submitted project due to technological failure (e.g. breakdown)	☐	☐	☐	☐	☐
	Accidents in the submitted project due to human failure (e.g. mismanagement)	☐	☐	☐	☐	☐
	Accidents in **other** existing installations in the project's environment	☐	☐	☐	☐	☐
	Sabotage	☐	☐	☐	☐	☐
Other – please give details		☐	☐	☐	☐	☐

Natural hazards

Across all Member States, the majority of EIA stakeholders stated that coverage of natural hazards in EIAs is 'standard' or applied 'often'. Of the 183 respondents, 34% felt that natural hazards relevant to a submitted project are considered on a 'standard' basis. Another 24% stated that natural hazards are addressed 'often'. This adds up to the absolute majority of 58% who had the perception natural hazards are dealt with in EIAs in a quite regular and frequent way in their countries. The other answering options were chosen with less and decreasing frequencies: 21% of the respondents observed that natural hazards are addressed 'seldom', and 13% have the perception that they are not an issue within EIA in their countries at all, together amounting to 34% who gave evidence of rather poor or lacking coverage of natural hazards in EIAs. Close analysis of questionnaire data shows that the two MS with the highest response rates, Slovakia and the UK, do not cause a bias of these results.

Comparative analysis of questionnaire results on **country-level** discloses considerable variation between Member States in the amount of consideration that appears to be given to natural hazards, with the entire spectrum of answers ranging from a few countries with ticks only in the 'standard' and 'often' fields (Netherlands, Latvia) to one country with ticks only in the 'seldom' and 'not at all' fields (Estonia). Of 18 Member States with a reasonable number of returned questionnaires, responses from eight countries provide the overall picture that coverage of natural hazards is a quite established feature of EIA (Austria, Czech Republic, Cyprus, Latvia, Netherlands, Slovenia, Slovakia, UK). Country-level results from these Member States bear the greatest resemblance to the pattern of EU-level results. On the opposite end of the spectrum, all or most respondents from Denmark and Estonia stated that natural hazards are addressed 'seldom' or 'not at all', therewith differing most from results for the EU 25. In between there is a group of six countries (Belgium, Germany, Ireland, Malta, Poland, Portugal) where responses indicate a sometimes broad distribution of stakeholder perceptions even within countries but, when balanced against each other, responses indicate an overall tendency towards a more or less fair coverage of

natural hazards. For Finland and Sweden, results present a highly contradictory pattern that resists meaningful interpretation.

Accidents due to technological failure

According to stakeholder responses **across all 25 Member States**, internal technological risks in the submitted project are dealt with in EIAs in the EU to a large extent. Nearly 62% of the responding experts on EU-level reported that risks of accidents caused by technological failure (e.g., breakdown, malfunction, process failure) are considered in EIAs as a matter of routine or 'often', with both options getting almost equal scores, compared to 31% who jugded this hazard category being addressed 'seldom' or 'not at all'. With only 7% of respondents approving, no coverage of accidents due to technological failure at all was clearly the lowest-ranking option. Non-consideration of Slovakia and the UK does not cause any noticeable change of this distribution.

Comparison of **country-level** results shows more similarities than differences, i.e. according to stated opinions of responding experts the consideration of risks of accidents with regard to technological risk sources displays a comparatively narrow, but nonetheless still existent range of variability between Member States. Two groups of countries with similar results can be identified: Most respondents from Germany, Denmark, Finland, Ireland, Latvia, Netherlands, Sweden, Slovenia and Slovakia stated that risks of technological accidents are covered on a 'standard' basis or 'often' in EIAs, with the Netherlands and Slovenia being the top-ranking countries. Compared to the benchmark of EU-level results, responses from this group of countries suggest mostly a wider or similar degree of coverage. Answers from the second group of countries, comprising Austria, Belgium, Cyprus, Estonia, Malta, Poland and Portugal, provide the picture that risks of technological accidents are considered 'often' or reasonably frequently. However, according to empirical data the degree of consideration appears to be below the EU 25 mean level. Of the second group, only in Austria, Poland and Portugal also the option 'not at all' was chosen at least by one respondent. For the Czech Republic and the UK, responses are distributed in such an even or contradictory way that no reasonable statement can be made. Apart from these two countries, there is no Member State whose results deviate in a striking way from EU-level results.

Accidents due to human failure

Accidents in the submitted project caused by human failure (e.g., mismanagement, handling errors, inattention, lacking training) appear to be taken into account in EIAs only to a moderate extent, clearly less often than accidents due to technological failure. Of the 183 respondents from **all Member States**, 36% stated that human causes for accidents are addressed 'seldom' in EIAs, making it the top-ranking option. In order of decreasing frequency, the next-ranking choices were 'often' (22%), 'standard' (16%), and 'not at all' (13%). Added up, 38% of the stakeholders responded that accidents in consequence of human failure are dealt with on a routine basis or 'often', compared to the majority of 49% who stated that this kind of hazardous incidents is considered only 'seldom' or 'not at all'. A considerable amount of respondents (13%) expressed their insecurity about the issue by stating that they did 'not know'. Ignoring the results from Slovakia and the UK causes only a slight shift in distribution of responses in terms of a modest increase of ticks for the option 'often' without, however, changing anything about rankings of the options.

Country-to-country comparison reveals a considerable degree of variation in appraisal of accidents with human causes between Member States, but also within many Member States. The spectrum ranges from the Netherlands and Slovenia with a maximum of ticks for the 'standard' field to Belgium at the opposite end, as the only country where only the 'seldom' or 'not at all' fields were chosen. Besides the two top-ranking countries (Netherlands, Slovenia), balanced responses from a large group of countries indicate that accidents due to human failure are considered either fairly 'often' (Germany, Finland, Ireland, Latvia, Slovakia) or more often than 'seldom' (Cyprus, Denmark, Estonia, Malta). This group shows the closest resemblance to overall results from the EU 25. In addition to Belgium, responses from Poland and Portugal may be classified as ranking below EU-level results. Among respondents from the four countries Austria, Czech Republic, Sweden and the UK any consent on the extent of coverage of accidents caused by human failure was lacking, being reflected in a very even or extremely contradictory distribution of answers.

Accidents in other existing installations in the project environment

On **EU level**, the question referring to consideration of environmental risks in consequence of impacts on a project from possible accidents in other installations or facilities yielded distinct results. The clear majority of 40% of all 183 respondents stated that external disasters in the project environment are taken into account only 'seldom', as opposed to a minority of 10% who had the impression that this is a 'standard' feature of EIAs. Added up, 27% stated that this kind of risks from cumulative effects is considered in a 'standard' way or 'often', compared to 60% who judged that this is done only 'seldom' or 'not at all'. It is worth mentioning that 13% of the responding experts expressed that they had no sufficient knowledge about this issue by ticking 'do not know'. Calculation of EU-level results without including responses from Slovakia and the UK results in an increase of positive answers for the option 'often' by 4%, without, however, changing the shares of the other options considerably, which makes both 'often' and 'not at all' the second-ranking answers. This modest shift is caused because proportionately few respondents from the two countries stated that external accidents are addressed 'often'.

Country-level results again oscillate within a notable range, indicating some variability in EIA practice between Member States in terms of consideration of external accidents. At the opposite ends of the spectrum are the Netherlands, which are the only Member State with a clear tendency of responses towards frequent and regular coverage of risks of accidents in the project environment, and a small group of three countries (Estonia, Ireland, Portugal), where no evidence was provided that this category of risk is considered more frequently than 'seldom'. Responses from other countries do not deviate in an eye-catching way from EU-level results, suggesting poor or very moderate coverage of cumulative risks from external accidents. While showing a similar overall tendency, in particular in Sweden and the UK the perceptions of stakeholders exhibit the largest intra-national variation. Due to an evenly distributed pattern of answers, with often the same number of ticks for the 'standard' and the 'not at all' options, results from the Czech Republic, Denmark, Germany and Slovakia do not allow meaningful interpretation.

Sabotage

According to the distinct feedback from experts, sabotage as a possible source of significant environmental risks appears to be largely outside the scope of EIA practice in Europe. 40% of **all respondents** stated that sabotage is not addressed 'at all' in their countries, which represents

more than 50% of those experts who have an opinion on this issue. Another 27% rated this extraordinary hazard to be covered only ‘seldom’, amounting to the absolute majority of 67% of all responding experts who stated to have no or only little knowledge of its consideration in EIA, compared to a share of 10% who made an opposite experience. However, the small number of experts who ticked ‘standard’ or ‘often’ remained a minority even among the respondents of their own countries. Since those persons predominantly came from Slovakia and the UK, the higher response rates of these two countries cause a slight increase in choices for 'standard' and 'often' in terms of percentages, as well as a slight decrease in the shares of 'seldom' and 'not at all'. Interestingly, 23% said they did 'not know’.

The EU-level outcome is basically replicated at the **country-level**, where the most homogenous pattern of responses among all extraordinary hazards can be observed. To the predominant part, the only difference in results between Member States persists in the extent to which the 'seldom' or 'not at all' options have been chosen. In a larger group, comprising Austria, Belgium, Denmark, Estonia, Ireland, Malta, Netherlands, Poland, Portugal, Sweden, Slovakia, and the UK, the opinion that sabotage is not an issue in EIA 'at all' was the top-ranking option. In a smaller group, composed of the Czech Republic, Cyprus, Germany and Finland, the perception that sabotage is only 'seldom' considered was the first-ranking option. There are only four countries (Germany, Sweden, Slovakia, UK) where scarce evidence of some systematic coverage of sabotage was given, i.e. where scattered ticks for the 'standard' option were recorded. However, these are to a large extent outweighed by the other responses from those respective countries. It is worth reporting that results from all Member State provide a reasonably clear picture, with no extremely contradictory distributions occurring.

Based on returned questionnaires from 183 respondents and on an evaluation across all Member States, Figure 28 and Figure 29 show the **EU-level results** to the question: Which types of extraordinary hazards are addressed in EIAs?

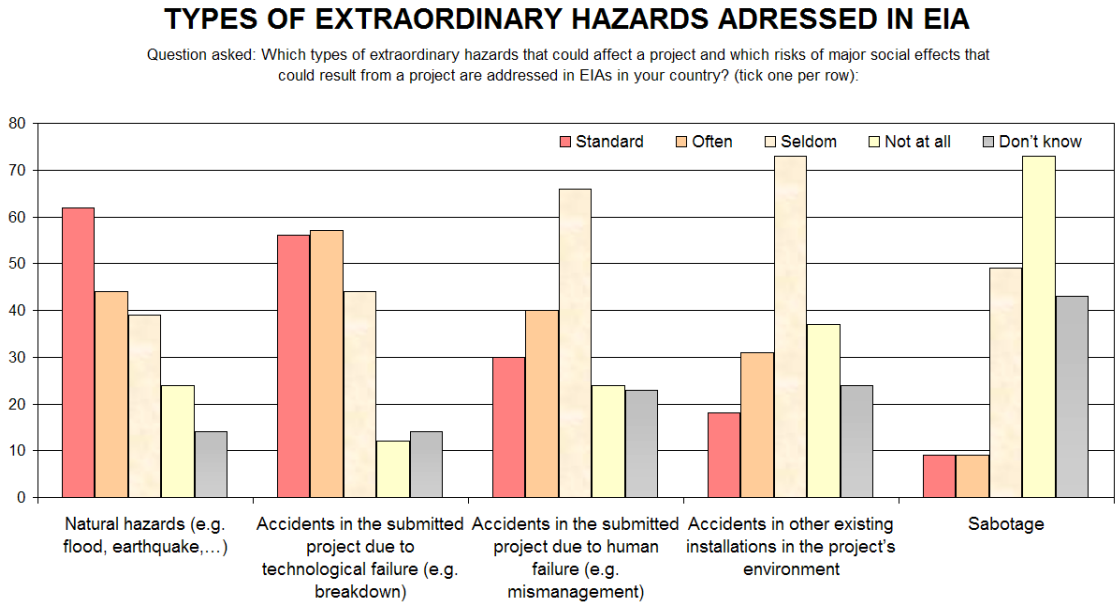

Figure 28 Frequency distribution of answers on EU-level to question No. 10A: Which kinds of extraordinary hazards are addressed in EIAs? (Absolute frequency of answers per hazard category and answering option; 183 returned questionnaires)

	Degree of consideration of extraordinary hazards in EIA [%]				
Hazard category	**Standard**	**Often**	**Seldom**	**Not at all**	**Don't know**
Natural hazards	33,88	24,04	21,31	13,11	7,65
Internal accidents – technological failure	30,60	31,15	24,04	6,65	7,65
Internal accidents – human failure	16,39	21,86	36,07	13,11	12,57
External accidents	9,84	16,94	39,89	20,22	13,11
Sabotage	4,92	4,92	26,78	39,89	23,50

Figure 29 Percentages of answers on EU-level per hazard category and answering option to question No. 10A: Which kinds of extraordinary hazards are addressed in EIAs?

Based on qualitative comparative evaluation of **country-level** questionnaire results to question no. 10A, Figure 30 presents a country-to-country overview of the degree to which stakeholders think that extraordinary hazards are considered or not considered in EIA:

Country	**Natural hazards**	**Internal accidents – technological failure**	**Internal accidents – human failure**	**External accidents**	**Sabotage**
AT	✓✓	✓	?	××	×××
BE	×	×	×××	××	×××
CZ	✓✓	?	?	?	××
CY	✓✓	✓	×	×	××
DE	✓	✓✓	✓	?	×
DK	××	✓✓	×	?	×××
EE	×××	✓	×	×××	×××
FI	?	✓✓	×	××	××
IE	×	✓✓	✓	×××	×××
LV	✓✓	✓✓	✓	✓	×
MT	✓	✓	×	××	×××
NL	✓✓	✓✓✓	✓✓	✓✓	×××
PL	×	✓	××	××	××
PT	✓	×	××	×××	×××
SE	?	✓✓	?	×	×
SI	✓✓	✓✓✓	✓✓	✓	×××
SK	✓✓	✓✓	✓	?	×
UK	✓✓	?	?	×	×

Figure 30 Overview of the degree to which responding stakeholders think that extraordinary hazards are considered or NOT considered in EIAs in their countries (qualitative evaluation of country-level results; 183 returned questionnaires)

✓ degree to which extraordinary hazards are considered in EIAs, according to stated stakeholder perceptions
× degree to which extraordinary hazards are NOT considered in EIAs, according to stated stakeholder perceptions
? contradictory results, unclear picture
EE, FR, GR, HU, IT, LT, LU ... not shown (response rate too low)

Comparative analysis across hazard categories

Comparison of stated stakeholder perceptions on **EU-level** across hazard categories shows that the different types of extraordinary hazards and associated risks are considered in EIAs to very different degrees along a wide range of coverage. Questionnaire results clearly indicate that natural hazards and accidents in the submitted project due to technological failure are more often dealt with in EIAs than the other hazard categories. With 58% of all respondents who approved that consideration is 'standard', EIA performance profile in terms of regular coverage of extraordinary hazards appears to be best in particular with regard to natural hazards. With the highest score in the two aggregated classes 'standard' and 'often' (62%), also internal technological risks from accidents appear to be taken into account regularly to a comparatively large extent. Only 7% of respondents gave no evidence of any coverage of technological accidents at all, which is the smallest share for this grade among all hazard types. Although empirical data on the given question do not allow conclusions on the exact way hazards are considered in EIA, nor on the depth or quality of hazard assessment, it would thus appear that coverage of these two hazard categories is a quite established feature of EIA in the European Union.

According to stakeholder perceptions, risks of accidents due to human failure are addressed only to a moderate extent, distinctly less often so than technological causes of accidents, but more often than impacts from accidents in the project environment and sabotage. Both internal accidents caused by human failure and risks from external accidents yielded similar distribution patterns of answers across grades and reached similarly high degrees of support for the view that consideration occurs only 'seldom'. One might speculate that a comparatively high share of almost 13% who had no opinion on the extent of coverage of accidents caused by human failure might indicate difficulties in discriminating technological and human causes of accidents, as both causes are in fact often linked by a chain of events. Risks arising from cumulative effects with potential accidents in other existing projects are reported to be examined on a routine basis or 'often' only by 27% of all respondents.

Being the only hazard category where completely missing coverage was by far the top-ranking answering option, it is obvious that sabotage is to an overwhelming extent seen as outside the scope of EIA in the European Union. A remarkably high number of respondents who stated that they did 'not know' (24%) could indicate that sabotage in the context of EIA may be perceived as a still rather exotic issue or even a 'white spot'.

For all hazard categories except sabotage, analysis of **country-level** results provide much empirical evidence that there exist considerable differences between Member States in the extent to which each of the hazard categories is covered, as do the distribution patterns of answers across answering options on EU-level. Differences between countries appear to be largest in the consideration of natural hazards, accidents due to human failure and external accidents. Each of these hazards is addressed more regularly in some countries than in others. The spectrum of variability appears to be less wide in the case of accidents due to technological failure. The largest degree of similarity persists in the almost equally strong degree to which sabotage is disregarded in EIA practice.

Even within individual hazard categories, in many cases a remarkable degree of disagreement also exists within Member States, sometimes leading to completely contradictory responses from stakeholders. Thus, it cannot be excluded that disparities in coverage may also exist between

regional EIA regimes on intra-national level, between individual EIA cases within national EIA systems.

Regarding coverage of extraordinary hazards **across the different hazard categories in individual countries**, empirical evidence indicates that there is large intra-national variation in the way the different hazards are dealt with. For instance, stakeholders reported that in Denmark sabotage is completely disregarded, natural hazards are in general poorly covered, accidents caused by human failure are addressed 'seldom' or 'often', but consideration of accidents caused by technological failure is almost common practice. There is no Member State where all hazard categories are considered or not considered to the same degree. However, setting sabotage as a similarly neglected source of risk aside, responses from some countries show a larger degree of continuity across hazard categories than others. In particular, in the Netherlands, Slovenia, Latvia and, to some part, Germany and Slovakia, all hazard categories (except sabotage) would appear to be considered frequently or to an at least fairly reasonable extent (more than 'often'). On the other hand, in another group of countries (Belgium, Estonia, Poland, Portugal) empirical data suggest rather poor coverage of all hazard categories. For the rest of the 18 countries considered here, no particular overall trend can be identified.

The following quotations from the additional statements give an impression of the range within which extraordinary hazards are dealt with in EIAs:

> *"Final disposal of burnt nuclear fuel is an exception to above ticked answers* [comment from study authors: 'seldom' for all hazard categories]*, in that case risks were studied largely and thoroughly"* [Finland].

> *"Explanation for the answers* [comment from study authors: 'not at all' for sabotage; 'standard' for all other hazard categories] *on question 10A: Hazards are included in EIA when they are relevant. That is, they are included if limit values for risk (individual risk, group risk, risk of flooding) are (almost) exceeded. So, with ticking 'standard' we don't mean to say that these items are always included, we do mean to say that this type of hazard is always considered when relevant. Human failure is especially considered in large projects (e.g. nuclear plants); for small standard projects, it has no role in the calculations"* [Netherlands].

3.2.3 Major social risks considered in EIA

Question No. 10B asked to what extent different kinds of major social and socio-economic impacts that might result from a project are considered in EIAs in Member States. The groups of social impacts mentioned refer to socio-economic changes within the affected communities, safety-related impacts (crime), direct or indirect demographic changes, and issues of social equity. These impacts have been meant as examples and are by far not complete; however, adding of additional examples was possible. The multiple choices offered to respondents were the same as in question No. 10A and characterised different grades of regularity or frequency by which certain types of impacts are addressed in EIAs. The wording of the question is reproduced below.

Which risks of major social effects that could result from a project are addressed in EIAs in your country? (tick one per row)

B	**Major social risks**	Standard	Often	Seldom	Not at all	Don't know
	Unemployment, loss of income, impoverishment	☐	☐	☐	☐	☐
	Increase in crime rate	☐	☐	☐	☐	☐
	Population changes (migration, relocation…)	☐	☐	☐	☐	☐
	Social exclusion, disintegration	☐	☐	☐	☐	☐
Other – please give details		☐	☐	☐	☐	☐

Unemployment, loss of income, impoverishment

On **EU-level**, the relative majority of 36% of all respondents answered that risks of unemployment, loss of income, or impoverishment are considered 'not at all', followed by another 28% who stated that such is only 'seldom' the case, which adds up to the absolute majority of 64% who have the perception that the mentioned negative socio-economic impacts are 'not at all' or 'seldom' an issue within EIA. This compares to 27% who felt that such social impacts are considered 'often' or in a 'standard' way, the latter option being the lowest-ranking of all (8%). Setting aside responses from Slovakia and the UK does not change anything about rankings of the options relative to each other, but mainly increases the share of the option 'not at all' by almost 5%, therewith making the results on EU-level even more unambiguously.

Country-wise analysis shows that for many countries the given question yielded quite contradictory results and provides rather unclear pictures. However, according to empirical data, only in Ireland and, to some extent, also in Latvia unemployment, loss of income and impoverishment appear to be considered in EIAs on a quite frequent basis. Responses from Germany, Netherlands and Sweden strongly support the interpretation that these socio-economic impacts are considered 'not at all', whereas tendencies for Belgium, Cyprus, and Denmark are similar, but slightly less distinct. Distributions of responses from these aforementioned six Member States correspond most with EU-level results. Experts from most other Member States with sufficient return rates provided one or more ticks also in the 'standard' and/or 'often' field, making the results look quite patchy, but with overall tendencies towards either 'seldom' or 'often'. Most ticks for the options 'standard' and 'often' were provided by respondents from Slovakia and the UK, but these are outweighed by a majority of far less optimistic judgements.

Increase in crime rate

Of all social risks asked, an increase in crime rate is the one that is most clearly outside the scope of EIA. Of all 183 respondents on **EU-level**, 55% stated that it is considered 'not at all', followed by 27% who asserted that this is 'seldom' an issue. This makes up for the overwhelming amount of 82% who never or only 'seldom' made the experience that consequences of a project on the crime rate within the affected social environment were investigated, compared to 6% who have the view that coverage by EIA is 'standard' or occurs 'often'. Without responses from Slovakia and the UK, the discontinuity between the first-ranking choice 'not at all' and the next-ranking option 'seldom' would become even more distinct: 62% ('not at all') versus 23% ('seldom').

EU-level results are to the most part replicated at the **country-level**. In nearly all of the 18 Member States with fairly reasonable return rates the rankings of the grades are completely similar, with 'not

at all' being the most frequently chosen answer. There are only two countries (Czech Republic, Estland) where one tick for the 'standard' field was recorded, which is, however, in both cases overcompensated by the choices of other responding fellow-men. Only the two countries from the British Islands (Ireland, UK) deviate from the overall pattern of results: there, the relative majority of respondents stated that the social risk of an increase in crime rate is 'seldom' examined in EIA.

Population changes (migration, relocation, etc.)

Demographic changes to the affected population in terms of physical population movements appear to be considered less seldom than other social impacts. On **EU-level**, 34% of all respondents asserted that such impacts are at least 'seldom' addressed in EIA, making this the top-ranking answer. Still, 30% stated that shifts in population are considered 'not at all', together accounting for the absolute majority of 64% who said they evidenced no or only rare coverage of population changes, compared to 24% who responded that this is an 'often' applied or 'standard' part of EIA practice. In this particular case, close investigation shows that the higher return rates from Slovakia and the UK do in fact cause some bias of EU-level results. If these two countries are excluded from calculation, the share of respondents who decided for 'not at all' rises to 37%, while the shares of the other options remain basically the same. As a result, no coverage of population changes at all would then be the top-ranking answer.

On **country-level**, the range of distribution of results reaches from Ireland, Latvia and Slovenia, which are above EU-level results, to Denmark and Germany, which are most clearly below EU-level results. However, no single Member State can be identified where coverage of population changes would appear to be 'standard' practice. The pattern of responses is most contradictory for Estonia and Finland, where no clear picture can be gained at all, although also the responding experts from Slovakia and the UK show a considerable degree of disagreement.

Social exclusion, disintegration

According to empirical results on EU-level, assessment of effects on different population groups appears to be poorly covered in EIAs. 42% of all respondents replied that such social impacts are addressed 'not at all'. Added up with 32% who stated that such is only 'seldom' the case, this amounts to the large majority of 74% who gave no or little evidence of any systematic treatment of issues of social equity in EIA, versus 8% who made an opposite judgement. Examination of results as to biases induced by responses from Slovakia and the UK shows that the two countries have no effect on rankings of answering options, but that they level the difference between 'seldom' and 'not at all': not considering Slovakian and British answers increases the share of choices for 'not at all' up to 47%, and decreases the one for 'seldom' down to 28%.

Comparison of **country-level** results shows a picture that for most Member States resembles closely the one on EU-level, with a remarkably narrow range of variability. The bulk of all countries differ just in the extent to which responses tend towards 'seldom' coverage in EIA or no coverage 'at all'. While most respondents from Austria, Czech Republic, Germany, Denmark, Malta and Sweden supported the view that impacts on social equity are addressed 'not at all', respondents from Belgium, Cyprus, Estonia, Finland, Ireland, Latvia, Netherlands, Poland, Portugal, Slovakia and the UK accentuated the 'seldom' option to a higher extent. There are only three countries (Slovenia, Slovakia, UK) where one respondent in each case chose the 'standard' option. But while

Slovakia and the UK still fit to the overall pattern of results, in Slovenia these are highly contradictory.

Based on returned questionnaires from 183 respondents and on an evaluation **across all Member States**, Figure 31 and Figure 32 show the results to the question: Which risks of major social impacts that that could result from a project are addressed in EIA?

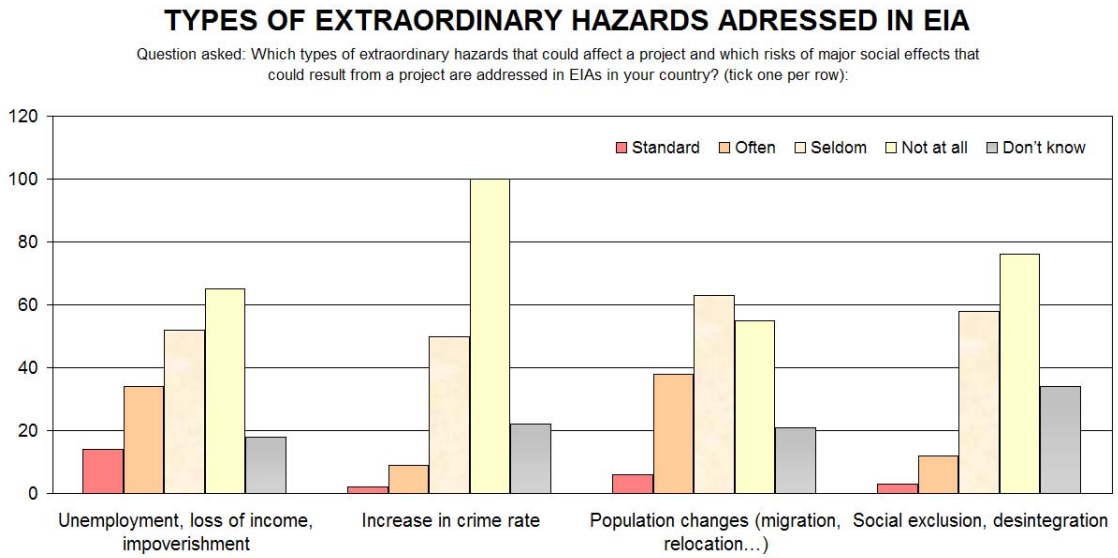

Figure 31 Frequency distribution of answers on EU-level to question No. 10B: Which major social risks are addressed in EIAs? (Absolute frequency of answers per hazard category and answering option; 183 returned questionnaires)

	Degree of consideration of major social risks in EIA [%]				
Social impact category	**Standard**	**Often**	**Seldom**	**Not at all**	**Don't know**
Unemployment, loss of income, impoverishment	7,65	18,58	28,42	35,52	9,84
Increase in crime rate	1,09	4,92	27,32	54,64	12,02
Population changes (migration, relocation, etc.)	3,28	20,77	34,43	30,05	11,48
Social exclusion, disintegration	1,64	6,56	31,69	41,53	18,58

Figure 32 Which major social risks are addressed in EIAs? Absolute frequencies of answers on EU-level per hazard category and degree of consideration in percent of 183 returned questionnaires.

Based on qualitative comparative evaluation of **country-level** questionnaire results to question no. 10B, Figure 33 presents a country-to-country overview of the degree to which EIA stakeholders think that certain major social risks are considered or not considered in EIA:

Country	Unemployment, loss of income, impoverishment	Increase in crime rate	Population changes (migration, relocation, etc.)	Social exclusion, desintegration
AT	×	×××	××	×××
BE	××	×××	××	××
CZ	?	××	××	×××
CY	××	×××	××	××
DE	×××	×××	×××	×××
DK	××	×××	×××	×××
EE	✓	××	?	××
ES	–	–	–	–
FI	✓	××	?	××
IE	✓✓	×	✓	××
LV	✓	××	✓	××
MT	×	×××	××	×××
NL	×××	×××	××	×
PL	✓	××	×	××
PT	×	×××	×	××
SE	×××	×××	××	×××
SI	×	××	✓	?
SK	✓	××	×	××
UK	✓	×	×	××

Figure 33 Overview of the degree to which responding stakeholders think that major social risks are considered or NOT considered in EIAs in their countries (qualitative evaluation of country-level results; 183 returned questionnaires)

✓ degree to which extraordinary hazards are considered in EIAs, according to stated stakeholder perceptions
× degree to which extraordinary hazards are NOT considered in EIAs, according to stated stakeholder perceptions
? contradictory results, unclear picture
EE, FR, GR, HU, IT, LT, LU ... not shown (response rate too low)

Comparative analysis across social impact categories

In general, risks that a development may cause major impacts on social and socio-economic characteristics of the affected population appear to be considered in European EIA systems along a relatively narrow spectrum ranging from a modest extent to not at all. **EU-level** results show similar and quite unambiguous frequency distributions, with 'not at all' and 'often' being the most often ticked answering options for all mentioned social impact categories. With the majority of experts responding that they are taken into account 'seldom', population changes appear to be covered better in comparative terms than other social risks, which are each by the majority perceived to be addressed 'not at all'. An increase in crime rate is the least covered impact category ('not at all' and 'seldom': 82%), followed by social exclusion and disintegration (74%). On the latter, 34% of respondents could not form an opinion, which indicates that many EIA experts may not be used to associate EIA with issues of social equity.

While **country-level results** show limited variability *between countries* for the impact groups 'socio-economic decline' and 'population changes', responses suggest that 'increase in crime rate' and 'social exclusion and disintegration' are covered 'seldom' or 'not at all' in all countries to an almost equal extent. With only a few gradual exceptions showing more optimistic results for some impact types (Ireland and, to some extent, Latvia, Slovakia, UK), it would appear that there is no Member State where one impact would be treated in a significantly different way from the others.

The following additional statement exemplifies how major social risks are seen in the context of EIAs in many Member States:

> *"This has to be considered if relevant, but most aspects not within EIA"* [Germany].

3.2.4 Stages of risk assessment usually applied to EIA

Relating to risks in consequence of extraordinary hazards, question no. 11 asked which key steps of an idealised risk assessment process are usually applied within EIA, provided that a risk assessment is performed. The multiple choices offered were based on common models of a technically sound risk assessment process and comprise basic steps that a complete cycle of risk assessment should follow, such as hazard identification and hazard assessment, exposure assessment, determination of the magnitude or severity of potential adverse consequences, and risk characterisation (cf. chapter 1.3.1). In addition to assessment tasks in the narrower sense of the word, also tasks of risk management have been included (e.g., mitigation measures), because these appear particularly important in the context of EIA. Compliance with the mentioned basic steps is largely independent of the exact nature of risk, of concrete applications of risk assessment to specific problems (technological safety assessment, health risk assessment, etc.), and of the particular assessment methods applied. Aspects of risk management, decision-making, and public participation that are particularly relevant to applications in EIA have been included in the design of the question.

Following general theoretical models, the mentioned key steps have been presented in the logical and temporal order of their assumed implementation. Nonetheless, in practice some of them may be performed rather parallel than strictly sequential. Also, provided that risks are significant, risk assessment may be an iterative process. Social impacts have explicitly been excluded from the scope of the question.

The presentation of the question was as follows:

Which of these stages of the assessment of risks due to extraordinary hazards (natural disasters, accidents etc.) are usually applied to EIAs in your country? (Tick all that apply)

- ☐ Identification of relevant hazards
- ☐ Characterisation of identified hazards (probability, intensity, spatial range,…)
- ☐ Assessment of exposure and of vulnerability/sensitivity of target objects (natural environment, human health, material assets) to impacts of a hazardous event
- ☐ Assessment of probability and magnitude of negative effects (damage, harm)
- ☐ Risk characterisation: estimation of resulting risk and evaluation of its significance
- ☐ Measures to avoid, reduce or offset risks (mitigation measures)

- ☐ Assessment of remaining risks, including its acceptability/tolerability
- ☐ Public participation in risk assessment (consideration of individual perceptions of risk, involvement in decision-making on mitigation measures and acceptability of risk,…)
- ☐ Other steps – please give details
- ☐ I don't know

The multiple choice design of the question implies that the total number of ticks is much higher than the number of returned questionnaires. Percentages are calculated out of a total of 183 respondents. Multiple responses mean that they add up to more than 100%.

EU-level results

Stakeholders responded that when risk assessment is applied, the different stages of the assessment process are applied within EIAs with considerably varying frequencies. With regard to the number of ticks per answering option, a stratification of EU-level results can be distinguished, in which often several options represent one layer with similar frequencies of ticks.

'Identification of relevant hazards' and 'measures to avoid, reduce or offset risks' are the two top-ranking answers. Both have been chosen almost equally frequently by 78% of the respondents.

The next-ranking layer is represented by two process-related stages of risk assessment relating to exposure and vulnerability assessment and to hazard characterisation. In both cases, almost two thirds of the respondents (65% and 64% respectively) stated that these steps are usually part of the assessment process.

58% of the responding experts stated that the magnitude of the potential adverse consequences and the probability of their occurrence are usually assessed, closely followed by the step of 'risk characterisation' that was ticked by 56% of respondents.

The remaining options were chosen with successively decreasing frequencies. 33% of the responding stakeholders stated that an 'assessment of remaining risks', which should be based on the assumption that proposed risk control and risk reduction measures have been implemented, and an appraisal of the 'acceptability or tolerability' of residual risk are usually applied whenever a risk assessment is undertaken. Only 27% had made the experience that risk assessment and risk management involved public participation. Finally, 8% of respondents expressed their insecurity about answering the question by stating that they 'did not know'.

Figure 34 presents the overall results on **EU-level**, based on absolute number of ticks per answering option.

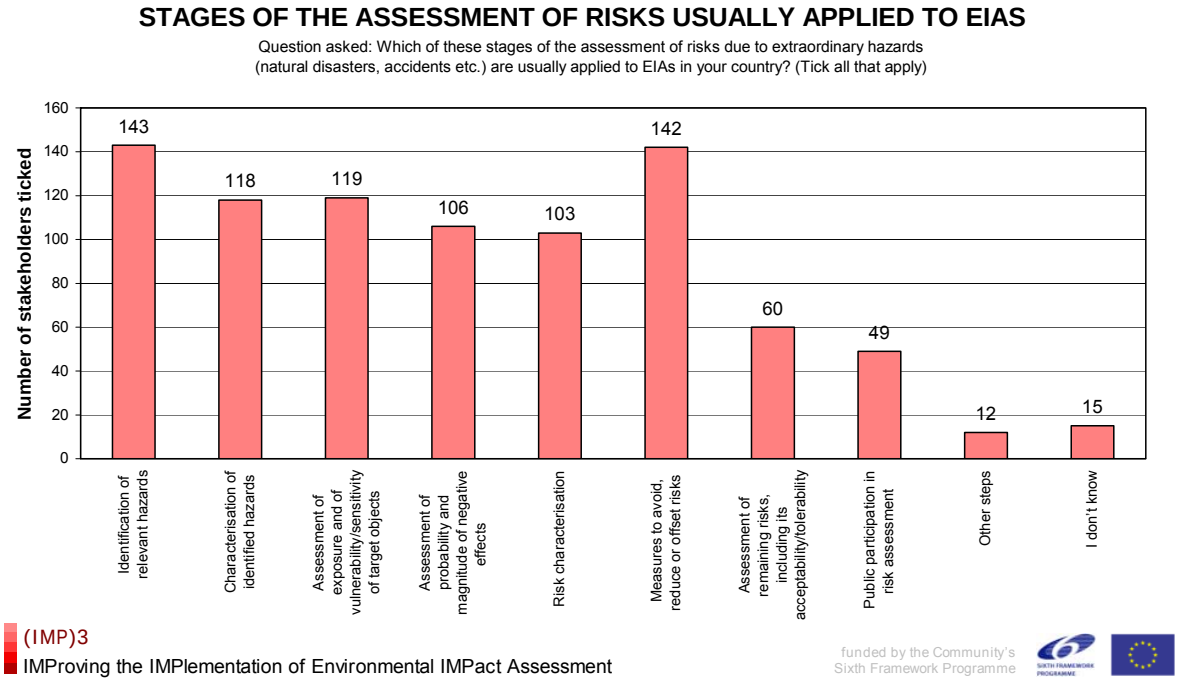

Figure 34 Results of question no. 11 (in absolute number of ticks per answering option): Which of these stages of the assessment of extraordinary hazards are usually applied to EIAs in your country?

In Figure 35, the given key steps of a risk assessment process within EIA are ranked according to the absolute number of ticks per answering option, and to the share of ticks in percent of the total number of responding persons, respectively.

Rank	Stages of Risk Assessment	ticks	
		abs.	in % of responses
1	Identification of relevant hazards	143	78
2	Measures to avoid, reduce or offset risks	142	78
3	Assessment of exposure and of vulnerability/sensitivity of target objects	119	65
4	Characterisation of identified hazards	118	64
5	Assessment of probability and magnitude of negative effects	106	58
6	Risk characterisation	103	56
7	Assessment of remaining risks, including its acceptability/tolerability	60	33
8	Public participation in risk assessment	49	27
9	I don't know	15	8

Figure 35 Ranking of answering options on EU-level, according to number of ticks.
[Ticks per option are given in absolute numbers and in rounded percent of the total number of returned questionnaires (183).]

Country-level results

Country-level results for the two top-ranking options are very similar to each other, as well as to EU-level results. Hazard identification and mitigation measures are the two steps of risk assessment and management that are stated to be most often applied in almost all Member States. The only difference lies in the ranks of both options: in some countries hazard identification is the top-ranking option, in others mitigation measures were ticked most often, sometimes frequencies of ticks are equal.

An equal degree of similarity applies to public participation in risk assessment/management, which achieved the lowest scores in most Member States. Respondents from five countries (Ireland, Latvia, Portugal, Sweden, Slovenia) agreed that the public is not involved at all. However, regarding absolute numbers of ticks in relation to total responses, it must be stressed that in some countries public participation appears to be applied only slightly less often than other tasks. This is in particular true for the Netherlands, and to a lesser extent for the Czech Republic, Slovakia, Austria, and the UK, in the order of decreasing coverage of participation.

With some exceptions, an assessment of residual risk and consideration in decision-making on its acceptability appears to be a seldom practised task within EIAs in most countries. Yet, answers from Germany, Malta, and the Netherlands suggest that it may be more or less common practice in those countries. Country-level results for the other stages of a complete risk assessment process are more mixed and indicate some variability in EIA practice between Member States in this regard.

Some countries can be identified where similarly high scores have been achieved for all or most options, suggesting a more systematic and coherent approach to risk assessment, and a more complete coverage of the entire process of risk assessment and management in EIAs. This holds particularly true for the Netherlands. To a lesser extent, it also applies to Germany, Finland, and Malta, albeit with gaps in coverage of public participation and assessment of residual risk.

Figure 36 presents the rankings of each answering option on **country-level**. Determination of ranks is based on the number of ticks per option. The following Member States are not displayed separately in the table because response rates were too low to allow for reasonable interpretation: Spain, France, Greece, Hungary, Italy, Lithuania, and Luxembourg. But in calculating overall results and determining ranks on EU-level, responses from these countries have been taken into account.

Rankings of options per country (according to number of ticks)

Country	Identification of relevant hazards	Characterisation of identified hazards	Assessment of exposure and of vulnerability/sensitivity of target objects	Assessment of probability and magnitude of negative effects	Risk characterisation	Measures to avoid, reduce or offset risks	Assessment of remaining risks, including its acceptability/tolerability	Public participation in risk assessment	I don't know	Number of ticks	Number of respondents
n.t.	2	3	3	5	2	1	6	7	0	93	16
AT	2	3	2	3	4	1	5	5	6	51	11
BE	2	2	2	2	2	1	0	4	3	30	7
CZ	1	3	1	1	2	1	4	3	0	32	6
CY	1	2	1	0	0	1	2	2	0	15	4
DE	1	1	2	3	4	3	3	5	6	53	12
DK	1	2	2	2	4	2	0	3	3	22	7
EE	1	2	1	2	1	1	2	2	2	13	4
FI	1	2	2	3	2	1	4	5	0	38	8
IE	1	1	1	1	2	1	0	0	0	11	2
LV	1	2	2	0	0	1	1	0	0	8	2
MT	2	1	1	1	1	1	2	3	0	41	6
NL	1	1	1	1	1	1	2	2	0	32	4
PL	1	1	2	2	3	4	6	5	0	35	9
PT	2	3	4	5	1	1	6	0	0	33	8
SE	2	4	4	3	5	1	6	0	7	53	11
SI	2	1	2	2	2	1	3	0	0	29	5
SK	1	3	4	5	6	2	8	7	9	155	33
UK	2	3	4	3	3	1	5	5	6	105	22
EU25	1	4	3	5	6	2	7	8	9	855	183

Figure 36 Rankings of answering options per country, according to absolute numbers of ticks.
1 ... most often ticked
2 – 9 ... ranks decrease with decreasing number of ticks
0 ... no ticks
EE, FR, GR, HU, IT, LT, LU ... not shown (response rate too low)

The following statements from respondents are selected quotations taken from the additional remarks. They give additional information on the issue and indicate the range of opinions:

"Risk assessment is only considered relevant in few large and risky projects" [Denmark].

"The EIA mentions other safety studies, but if these are not available risk assessment is included in the EIA" [Belgium].

"The ticked answers [comment from study authors: hazard characterisation, assessment of probability and magnitude of negative effects, risk characterisation, mitigation measures] *are usually not applied, but seldom in case of industrial developments"* [Belgium].

"Other steps: consultation with authorities for the purpose of specifying ALARP [comment of study authors: reduction of risk to a level 'As Low As Reasonably Practicable'] *and tolerable risk"* [Slovenia].

"Other steps: The EIS, including the assesment of risk, is reviewed by indepent experts of the Dutch Commission for EIA. When necessary, the Commission signals the necessity of risk assessment in its advice" [Netherlands].

3.2.5 Main barriers to more coverage of risk assessment in EIA

In question no. 12, stakeholders were asked to state their perceptions of the main barriers to more coverage and deeper integration of risk assessment in EIAs. It was expected that answers would give important indications for the identification of appropriate measures to improve coverage of risk assessment in EIAs. It was decided to include both extraordinary risks and risks of major social impacts in the scope of the question, concededly, at the possible expense of clearness of results.

Similar to question no. 11, a number of answering options were offered from which multiple choices could be made. The exact wording of the question is reproduced below:

Which do you think are the main barriers to more coverage of risk assessment (extraordinary and/or major social risks) in EIAs in your country? (Tick all that apply)

- ☐ National EIA legislation does not explicitly demand it
- ☐ National guidance on EIA implementation does not recommend inclusion
- ☐ Technical guidance on **how** to apply risk assessment is missing or insufficient
- ☐ Lack of adequate methods
- ☐ Lack of know-how in risk assessment on the part of EIA stakeholders
- ☐ No clear definition of risk exists
- ☐ Risk issues are too complicated to be included in EIAs.
- ☐ Risk assessment is applied in other project authorisation procedures separate from EIA.
- ☐ Addressing risk issues in EIA would make public participation more complicated.
- ☐ Including risk issues in EIA would increase duration and overall costs.
- ☐ Decision-makers do not consider risk assessment to be important, or feel uncomfortable about decisions on acceptability (tolerability) of risks
- ☐ Other reasons – please give details
- ☐ I don't know

The multiple choice design of the question implies that the total number of ticks is much higher than the number of returned questionnaires. Percentages are calculated out of a total of 183 respondents. Multiple responses mean that they add up to more than 100%.

EU-level results

From the entire range of barriers offered, each was chosen by considerable shares of the 183 respondents. However, some have been chosen with significantly higher frequencies than others. On EU-level, the scores of the individual options are distributed quite evenly within a range of 97 and 23 ticks, representing 53% and 13% of all respondents, respectively. Consequently, a clear ranking of stakeholder preferences in terms of perceived barriers to improved coverage of risk assessment in EIAs can be established for the entire EU 25 (Figure 38). The seven top-ranking barriers in the order of decreasing frequency (given in percent of responding persons) were the following:

- Technical guidance on how to apply risk assessment is missing or insufficient (53%)
- Lack of know-how in risk assessment on the part of EIA stakeholders (46%)
- National EIA legislation does not explicitly demand it (36%)
- Lack of adequate methods (35%)
- Risk assessment is applied in other project authorisation procedures separate from EIA (30%)
- Including risk issues in EIA would increase duration and overall costs (30%)
- No clear definition of risk exists (27%)

Out of the top four barriers that were most frequently experienced to hinder more intense application of risk assessment in EIA, three refer to similar knowledge-related issues: lack of technical guidance, lack of technical expertise, and lacking knowledge of adequate methods. Moreover, 27% of the respondents stated that a clear definition of the concept of risk in the context of EIA is missing, which seems to belong to a related category. Combined, these barriers received 45% of all 603 ticks recorded. Interestingly, the statement 'Risk issues are too complicated to be included in EIAs' was felt to be a barrier by only 13% of respondents.

Further barriers that were often chosen relate to the legal framework conditions under which national EIA systems operate. 36% of the respondents identified missing requirements in EIA legislations to consider risks as a main barrier, making it the third-ranking option. Another 30% stated that the existence of requirements for a separate risk assessment in other project-related development consent procedures that are subject to different regulatory regimes is a main barrier to the application of risk assessment in EIA.

Among the suggested barriers chosen least often was that 'Addressing risk issues would make public participation more complicated'. Given the result of question no. 11 regarding the distinct lack of public involvement with risk issues, this is a somewhat puzzling and contradictory result.

Also, the hypothesis that risk assessment would not be requested strongly enough by decision-makers, perhaps because they would want to avoid difficult decisions on acceptability of risks, is supported only by a comparatively low share of respondents (20%).

Figure 37 shows the **EU-level** results to the question: Which do you think are the main barriers to more coverage of risk assessment in your country?

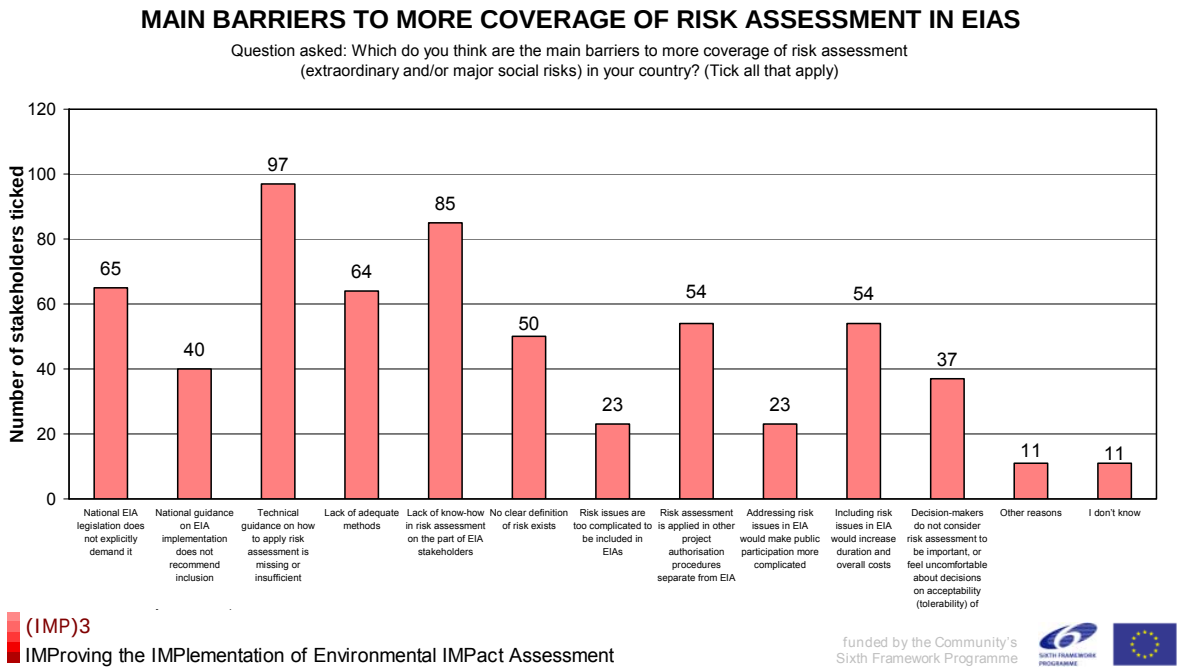

Figure 37 Results of question no. 12 (in absolute number of ticks per answering option): Which do you think are the main barriers to more coverage of risk assessment in your country?

Figure 38 presents the rankings of perceived barriers according to their scores for EU-level results.

Rank	Main barriers	ticks	
		abs.	in % of responses
1	Technical guidance on how to apply risk assesment is missing or insufficient	97	53
2	Lack of know-how in risk assessment on the part of EIA stakeholders	85	46
3	National EIA legislation does not explicitly demand it	65	36
		64	35
5	Risk assessment is applied in other project authorisation procedures separate from EIA	54	30
	Including risk issues in EIA would increase duration and overall costs		
6	No clear definition of risk exists	50	27
7	National guidance on EIA implementation does not recommend inclusion	40	22
8	Decision-makers do not consider risk assessment to be important, or feel uncomfortable about decisions on acceptability of risks	37	20
9	Addressing risk issues in EIA would make public participation more complicated	23	13
	Risk issues are too complicated to be included in EIAs		
10	I don't know	11	6

Figure 38 Ranking of answering options on EU-level, according to number of ticks. [Ticks per option are given in absolute numbers and in rounded percent of the total number of returned questionnaires (183).]

Comparison of results between **stakeholder groups** shows extensive similarities in the way barriers are perceived, in particular for the top-ranking and last-ranking answering options. Corresponding with overall EU-level results, 'missing or insufficient technical guidance' and a 'lack of know-how on part of EIA stakeholders' were identified as the most important barriers by all stakeholder groups. Only representatives of regional governments thought that 'missing requirements for risk assessment in EIA legislation' were more important obstacles than a 'lack of know-how'. However, with the exception of the group 'others', national EIA legislation received considerably high scores within all stakeholder categories. Totally complying with overall results, the two statements 'Risk issues are too complicated to be included in EIAs' and 'Addressing risk issues in EIA would make public participation more complicated' were rated the last-ranking barriers by all groups.

Nevertheless, some group-specific differences do exist. 'Lack of adequate methods' was chosen proportionately less often by members of NGOs and regional governments than by the other groups. 'Application of risk assessment in other project authorisation procedures separate from EIA' was chosen considerably often by most groups, except NGOs and the group 'others'. Only members of academic institutions thought more often than is reflected in overall results that an 'Increase in duration and costs of EIAs' would be a main barrier. While national and regional governments did not think that a 'lack of request for risk assessment by decision-makers' would be an important barrier, members of academic institutions and NGOs did so more often.

Figure 39 presents an overview of results per stakeholder category.

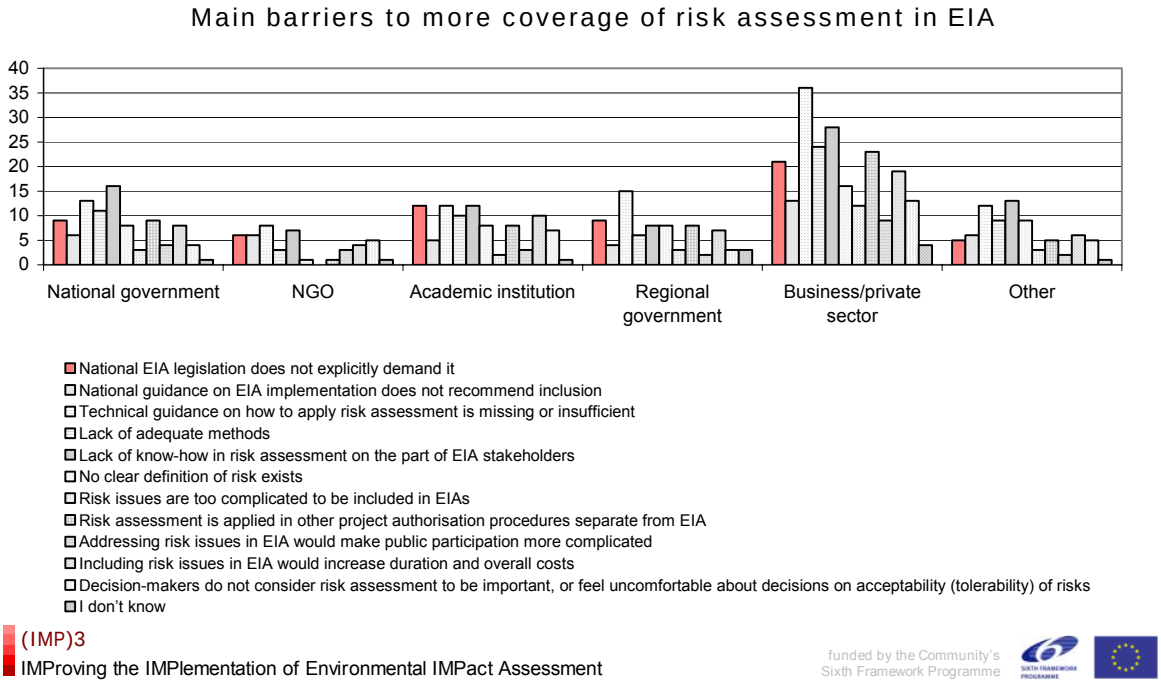

Figure 39 Opinions of different stakeholder groups on the main barriers to more coverage of risk assessment in EIA (frequency distribution of answers per stakeholder group on EU-level, 183 returned questionnaires)

Country-level results

Naturally, results on country-level are more mixed. Perceptions of barriers in the different Member States appear to be highly varied. Each of the statements offered was ranked as the most important or second-to-most important barrier in at least two Member States. On the other hand, each option except 'Lack of know-how' was also judged to be no barrier at all in at least one country.

However, many similarities exist. The first-ranking barrier on EU-level ('Technical guidance on how to apply risk assessment is missing or insufficient') was also perceived the top- or second-ranking barrier in most countries except Germany, UK, Estonia and the Netherlands (zero ticks in the latter two countries). The second-ranking barrier on EU-level ('Lack of know-how in risk assessment on part of EIA stakeholders') was felt to be one of the two most important barriers also in the large majority of Member States, except Austria, Belgium, Germany, Denmark and Portugal. The third-ranking barrier on EU-level ('National legislation does not explicitly demand it') was also ranked at first or second place in many countries (except Czech Republic, Cyprus, Finland, Malta, Sweden, Slovenia and Slovakia).

Quite different to EU-level results, the statement 'Decision-makers do not consider risk assessment to be important, or feel uncomfortable about decisions on acceptability of risks' was seen as one of the two most significant barriers by respondents from six Member States (Estonia, Ireland, Netherlands, Poland, Portugal, Slovenia). Only in the Czech Republic and Cyprus, a 'lack of adequate methods' was ranked at first place, but it often received a considerable number of ticks also in other countries. 'Risk assessment under other authorisation procedures' received high scores in particular from German respondents, but it was scored not at all in Estonia, Malta and Slovenia. Especially in Poland, concerns that 'Including risk issues in EIAs would increase duration and overall costs' seem to be a significant barrier.

Among all options, 'National guidance on EIA does not recommend inclusion' was most often felt to be no barrier at all on country-level (Austria, Belgium, Estonia, Finland, Latvia, Malta, Slovenia), but it was ticked by the majority of respondents from the UK.

Outstanding among all countries are the Netherlands: responses indicate that little barriers to more coverage of risk assessment in EIA are seen.

Other barriers that were mentioned or further specified include the following:

- Lack of know-how in risk assessment on the part of EIA regulatory and EIS review authorities [Portugal].
- Fear of EIA and EIS review authorities regarding the reactions of the public during public consultation [Portugal].
- Lack of willingness to fund appropriate studies or address risks on the part of project proponents [UK].
- Concerns about putting too much burden on EIA [UK].
- Overlaps with Health and Safety risk assessments [UK].

- Risks associated with the wider human environment (risks of major social and socio-ecomic impacts) are largely outside the scope of national EIA systems [Austria; France] or fall more naturally into CSR (corporate social responsibility) [UK].
- Social risks should be better dealt with at strategic level [Austria].

Based on the number of ticks per option, Figure 40 presents the rankings of barriers on **country-level**. Spain, France, Greece, Hungary, Italy, Lithuania and Luxembourg are not displayed separately because of response of low return rates. But in calculating overall results and determining ranks on EU-level, answers from these countries have been taken into account.

Rankings of options per country (according to number of ticks)

Country	National EIA legislation does not explictly demand it	National guidance on EIA does not recommend inclusion	Technical guidance on *how* to apply risk assessment is missing or insufficient	Lack of adequate methods	Lack of know-how in risk assessment on the part of EIA stakeholders	No clear definition of risks exists	Risk issues are too complicated to be included in EIAs	Risk assessment is applied in other project authorisation procedures separate from EIA	Addressing risk issues in EIA would make public participation more complicated	Including risk issues in EIA would increase duration and overall costs	Decision-makers do not consider risk assessment to be important, or feel uncomfortable about decisions on acceptability of risks	I don't know	Number of ticks	Number of respondents
.t.	5	6	1	3	4	3	6	2	6	0	6	6	39	16
AT	1	0	1	3	3	2	3	4	4	3	3	3	28	11
BE	2	0	1	4	3	4	4	3	0	3	0	0	17	7
CZ	0	4	1	1	2	4	4	3	4	3	0	4	20	6
CY	3	2	1	1	1	2	4	4	4	3	0	0	25	4
DE	2	4	3	3	5	6	6	1	4	4	4	0	36	12
DK	2	3	1	3	3	2	0	4	0	0	0	4	19	7
EE	2	0	0	2	1	0	2	0	2	2	1	0	9	4
FI	4	0	1	4	2	4	0	3	0	4	4	0	22	8
IE	2	2	1	2	2	2	2	2	2	2	2	0	12	2
LV	1	0	1	0	1	0	1	1	1	0	0	0	6	2
MT	5	0	2	3	1	3	5	0	5	3	4	0	24	6
NL	1	1	0	0	1	0	0	1	1	0	1	0	8	4
PL	1	5	1	3	1	5	6	6	0	1	2	0	41	9
PT	1	4	2	4	4	5	5	3	5	2	2	0	29	8
SE	3	5	2	3	1		4	5	6	4	6	6	37	11
SI	3	0	1	3	1	2	0	0	3	3	1	0	15	5
SK	6	6	2	3	1	4	7	5	7	4	8	9	131	33
UK	2	1	3	8	2	5	9	4	8	5	7	9	77	22
EU25	65	40	97	64	85	50	23	54	23	54	37	11	603	183

Figure 40 Ranking of answering options per country, according to absolute number of ticks.
1 ... most often ticked
2 – 9 ... ranks decrease with decreasing number of ticks
0 ... no ticks
EE, FR, GR, HU, IT, LT, LU ... not shown (response rate too low)

Some respondents made additional remarks or raised related issues, among which were the following:

"There are no barriers. Risk assessment is fully covered in the Dutch legislation. A recent incident (explosion in fireworks storage in the residential area of Enschede) has focussed attention of all decision-makers to this aspect" [Netherlands].

"There is a risk for confusion today as total risk management has been high lighted and covers everything – and sometimes it becomes too much. EIA for roads should mainly deal with impacts due to accidents with dangerous goods and impacts due to landslides etc. Normally, geotechnical surveys are most important to avoid landslides or geohydrological risks. These surveys have combined purposes, both for technical solutions and for environmental assessment. Adequate risk issues for users of road tunnels – but that should not be a part of EIA but of other type of impact assessment (for users)" [Sweden].

3.2.6 Effectiveness of risk assessment in EIA

Question No. 13A asked to what extent EIA stakeholders think that assessment of extraordinary risks during the EIA process has been effective in causing modifications of project designs or alterations of proposed developments in general, or in otherwise influencing project designs before or after application for development consent. Formulation of the question appreciates that optimisation of projects in terms of risk prevention and risk reduction, including choice of more appropriate alternatives and more suitable project locations, can be a result of the practical implementation of an EIA in the frame of EIA procedures (iterative feedback of assessment results with design process, mitigation and precautionary measures foreseen in the EIS, brought forward by public participation, or prescribed by the competent authorities, etc.) as well as of the mere existence of institutionalised EIA (anticipative project design under the premise of EIA). In paraphrase, the question asked to what extent the decision-making process is influenced by results of risk assessment in the course of EIA procedures, and to what extent risk assessment on the part of project developers influences the development planning and project design process in stages prior to submission of an EIS.

Influence of EIA on project modifications, prior and/or after EIS submission, is a well acknowledged indicator of the effectiveness of EIA that has often been applied to evaluating outcome and performance of the EIA process (Wood & Jones, 1991, 1992, 1997; Wood et al., 1996; Kobus & Lee, 1993; Lee et al., 1994; Frost, 1994; Jones & Wood, 1995; Sadler, 1996; Reeder, 1994; Ortolano, 1993; Cashmore et al., 2004; Wende, 2001).

The design of the question is equal to the one described for question no. 10, i.e. for each hazard category multiple choices are offered, which characterise different degrees of influence that risk assessment in EIAs exerts on project design and project modifications. The exact wording of the question is reproduced below:

For each of the following: Do you think risk assessment in EIA has modified project designs or developments or otherwise influenced them before or after an EIA? (Tick one per row)

Type of hazard	*Mostly*	*Often*	*Seldom*	*Not at all*	*Don't know*
Natural hazards	☐	☐	☐	☐	☐
Accidents	☐	☐	☐	☐	☐
Sabotage	☐	☐	☐	☐	☐

Natural hazards

The majority of experts across **all Member States**, representing 36% of all respondents, stated that assessment of existent risks of natural hazards has 'seldom' an influence on project modifications (Figure 44). Combined with 12% who had no knowledge of any such influence on EIA outcome, 48% had the perception that even when natural hazards are considered, effectiveness of consideration in terms of project design is rare or non-existent. On the other hand, 17% of respondents made the experience that assessment of natural hazards 'mostly' leads to project modifications, and 22% stated that such is 'often' the case, which amounts to 39% who have a rather optimistic opinion about the effects of risk assessment on the project design and the decision-making process. Interesting about the overall distribution pattern of responses is that although the relative majority of stakeholders is sceptical or negative about the EIA outcome in terms of natural hazard assessment, they nevertheless rated 'no influence on project modifications at all' the last-ranking answer. However, this is mainly due to proportionately more positive answers from Slovakia and the UK than from the rest of the Member States: if these two countries are excluded from the evaluation, the option 'mostly' becomes the last-ranking and the option 'not at all' the third-ranking answer.

If EU-level results are differentiated after EIA **stakeholder categories** (Figure 41), the overall picture is replicated for most stakeholder groups. With the exception of the group 'other', the majority of respondents among all stakeholder groups stated that consideration of natural hazard has only 'seldom' an influence on project modifications. With the highest shares of respondents stating that natural hazard assessment leads 'mostly' or 'often' to modification of development proposals, representatives of the 'business/private sector' are apparently most convinced of the effectiveness of EIA in that respect. Quite different, no member of an NGO had the perception that project modification through natural hazard appraisal in EIA is common practice.

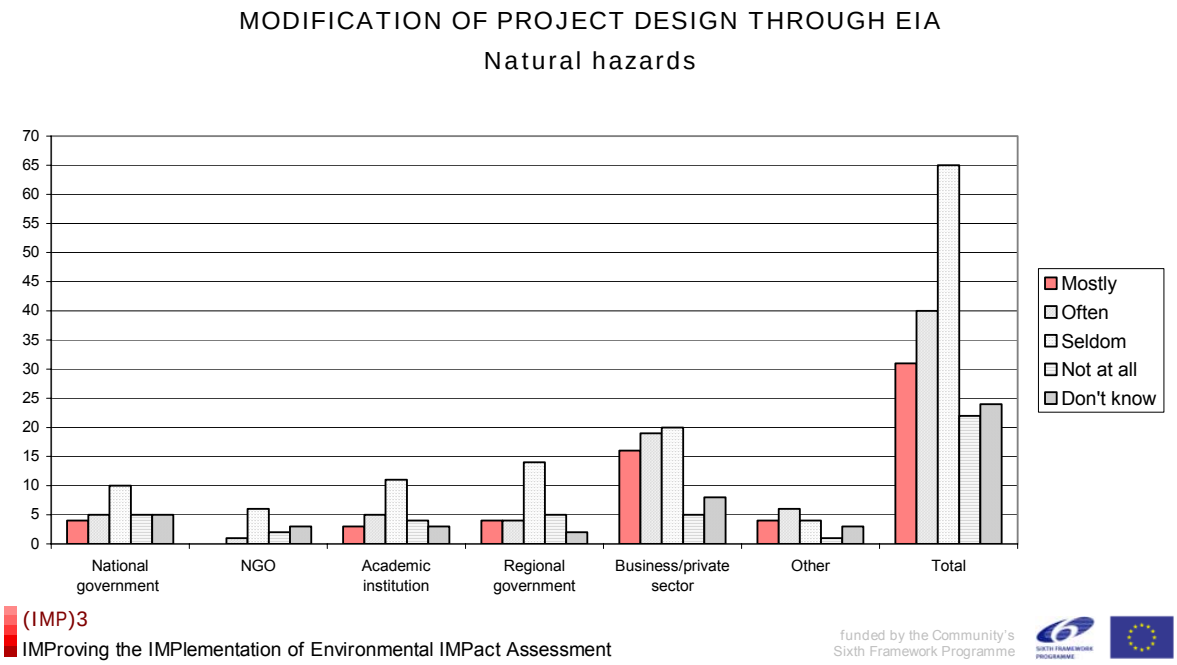

Figure 41 Influence of natural hazard assessment in EIA on project modifications per stakeholder group (frequency distribution of answers per stakeholder group and per degree of influence on EU-level, 183 returned questionnaires).

Country-level evaluation of questionnaire results (Figure 46) shows considerable variability of stakeholder perceptions between Member States, but in many cases also among respondents from the same Member States. Most effectiveness of natural hazard assessment in terms of project modifications was seen by experts from the Czech Republic, Slovenia, Slovakia, and the UK, whereas responses from Germany, Denmark and Finland indicate even less confidence in EIA effectiveness than do results on EU-level. Balanced answers from the other Member States correspond quite well with evaluation for the entire EU 25. Proportionately high shares of ticks for the 'do not know' field for some countries suggest some insecurity in answering the question.

Accidents

Among all hazard categories, safety-related technological risk assessments yielded the highest perceived influence of risk assessment on improvements of proposed developments. On **EU-level** (Figure 42), similar numbers of respondents stated that the assessment of risks of accidents leads to project modifications either 'often' (35%) or 'seldom' (33%). 13% asserted that this is 'mostly' the case, and only 5% negated any effectiveness in that regard. Added up, 48% of respondents were of the opinion that assessment of technological risks has regularly or quite frequently an influence on project design, compared to 38% who made opposite experiences. In terms of percentage, Slovakia and the UK cause a decrease of scores for the option 'seldom' by 5%. Excluding these two countries with the highest response rates from calculation would make the two options 'seldom' and 'often' change ranks, making 'seldom' the top-ranking option (instead of *vice versa*).

The overall pattern of results is basically the same for each **stakeholder category** (Figure 42). In all cases, project modifications as a result of considering risks of accidents are most frequently perceived to occur either 'often' or 'seldom', the main difference being the ranks of both choices. While the respective majorities of representatives of national governments, academic institutions,

the business/private sector and the group 'others' thought technological safety assessments are effective in most cases, members of NGOs and regional governments favoured to a larger extent 'seldom'. Again, the business/private sector appears to be most confident about the EIA outcome of risk assessment.

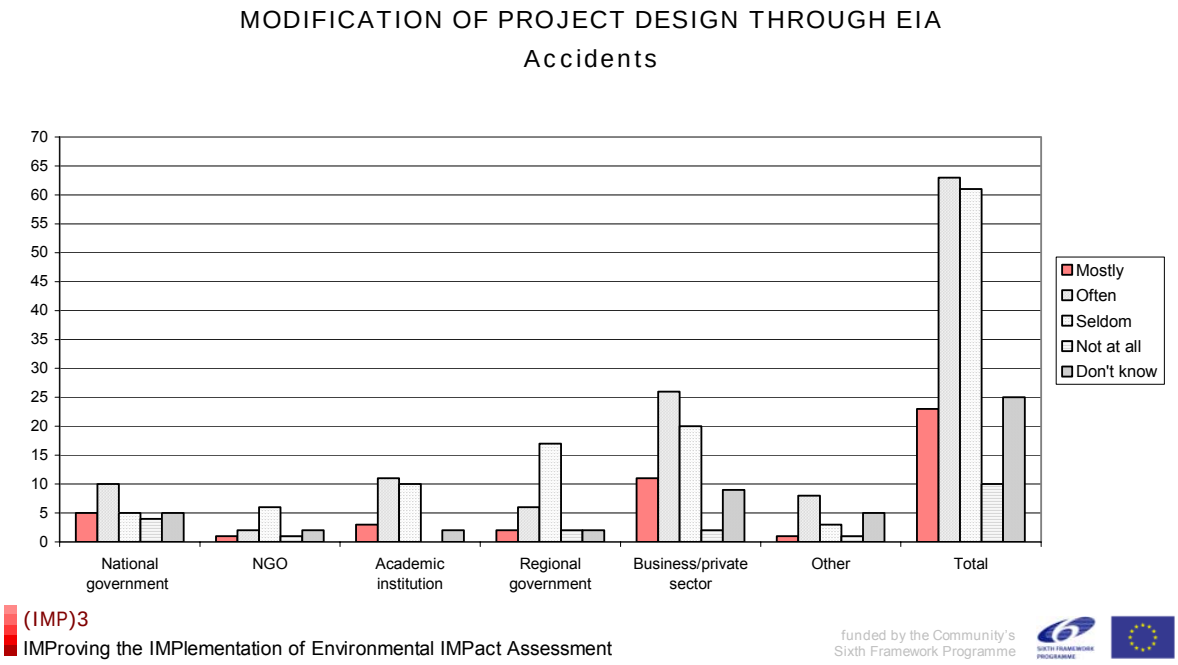

Figure 42 Influence of the assessment of risks of accidents in EIA on project modifications per stakeholder group (frequency distribution of answers per stakeholder group and per degree of influence on EU-level, 183 returned questionnaires)

Country-level results show some, albeit limited variation in perceived influence of technological risk assessment on project modifications between Member States (Figure 46). In Malta and the Netherlands, perceived effectiveness is most clearly above EU-level results, followed by a group of countries comprising Austria, Belgium, Germany, Sweden and Slovakia, where ticks for the option 'mostly', but no ticks for the option 'not at all' were counted. Due to broad distribution across all options, answers from Poland, Portugal and the UK provide a highly ambiguous picture, suggesting considerable divergence of perceptions among respondents.

Sabotage

Across **all Member States**, there was strong consent among respondents that EIA is largely or completely ineffective in integrating consideration of sabotage in decision-making on development planning and project designs (Figure 44). 43% of responding experts denied any effects on project modifications. Combined with another 25% who ticked 'seldom', this adds up for the vast majority of 68% who stated that consideration of risks of sabotage has no or little impact on decisions related to project design. Only 7% of all respondents claimed that project modifications in consequence of consideration of sabotage occur 'often' or 'mostly', with only 2 persons choosing 'mostly'. A remarkably large share of 25% had no opinion on this question, which may indicate that the risk of sabotage is not a familiar issue within EIA at all (cf. chapter 3.2.2). If the portion of respondents who ticked 'do not know' is not included in the calculation, the score of both options 'seldom' and

'not at all' increases to 91%. The overall tendency is fortified if answers from Slovakia and the UK are not taken into account.

The pattern of EU-level results (Figure 43) is basically replicated for all **stakeholder groups**, with the majority of representatives of each group stating that assessment of sabotage does not cause project modifications 'at all'. The second-ranking choices were either 'seldom' or 'do not know'. The only two ticks for 'mostly' were registered among the groups 'national government' and 'academic institutions', but in both cases these are by far outnumbered by the scores for less optimistic opinions. Similar to the other hazard categories, members of the group 'business/private sector' again appear to be slightly more confident than the other stakeholder groups, as can be concluded from the proportionately larger share of persons who stated that project modifications are at least 'seldom' attributable to consideration of sabotage.

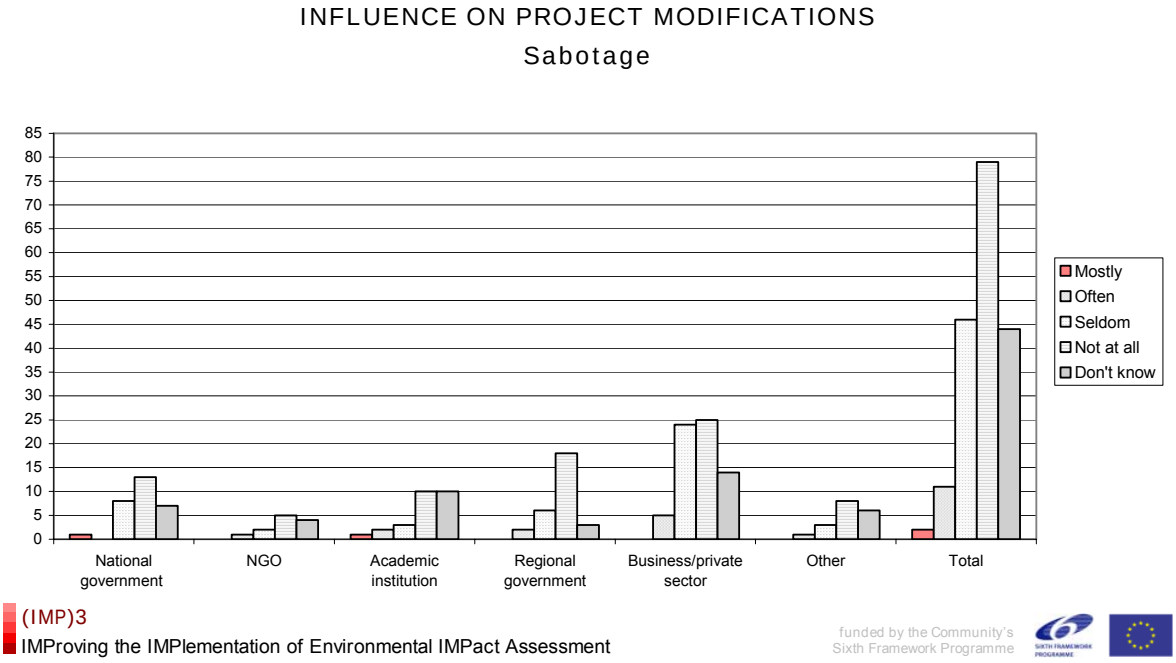

Figure 43 Influence of the assessment of risks of sabotage in EIA on project modifications per stakeholder group (frequency distribution of answers per stakeholder group and per degree of influence on EU-level, 183 returned questionnaires).

Country-level results show a high degree of similarity to each other (Figure 46). According to stakeholder perceptions, consideration of sabotage has clearly no or little impact on project modifications in all countries, with differences between countries being only a matter of degree. The UK is the only Member State where opinions are distributed across the entire range of options, which suggests a comparatively higher effectiveness of EIA in terms of considering the risk of sabotage in project designs.

Based on perceptions of all stakeholders on **EU-level**, Figure 44and Figure 45 show the degree of influence that assessment of risks related to extraordinary hazards in EIA has on project modifications.

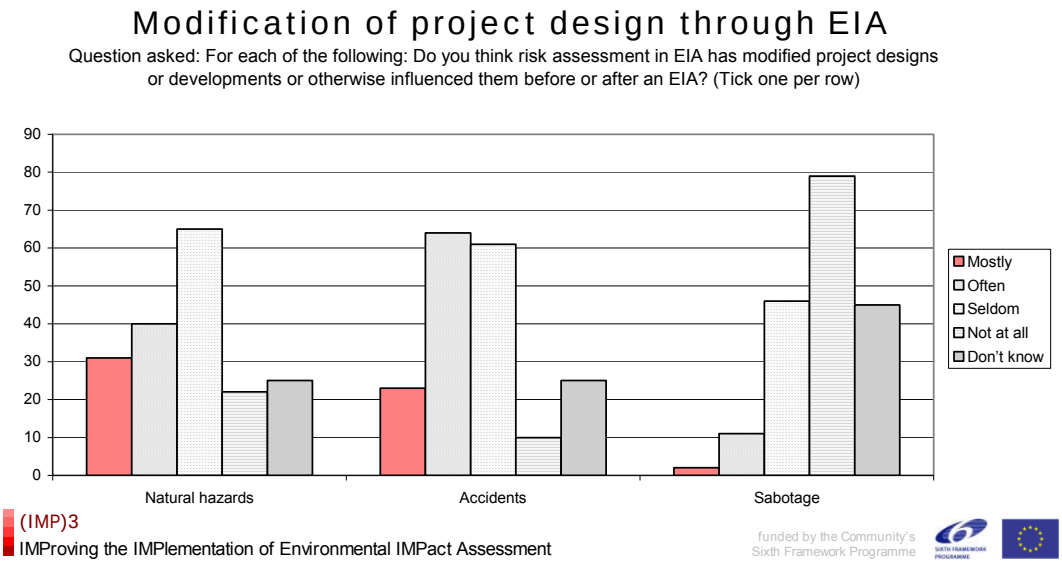

Figure 44 Frequency distribution of answers on EU-level to question No. 13A: Do you think risk assessment in EIA has modified project designs or developments, or otherwise influenced them before or after an EIA? (Absolute frequency of answers per hazard category and degree of influence; 183 returned questionnaires)

	Perceived influence of risk assessment on project modifications [%]				
Hazard category	**Standard**	**Often**	**Seldom**	**Not at all**	**Don't know**
Natural hazards	16,94	21,86	35,52	12,02	13,66
Accidents	12,57	34,97	33,33	5,46	13,66
Sabotage	1,09	6,01	25,14	43,17	24,59

Figure 45 Absolute frequencies of answers on EU-level per hazard category and per degree of influence in percent of 183 returned questionnaires.

Based on comparative evaluation of **country-level** questionnaire results to question no. 13A, Figure 46 presents a country-to-country overview of the degree to which EIA stakeholders think that assessment of extraordinary hazards in EIAs has an influence or has NOT an influence on project modifications:

Country	Natural hazards	Accidents	Sabotage
AT	×	✓	×××
BE	✓	✓	×××
CZ	✓✓	×	××
CY	×	××	×××
DE	××	✓	×××
DK	××	×	××
EE	?	×	×××
FI	××	✓	××
IE	✓	✓	×××
LV	✓	✓	××
MT	×	✓✓	×××
NL	✓	✓✓	×××
PL	×	?	××
PT	×	?	×××

Country	Natural hazards	Accidents	Sabotage
SE	?	✓✓	××
SI	✓✓	✓	×××
SK	✓✓	✓	××
UK	✓✓	?	×(×)

Figure 46 Overview of the degree to which responding stakeholders think that assessment of extraordinary hazards in EIAs has an influence or has NOT an influence on project modifications in their countries (qualitative evaluation of country-level results; 183 returned questionnaires)

✓ degree to which assessment of extraordinary hazards in EIAs has an influence on project modifications, according to stated stakeholder perceptions
× degree to which assessment of extraordinary hazards in EIAs has NOT an influence on project modifications, according to stated stakeholder perceptions
? contradictory results, unclear picture | EE, FR, GR, HU, IT, LT, LU ... not shown (response rate too low)

Comparative analysis across hazard categories

Based on questionnaire results, there is much empirical evidence that the impact of extraordinary hazards assessments on project modifications appears generally to be limited, but that the perceived magnitude of impact on decision-making depends on the hazard category. This impression is much in accordance with more general findings of previous country-specific and international research that has repeatedly shown that the effectiveness of EIA is in many cases not as good as it could be (cf. chapter 4.2). Cross-hazard evaluation of **EU-level** results indicates that there are differences in the levels of perceived effectiveness between the three broad types of hazards that are of interest here. Comparatively speaking, consideration of risks of accidents has a higher perceived influence on modification of project designs or other alterations of development proposals than do natural hazards or sabotage. With nearly half of all respondents stating that consideration of technological risks results 'mostly' or 'often' in project modifications, be it prior or after submission of the EIS, effectiveness of EIA in this regard may be termed comparatively high. If natural hazards are dealt with in EIAs, this is perceived to be less effective, albeit still 39% of respondents affirm that there are 'mostly' or 'often' effects on planning and decision-making. The picture is completely different for sabotage, which clearly is the source of risk that is perceived as most irrelevant to decisions on project design. Even in the rare cases (cf. chapter 3.2.2) where sabotage is in some way or another on the agenda of EIA, stakeholders report to an overwhelming extent that it has no or only little influence on the final realisation of projects.

Cross-hazard comparison of answers per **stakeholder group** shows that the overall pattern of results is basically replicated at group-level for all three hazard categories. The main difference compared to aggregated overall results is that the group 'business/private sector' has generally more positive perceptions of the effectiveness of extraordinary hazard assessment than the other groups. This applies to all hazard categories (natural hazards, accidents, sabotage). Representatives of 'NGOs' displayed a gradually more pessimistic view regarding natural hazards and accidents, but the difference is not striking.

Regarding coherency of stakeholder perceptions, comparative analysis of **country-level** results across hazard categories indicates that that there is some variation between Member States in the degree to which assessment of natural hazards and accidents is perceived to be effective. The range of variation appears to be larger for natural hazards than for accidents. However, the consideration of sabotage is perceived to be almost equally ineffective in terms of project modifications in all Member States, with differences being only a matter of degree.

There is no individual country where the degree of perceived effectiveness would be equal or strikingly similar for all three hazard categories (natural hazards, accidents, sabotage). In those Member States where the coverage of natural hazards and accidents would appear to be reasonably effective, the same does not apply to sabotage. However, there are few Member States (Cyprus, Denmark) where a rather pessimistic view was expressed for all three hazard categories, yet differences in degree do exist. However, if sabotage is not included in the comparison some similarities emerge. In this case, empirical data suggest that the coverage of both natural hazards and accidents is considered fairly effective to a similar extent in Belgium, Ireland, Latvia, Netherlands, Slovenia and Slovakia.

3.2.7 Effectiveness of assessing major social risks in EIA

Analogously to question no. 13A, in question no. 13B stakeholders were asked what influence they think the assessment of risks of major social impacts in EIAs has on modifications of project designs or on alterations of proposed developments in general, including influences on project planning prior to submission of an EIS. The social impact categories had been specified in the previous question no. 10B. The design of the question is equal to question no. 13A. The question was presented as follows:

Do you think assessment of the following in EIA has modified project designs or developments or otherwise influenced them before or after an EIA? (Tick one per row)

Type of impact	*Mostly*	*Often*	*Seldom*	*Not at all*	*Don't know*
Major social risks	☐	☐	☐	☐	☐

Of all respondents on **EU-level** (Figure 48), a majority of 34% stated that consideration of major social impacts, such as unemployment/loss of income/impoverishment, increase in crime rate, population changes (migration, relocation, etc.), and social exclusion/disintegration, did not have any effects on project modifications 'at all'. Another 29% stated that such is 'seldom' the case, adding up to 63% who saw little effectiveness of EIA in that regard. This compares to a combined percentage of 14% who had the perception that social impact assessment leads 'mostly' (4%) or 'often' (10%) to project modifications. A considerable share of respondents of 22% had no opinion on this issue, which is only slightly less than for the corresponding question on sabotage. Responses from Slovakia and the UK do not cause any remarkable bias of this distribution.

Perceptions of all **stakeholder groups** (Figure 47) closely resemble the overall pattern of results, the main difference being that representatives of 'national governments' and the 'business/private sector' made 'seldom' the top-ranking answer instead of 'not at all'. Quite similar to its perceptions of the effects of extraordinary hazards assessment, again the group 'business/private sector' was more positive about the effectiveness of social impact assessment in EIAs than the other groups. All ticks for 'mostly' came from three groups: the 'business/private sector' and administrations on national and regional level.

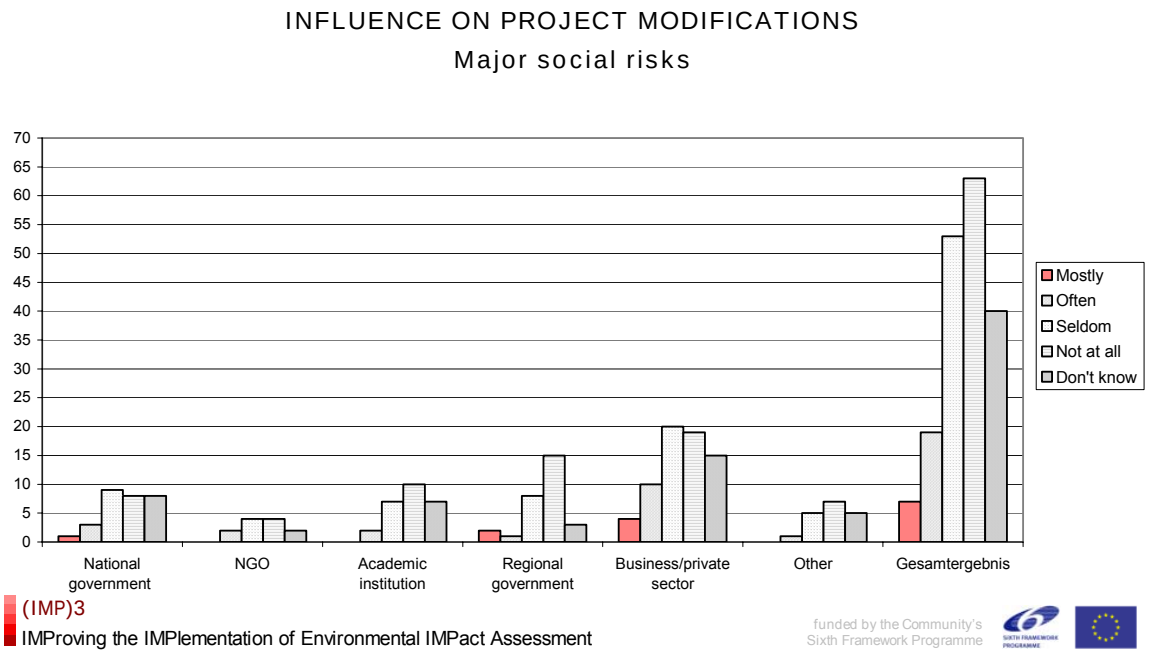

Figure 47 Influence of the assessment of major social impacts in EIA on project modifications per stakeholder group (frequency distribution of answers per stakeholder group and per degree of influence on EU-level, 183 returned questionnaires).

On **country-level** (Figure 50), results from most Member States conform well to EU-level results. No country can be identified where answers would suggest strikingly more optimistic perceptions of EIA effectiveness in terms of social impact assessment. There may be some indications that Latvia and, perhaps, the Czech Republic may tend towards more confidence in that respect, but empirical data do not really allow reliable conclusions. Answers in particular from Belgium, Germany, Denmark, and Sweden provide the clearest pictures that any influence of considering major social risks on project modifications is largely missing.

According to stated perceptions of all responding stakeholders on **EU-level**, Figure 48and Figure 49 show the degree of influence that assessment of major social risks in EIA has on project modifications.

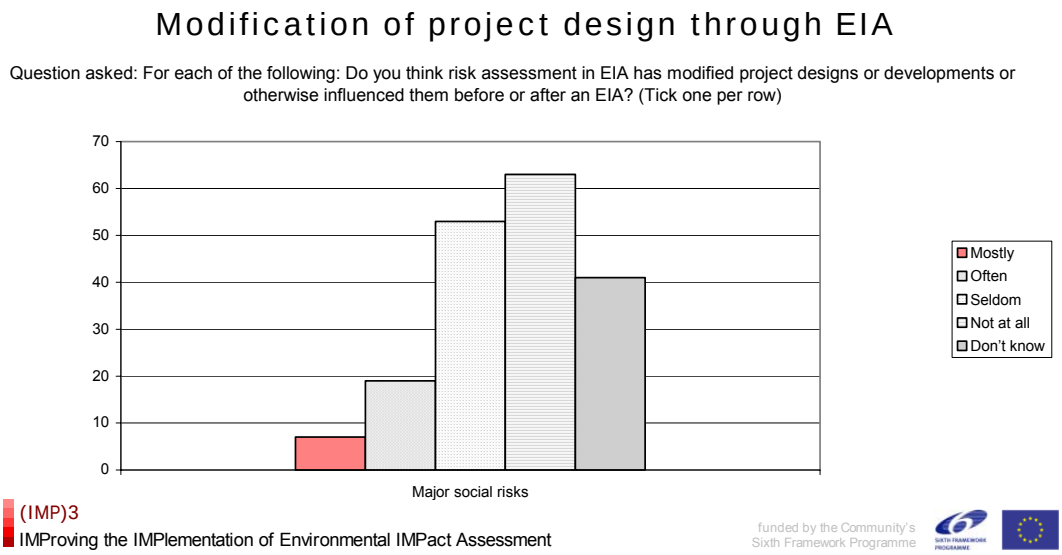

Figure 48 Frequency distribution of answers on EU-level to question No. 13B: Do you think assessment of major social impacts in EIA has modified project designs or developments, or otherwise influenced them before or after an EIA? (Absolute frequency of answers per degree of influence; 183 returned questionnaires

	Perceived influence of assessment of major social risks on project modifications [%]				
Impact type	**Standard**	**Often**	**Seldom**	**Not at all**	**Don't know**
Major social impacts	3,83	10,38	28,96	34,43	22,40

Figure 49 Absolute frequencies of answers on EU-level per degree of influence in percent of 183 returned questionnaires.

Country	Major 'social risks'	Country	Major 'social risks'
AT	××	LV	✓
BE	×××	MT	?
CZ	×	NL	××
CY	××	PL	××
DE	×××	PT	××
DK	×××	SE	×××
EE	××	SI	××
FI	××	SK	?
IE	×××	UK	××

Figure 50 Overview of the degree to which responding stakeholders think that assessment of major social risks in EIAs has an influence or has NOT an influence on project modifications in their countries (qualitative evaluation of country-level results; 183 returned questionnaires)

✓ degree to which assessment of major social risks in EIAs has an influence on project modifications, according to stated stakeholder perceptions

× degree to which assessment of major social risks in EIAs has NOT an influence on project modifications, according to stated stakeholder perceptions

? contradictory results, unclear picture

EE, FR, GR, HU, IT, LT, LU ... not shown (response rate too low)

3.2.8 Summary and conclusions of questionnaire findings

Based on analysis of 183 returned questionnaires, empirical evidence suggests the following overall picture of European EIA practice in terms of risk assessment:

Extraordinary hazards and risk considered in EIA

The different potential risk sources that are at the focus of the present report are covered to very different degrees in the European Union. A considerable range of variability in consideration of most extraordinary hazards persists both within individual Member States as well as between Member States. EIA performance profile appears to be best with regard to natural hazards and internal technological accidents. Both risk sources are addressed more regularly than other hazard categories, albeit notable differences between countries exist. In some countries coverage appears to be a matter of routine, whereas in others it is a much weaker feature of EIA. Internal risks of accidents caused by human failure are addressed only to a moderate extent, distinctly less often so than technological causes of accidents, but more often than impacts from accidents in the project environment. With only a few exceptions, "cumulative" risks from external accidents in other installations are considered only seldom in the vast majority of Member States. With only scarce evidence of any regular coverage at all, sabotage as a possible source of environmental risk is to a large extent outside the scope of EIA practice in Europe. It must be added that empirical data on the given question do not allow conclusions on the exact way hazards are considered in EIA, nor on the depth, deliberateness or quality of hazard assessment. Also, responses do not indicate in which stage of the EIA process (prior to EIA, screening, scoping, EIS, EIS review, decision, public participation) consideration takes place.

Differences between countries appear to be largest in the consideration of natural hazards, accidents due to human failure and external accidents. Each of these hazards is addressed more regularly in some countries than in others. The spectrum of variability appears to be less wide in the case of accidents due to technological failure. The largest degree of similarity persists in the almost equally strong degree to which sabotage is disregarded in EIA practice.

There is no single Member State where all hazard categories would be considered or not considered to the same degree. However, setting sabotage as similarly neglected risk source aside, coverage across hazard categories in some countries shows a larger degree of continuity than in others. One group of Member States (Netherlands, Slovenia, Latvia and, to some part, Germany and Slovakia) can be identified where all extraordinary hazards (except sabotage) would appear to be considered either frequently or to an at least fairly reasonable extent. For another group of countries (Belgium, Estonia, Poland, and Portugal) empirical data suggest poor or largely lacking coverage of all hazard categories. For all other countries, no particular overall tendency in terms of cross-hazard coverage can be identified.

In some cases, there was a considerable amount of disagreement among respondents from one and the same country on the extent of coverage of certain hazard categories.

Key steps of the risk assessment process usually applied to EIA

The different key stages of an idealised risk assessment process appear to be applied within EIAs with considerably varying frequencies. According to stakeholder responses on EU-level, the two steps that are conducted most often (each: 78% of all responses) are:

- the identification of relevant hazards, and
- measures to avoid, reduce or offset risks.

The two tasks of risk assessment that are applied least often are:

- public participation in risk assessment/management (27%), and
- assessment of the residual risk (based on predicted effectiveness of proposed risk control and risk reduction measures), including the appraisal of its acceptability or tolerability (33%).

All other procedural tasks that would predominantly require performance in a sequential order after hazard identification and prior to assessment of residual risks appear to be done with frequencies ranking in between the top-ranking and the last-ranking tasks abovementioned.

The most important overall results are replicated at country-level. Hazard identification and mitigation measures are also the two steps of risk assessment and management that are most often applied in almost all Member States, the only difference being that in some countries hazard identification is the top-ranking option, whereas in others it is mitigation measures. Moreover, public involvement with risk issues is the weakest feature of EIA in most Member States, with nevertheless some countries (Netherlands and, to a lesser extent, Czech Republic, Slowakia, Austria, UK) apparently applying it more regularly than others. With some exceptions (Netherlands, Germany, Malta), an assessment of residual risk and its consideration in decision-making on acceptability appears to be a seldom practised task within EIAs in most countries. Country-level results for the other stages of a complete risk assessment process are more mixed and indicate some variability in practices between Member States.

In general, the risk assessment process within EIAs in the European Union tends to lack consistency and completeness, and may sometimes even appear patchy. A number of analytical key steps in between hazard identification and risk management is often lacking. However, there are a few Member States (in particular: Netherlands) where data suggest a more systematic and coherent approach to a complete risk assessment process.

Barriers

The barriers to more coverage of risk assessment in EIAs appear to be diverse. The two main barriers that were identified most frequently were that 'technical guidance on how to apply risk assessment is missing or insufficient' and a 'lack of know-how on the part of EIA stakeholders'. This opinion was shared by more than half of all respondents, and slightly less than half, respectively. The five next-ranking barriers were, in order of decreasing frequency: 'national EIA legislation does not explicitly demand it'; 'lack of adequate methods'; 'risk assessment is applied in other project authorisation procedures separate from EIA'; 'including risk issues in EIA would increase duration and overall costs'; 'no clear definition of risk exists'.

The two proposed barriers that were affirmed by the lowest shares of respondents were that 'addressing risk issues would make public participation more complicated', and that 'risk issues are too complicated to be included in EIAs'. However, it must be stressed that each barrier accomplished considerable overall scores and was ranked most important or second-to-most important in at least two Member States. Thus, none of the proposed obstacles can be regarded as irrelevant, depending on the country-specific context situations.

In general, perceptions of barriers in the different Member States appear to be highly variied. However, missing technical guidance on apply risk assessment was also the top- or second-ranking barrier in most countries (except Germany, UK, Estonia, Netherlands). Lack of know-how in risk assessment was also felt to be one of the two most important barriers also in a majority of Member States (except Austria, Belgium, Germany, Denmark, Portugal). Missing legal requirements for risk assessment was ranked at first or second place in many countries (except Czech Republic, Cyprus, Finland, Malta, Sweden, Slovenia, Slovakia). Quite different to EU-level results, that 'decision-makers do not consider risk assessment to be important, or feel uncomfortable about decisions on acceptability of risks' was seen as one of the two most significant barriers by respondents from six Member States (Estonia, Ireland, Netherlands, Poland, Portugal, Slovenia). 'National guidance on EIA does not recommend inclusion' was most often felt to be no barrier at all on country-level, but it was ticked by the majority of respondents from the UK. Most atypically, responses from the Netherlands indicate that little barriers to more coverage of risk assessment in EIA are seen at all.

Among other barriers that were mentioned by individual respondents were: fear of EIA authorities and EIS review agencies regarding the reactions of the public during public consultation; lack of willingness to fund appropriate studies or address risks on the part of project proponents; concerns about overburdening EIA.

Effectiveness of risk assessment in EIA

Questionnaire results provide much empirical evidence that even when extraordinary hazards are considered in EIAs the influence of hazard assessment on project designs, project modifications and decision-making on risk avoidance, risk reduction and risk control measures integrated into project designs is generally limited. However, in detail the perceived magnitude of the impact of hazard consideration on project characteristics depends on the hazard category. In comparative terms, consideration of risks of accidents has a higher perceived effectiveness on modification of project designs or other alterations of development proposals than has assessment of natural hazards or sabotage. Almost half of all respondents have the impression that technological risk assessments result often or at least seldom in project modifications. Consideration of natural hazards is perceived to be less effective, with nearly half of all respondents feeling that effectiveness is rare or non-existent, but with still 39% stating that it is effective mostly or often. In both cases there is some variation in perceived effectiveness on country-level, with the range of variation being larger for natural hazards than for accidents. Quite different, there was strong consent among respondents from all Member States that even when sabotage is taken into account it has little or no effects at all on EIA outcome.

There is no single country where the degree of perceived effectiveness would be equal or strikingly similar for all three hazard categories (natural hazards, accidents, sabotage). In those Member States where the coverage of both natural hazards and accidents in EIAs would appear to be

reasonably effective, the same does not apply to sabotage. However, there are few Member States (Cyprus, Denmark) where a rather pessimistic view was expressed for all three hazard categories, though differences in degree do exist. If sabotage is not included in the comparison, one group of countries can be identified where assessment of both natural hazards and accidents appears to be fairly effective to a similar extent (Belgium, Ireland, Latvia, Netherlands, Slovenia, Slovakia).

Among all stakeholder groups, the group 'business/private sector' has generally a more positive opinion of the influence of extraordinary hazards assessment on the EIA outcome in terms of modifications of project designs than all other groups. Members of NGOs tend to have a gradually more pessimistic view, but differences are a matter of degree. In all other cases, the overall distribution pattern of perceptions is basically replicated at stakeholder group-level.

Major social risks: coverage and effectiveness

Overall questionnaire results imply that risks of major impacts on social and socio-economic determinants are to a large extent a marginal or even non-existent issue in European EIA systems. Consideration across impact categories varies along a relatively narrow spectrum ranging from modest to not at all. With the majority of all respondents stating that they are dealt with 'seldom', population changes (migration, relocation, etc.) and socio-economic changes, such as unemployment, loss of income and impoverishment, appear to be covered more in comparative terms than other social impacts, which are each by the majority perceived to be addressed 'not at all'. An increase in crime rate is the least covered impact category ('not at all' and 'seldom': 82%), followed by social exclusion and disintegration ('not at all' and 'seldom': 74%). An unusually high proportion of respondents were not able to form an opinion on the latter impact category, which might document that issues of social equity in an EIA context are "unfamiliar territory" to many stakeholders.

While country-level results suggest limited variability between Member States for the impact groups 'socio-economic decline' and 'population changes', an 'increase in crime rate' and 'social exclusion and disintegration' appear to be out of the scope of EIA in all countries to an almost equal degree.

Even when major social risks are addressed in EIAs, the perceived effectiveness in terms of project modifications is modest. Nearly two thirds of all respondents saw no or little influence on EIA outcome. Differences between Member States appear to be mainly a matter of degree.

3.3 Results Interviews

3.3.1 General remarks

The interview results are analysed and presented along major key themes which provide the structure of the following sub-chapters of the given chapter 3. Themes have been defined by clustering groups of closely connected interview questions.

The method that has been applied to the evaluation of the interviews a strictly qualitative ‘content analysis’ (Gläser & Laudel, 2004; Mayring, 1993). Crucial variables have been determined for each theme, which provided the evaluation categories for extraction of information from the interview protocols and the search pattern for the screening of the protocols. From each interview protocol,

relevant information was extracted and allocated to the appropriate evaluation categories. In a first step of evaluation, a comparative analysis of information was conducted for each country. In a second step, a comparative cross-country analysis was done for each evaluation category and each theme. Interpretation and presentation of the interview results is done in a verbal-descriptive way.

3.3.2 Coverage of extraordinary hazards and risks in EIA

Under the given theme "Coverage of extraordinary hazards and risks in EIA", mainly answers to the following questions have been evaluated:

Wording of the questions

To what extent are abnormal risks considered in your country?

Which types of extraordinary hazards that could affect a project are addressed in EIAs in your country?

To which project types or situations is the assessment of abnormal risks usually applied?

Hazards considered

In general, there was much consent among interviewees from all sample countries that environmental risks that could arise from impacts of **natural hazards** on proposed developments are addressed to a greater or lesser extent in all Member States, but with different priorities attributed to different types of natural hazards. The weight given to certain hazards seems to depend much on specific national or regional characteristics of the natural environment, i.e. on the general liability of environmental conditions to occurrence of particular natural hazards. For instance, in Austria natural hazards typical of mountainous Alpine terrain, such as floods, avalanches, and geogenic hazardous incidents, like mudflows, debris flows, and landslides, are usually considered, whenever appropriate and relevant. The relevancy of hazards and the degree of their consideration may also differ between regions within states (e.g., in Germany avalanches and floods by mountain torrents are an issue mainly in the Southern Alpine part of the country). Flood risks rank among the most often mentioned natural hazard types (except Latvia) and account for the predominant part of all external hazards assessed within EIAs in the Czech Republic, where it was also rated the most important risk issue to be covered by EIAs. Their importance seems to have increased during the last years, probably due to major flood disasters in large parts of Europe (e. g., in summer 2002). Earthquakes appear to be an issue quite often, although there is some evidence that consideration of large-scale seismic risks is restricted mainly to high-risk project types (e.g., nuclear power plants in Germany) in designated earthquake risk zones. In some countries, avalanches, landslides, other unforeseen changes to the terrain and spring tides (harbour projects) were specified. Only in France, cyclones, heavy rainfall (both mainly in overseas departments), forest fires and rockfall were explicitly mentioned. Only in the UK it was stated that most of the aforementioned natural hazards are rarely addressed because their likelihood of occurrence is considered low. If so, it would be mainly to demonstrate the absence of any such risk. One interviewee from Germany stated that, apart from earthquake disasters, geological and geotechnical risks are often undervalued. Potential impacts of a project on natural hazards pre-existent in the project environment (e.g., increase in likelihood of occurrence, increase in hazard potential) were never mentioned, except by respondents from Portugal, who stressed that this is

out of scope of EIA, but would be covered by the separate licensing procedure subsequent to EIA. One German expert suggested that in areas of flood origin impacts of land use change on the likelihood that a flood will built up (increase of surface water runoff) should be included into the scope of EIA.

Respondents from several Member States emphasized that usually high risks of natural hazards are already identified by the project developers themselves or during early consultations with authorities, long before submission of the EIS. In those cases, normally a more appropriate alternative project location is selected before EIA procedures start. Otherwise, this would very likely lead to refusal of development consent. In those Member States where institutionalised natural hazard mapping (mainly for floods, avalanches, earthquakes) exists (e.g., Austria, Germany, Czech Republic), it appears to work as an efficient tool for timely hazard identification and suitable site selection. On the other hand, consideration of such natural hazards in the EIS is then often practised in a very formal way by just making references to risk zones designated in existent hazard maps.

Accidents caused by **technological failure** (breakdown, malfunction, process failure, etc.) also appear to be considered mostly as a matter of routine in all Member States, except the UK, where coverage within EIA is said to be rare and appears to be mainly restricted to large, Seveso-type project types (e.g., nuclear power plants). In many countries, the concept of accidents applied to EIAs embraces various degrees of events of fault and non-standard/non-routine modes of operation that could lead to accidental releases of pollutants or could otherwise cause damage. Hazardous incidents that were most often named as examples of technological risk sources comprised fire, explosions, increased emission levels due to operational disturbances, traffic accidents, transports of dangerous goods. However, in spite of quite regular coverage of risks of accidents, there was some indication that in particular in smaller countries with lower numbers of large, risky project types or absence of high-risk technologies technological risks are rather a side-issue in the EIS. In Austria, a discrimination was made between accident types that are rated as "more likely" (fires, traffic accidents etc.) and rare hazardous incidents whose occurrence is considered very unlikely, such as the crash of an airplane at the project location – while the first category is usually addressed, the latter is not, regardless of the potential magnitude of consequences.

Little mention was made of **accidents** caused by **human failure**, except by interviewees from Portugal, Latvia and Slovakia. In Portugal, technological and human failure are said to be considered always in combination with each other.

Except by interviewees from Portugal and Slovakia, no evidence was provided that impacts on proposed developments from potential **accidents in other existing installations** are addressed at all. External accidents are explicitly not in the scope of EIA in the UK, as well as in the Czech Republic, where it was said to be mainly a matter of Seveso II-regulations. One German interviewee added that assessment of cumulative impacts is a weakness of EIA in general, which would apply to an even higher extent to cumulative risks.

Sabotage was not a real issue in any interview. Some indications of its consideration were only made by interviewees from Portugal, Latvia and Slovakia. In Germany, where legislation relevant to EIA procedures (Statutory Order on Hazardous Incidents within the Federal Immission Control Act)

exists that provides for consideration of sabotage (cf. chapter 2.1.2), only railway sabotage was said to be an issue sometimes (probably due to some recent incidents).

In general, what hazard is considered in what depth and deliberateness depends much on project types, as well as on project locations. The degree of regularity of hazard assessment ranges from "only to a small extent" (Sweden) and "rarely" (UK) to "standard" (a number of countries).

Project types or situations to which risk assessment is applied

The **project types** named to which some kind of risk assessment is usually applied appeared in most cases to relate to technological risks (accidents, abnormal modes of operation, safety risks). Some Member States made restrictions regarding the range of project types that are usually considered risk-relevant, e.g. “mainly chemical industries” (Poland); “industrial projects, only occasionally other projects” (Latvia); “very seldom applied, only industrial projects” (Sweden). Interviewees from Portugal agreed that while risk assessment is generally seldom applied in EIA, it does occur quite regularly with certain industrial projects that require an independent industrial licensing procedure and/or with projects with a particularly high technological risk level, such as projects involving transport and storage of fuel (pipelines, storage facilities) and high voltage links, though mainly not under control of the EIA regime. Some Member States stressed that an entire pool of project categories is generally subject to risk considerations because of special legislative regimes outside the EIA system. In particular, in Germany various kinds of risks should be dealt with in EIA for all projects that are subject to both the EIA legislation and the Statutory Order on Hazardous Incidents under the Federal Immission Control Act. In France, a so called "hazard assessment study" ["*etude de danger*"] is required for "classified installations", which in practice account for approximately half of all projects for which EIA is required. Apart from that, the weight given to certain project categories differs between Member States. However, among the project types most frequently specified were the following:

- industrial facilities (in particular involving hazardous substances)
- chemical industries
- large heating power plants
- waste incineration plants
- pipelines (oil, natural gas)
- storage of fuels
- (high-ranking) transport infrastructure projects, tunnels
- airports
- nuclear industry (e.g., radiological risk assessments and extensive operational safety studies concerning risks of technical accidents in nuclear power plants), including final storage of spent nuclear fuel
- waste management projects (landfills, hazardous waste sites, including transport routes, waste water treatment plants, restoration of contaminated areas)
- energy industry (power plants, high voltage linkages and power lines)
- transport of dangerous goods

- flood protection projects (dykes, dams, etc.)

Specific project types that were mentioned only by individual countries comprised the following:

- livestock installations (Germany)
- mining projects (UK)

Interviewees from a number of Member States referred to particular **project locations** where various hazards and related risks are dealt with regularly:

- all projects in flood risk zones (Czech Republic)
- roads across former coal mines or World War I trench systems; fragile (lake) ecosystems; cavitatous sites (caustic rock formations, stone extraction sites, mushroom cultures); seismical risk zones, contaminated soil (France)
- Water protection areas (tank car accidents on roads) (Germany)

Interestingly, only one Slovakian interviewee related to risk perceptions of the public as a criterion for applying risk assessment ("projects that are perceived highly risky by the affected public").

Among the project categories that interviewees missed on the European and/or national project lists, there frequently were some that may appear particularly relevant in a risk assessment context because of their increased (technological/safety) risk potential: installations working with biotechnologies, in particular GMOs; removal and storage of asbestos; military installations; transmitter stations for cellular phones, but only after actual health impacts have been clarified (for further details on the issue of project types and project lists, please refer to the Final Report of Work Package 4).

Human health risks

Regarding potential receptors of adverse consequences and the assessment methods applied, a predominant theme emerging from most interviews was that most practical applications of risk assessment within EIA refer to human health risks. Though, it would appear that most of these human health risk assessments do not necessarily relate to the issue of extraordinary risks, but rather to prediction of health impacts from normal operation of a project. Human health impacts are dealt with in detail in the Final Report of Work Package 2. However, because this was a constant theme also in the context of risk assessment, some aspects of human health risk assessment are also included here.

There is strong evidence that at least in some countries the adverse consequences of hazardous events that are assessed pertain mainly to human health effects. This holds particularly true for Germany, where risk assessment is mostly applied to impacts on human receptors or to pollution of environmental media by substances toxic to humans (air, water, soil). Environmental risk effects on other biotic components of the receiving environment (animals, plants, ecosystems) are to the most part neglected. Consequently, toxicological and radiological health risk assessments are most often conducted. Death risks of accidents are considered more often in urban environments. Similarly, most interviewees from the UK pointed out that if risks are assessed in EIA, it is hardly ever from the environmental perspective, but rather as health risks. In the Czech Republic, public health risk

assessment is mandatory for all project types, regardless of the nature of impacts and of the relevancy of health impacts in specific cases, but workplace health aspects are not included.

Occupational health and workplace safety are outside the direct scope of EIA in a number of countries (Poland, Slovakia, Czech Republic, UK), whereas in others it is required by EIA legislation (e.g., Austria), or may become an issue within EIA procedures because of other legal requirements (e.g., Germany, France).

Results from non-EU countries

In the **USA**, the extent and intensity of coverage of abnormal risks in the EIA process appears to be varied, depending on the State, the kind of agency involved, the type of project, and project location. In general, most interviewees stated that risks posed by natural hazards (floods, earthquakes, etc.) and accidents are often covered in EIA, whenever case-specific circumstances indicate that it is appropriate and relevant, although risk assessment is not explicitly required by NEPA. Risks of accidents appear to be regularly assessed in energy projects – often stimulated by public discussion -, whereas they are seldom in transport projects. Sabotage as a risk source is generally not addressed. The role of land use planning in considering both man-made and natural hazards was stressed; hazardous sitting is usually avoided in early stages of project development.

In accordance with the federal EIA act, consideration of accidents and natural hazards is "standard" practice in **Canada**. Even in Provinces that do not require assessment of the impacts of the environment on the project, it is nevertheless done whenever relevant and useful. Risks of accidents are stated to be always covered.

Selected quotations

The following quotations from the interview protocols provide some further insight into stakeholder views:

"Extraordinary hazards that have a very low probability, like a crash of an aeroplane over the project area are not considered. In EIAs, more 'usual risks' are considered like train and car accidents, burning trucks in tunnels. (...) Natural hazards as flooding of rivers, avalanches and land slides in the Alps are usually assessed whenever appropriate" [Austria].

"Consideration of accidents is 'standard' for many project types (nuclear and other power plants, waste incineration plants, chemical and other industrial plants, tunnels, etc.). However, risks of accidents are not an independent issue of EIA, but they are rather part of other development consent procedures. German environmental legislation requires EIA only to deal with additional issues that are not already covered by other environmental laws.

Regarding hazardous waste sites, transport routes are usually included in the assessment, but, in general, accidents in other existing installations that could affect the submitted project are seldom considered. In this regard, the spatial perimeter of risk assessment is surely often too limited. Insufficient coverage of interdependent and cumulative effects, including risks, is a weak point of EIAs in general. I do not know any single case where sabotage has been considered, but I cannot exclude that cases may exist" [Germany].

"Abnormal risks are rarely considered in the context of EIA procedures. In the case of industrial project developments, especially those involving fuel storage, it might be required, as well as for the case of high voltage links. However, abnormal risks assessment is usually considered only for very particular types of projects.

Furthermore, risk assessment scope and weight for these types of projects may vary considerably, depending essentially on the EIA Commission members' sensibility to these questions. Anyway, for the most part, risk assessment occurs in the context of other control regimes but EIA" [Portugal].

"There is a difference between those projects requiring a risk assessment notification in the course of an industrial licensing procedure and every other type of project. For the latter, risk assessment is usually quite incipient and superficial, and based mostly on qualitative evaluations.

Risk assessment pertains very little to environmental impact assessment procedures. In this case, risk estimation is limited to hazards identification and to the respective probability of occurrence calculation. Most of the time, results are presented in the form 'in the last x years, there has only been a case of roof collapse, albeit there was already a problem of bad foundations'" [Portugal].

"I have rarely seen natural hazards addressed in EIAs. Rare examples are only to demonstrate that there are no such hazards. Hazards due to technological/human failure are rare but I have seen them addressed for example in the nuclear industry. Accidents as a result of other projects in the environment or sabotage I have never seen addressed" [UK].

"I don't think they generally think about it. They might be for the exceptional issue e.g. nuclear. I don't think its high on the agenda. It's not overtly something that the Directive requires.

However, there is national planning advice which does provide guidance on in which circumstances risk issues should be considered. It explains that while it is not routine matter where there are likely to be such risks they should be considered.

Hence, the extent to which abnormal risks are considered in EIAs depends on the nature of the development under consideration.

Depending on the project I would expect to see risks of technological failure and human error to be assessed either within the EIA or separately as a part of other regulatory and safety procedures [...]. For major industrial developments the Health & Safety Executive would tend to get involved as well as specific licensing and authorisation procedures. So EIA is not the only process through which risks are identified and assessed" [UK].

3.3.3 Methods applied

Under the given theme "Applied Methods", mainly answers to the following questions have been evaluated:

Wording of the questions

Do you know what methods, techniques or tools of risk assessment are most often applied in EIAs? – Please give some examples

Are these methods adequate/effective?

If not, could you suggest approaches which would be more adequate?

Methods applied

The methodological approaches applied to risk assessment in EIAs within the ten sample Member States appear to be varied, both between countries and on country-level, albeit similarities exist. In general, what method is employed depends much on project types, on the risk issues considered most important in particular situations, as well as on the involved EIA experts. Broadly stated, in those cases where some form of risk assessment is applied, both qualitative and quantitative approaches are used, including combinations of both. However, qualitative techniques appear to be used much more frequently, both on EU-level and in most Member States.

Purely verbal-descriptive ways of characterising hazards and adverse consequences appear to be applied frequently in EISs (Austria, Czech Republic, France, Germany, Portugal, Slovakia, UK), often relying on expert judgments to provide approximate risk estimates. Often, descriptive analysis is supported by simple qualitative tools, such as checklists, matrices, or decision trees (Austria, Czech Republic, France, Latvia, Poland, Slovakia, UK), which are sometimes also applied as stand-alone techniques or in a mix with quantitative approaches. Swedish and Slovak interviewees named a particular application of a matrices-type approach: comparative evaluation of estimated risk significances (low/high risk), based on qualitative expert judgments, in order to facilitate identification of the greatest risk as well as priority-setting for further risk analysis and/or for designing risk management measures. In countries where hazard mapping is established (e.g., Austria, Czech Republic, Germany), it is common to use available hazard maps as a baseline information and to make some reference to them in the EIS, mostly by comparing the location of the project with designated risk zones in existent hazard maps (floods, avalanches, seismic hazards, some other geogenic hazards). Even in those countries where comparatively advanced quantitative models and methods of risk assessment exist in EIA practice, qualitative approaches appear to be by far predominant (e.g., Czech Republic, Germany, Slovakia). Discussion of accident scenarios appears to be a quite established feature in Austrian EIAs, often combined with quantitative calculation of dispersion rates of released toxic substances for different emission levels and for different dispersion pathways. Often the worst case scenario is calculated, but there is also some evidence that in case of high impact magnitudes both project developers and decision-makers are reluctant to use worst case scenarios because of prevailing fears that this might lead to unacceptable risks (Austria).

The spectrum of semi-quantitative and quantitative methods that have been mentioned comprises both relatively simple techniques and more complex models of risk assessment. The following straight-forward approaches have been named by experts from some Member States: analogies

based on accident statistics (Austria), extrapolation of risk estimates from comparison with previous similar projects (Germany), and calculation of return probabilities of periodical natural hazards from historical records (Austria, Czech Republic). In particular for flood risks, also computer-based modelling and simulation approaches are sometimes used, in particular for more recent cases (Austria, Czech Republic, and France), albeit some of these applications may not be done on project level but rather for preceding hazard mapping. Statistical frequency or probability analyses appear to be one of the most regularly applied quantitative methods in risk assessment in many Member States (Czech Republic, Latvia, Portugal, UK). In Austria, estimating the risk causal paths is sometimes done by applying methods coming from process engineering.

Various forms of health risk assessment appear to represent a quite frequent application of risk assessment in methodological respects, although not necessarily related to extraordinary hazards. Remarkably, health risk assessment is obligatory for all kinds of projects in the Czech Republic, although not always strictly quantitative methods are being applied. In general, the four-step US EPA model of health risk assessment (cf. chapter 1.3.1.5) is used in Czech EIAs, in some cases US EPA methods have also been used in Slovakia. Usually, at least some steps in health risk assessments are based strongly on quantitative calculations, including, e.g., calculation or modelling of dose-exposure or dose-response relationships, which are also used routinely in health risk assessments in the UK (but mainly not under EIA legislation). Toxicological and radio-ecological (health) risk assessments for certain project types (e.g., waste incinerators, nuclear installations) are said to be “classical” applications of quantitative risk assessment in Germany. Depending on the significance of a given risk, in some sample countries computer-based mathematical models have been introduced to risk assessment within EIAs in recent years (Austria, Czech Republic, still rarely also in France, Poland, UK). From the Slovak Republic, one case study example of a mining activity was reported where an ecological risk assessment according to US EPA methods had been carried out.

According to the French “classified installations” regulations, a “hazard assessment study” ["*etude de danger*"] has to be prepared and submitted along with the EIA Impact Study. Its purpose is to identify sources of danger, identify foreseeable accident scenarios, evaluate consequences of an accident, and justify measures for prevention and mitigation of effects. However, no mentioning is made of the particular methods that are usually employed in the preparation of the “hazard assessment study”. One French interviewee explained that sophistication of methods in France depends on type and dimension of projects. For small projects only rough estimations are undertaken, whereas modelling techniques are used for large projects, for example associated to flood and water issues. This basic approach may be true in a similar way for many other Member States.

In Portugal, a distinction is made between industrial and non-industrial risks. For non-industrial projects, qualitative approaches prevail, especially those based on experts' opinions: hazards and their probability are identified (rather than quantified) in a limited and rather descriptive manner. For industrial projects, a separate legal instrument that provides for some kind of industrial impact assessment exists; assessment of industrial risks is often quantitative (probability/statistical analysis) and tends to be formalised. A more thorough risk assessment is also usually applied to certain high-risk projects, such as fuel storages, high voltage links, or dams. However, the focus seems to be much on hazard identification and risk reduction measures, and less on examination of the environmental consequences of an accident occurring. It was said that Portuguese developers prefer to invest in safety measures than in comprehensive risk assessment.

In the UK, most (quantitative) risk assessment work is done not under EIA legislation and not within EIA procedures, but mainly under COMAH (Control of Major Accident Hazards) legislation and regulations, as well as under the legislation on Health and Safety at Work, which have their own licensing regimes governed by the Health and Safety Executive (HSE). However, a certain class of EIA projects are subject to consultation with HSE, which advises planning authorities on off-site risks. Although there is no legal requirement in the UK to consider extraordinary risks in EIA, in practice national authorities nevertheless "expect risks from flooding and landslides to be addressed" in EIAs (cf. chapter 2.2.2.1). Similarly, provisions relating to earthquakes are regulated by separate regulations, but EIA "is expected" to consider seismic risks likely to cause significant structural damage. It is recommended, though not required, that the ES should include indications of preventive measures and reference to compliance with Seveso II-related licensing regimes. In Scotland, guidance on EIA (Planning Advice Note PAN 58: Environmental Impact Assessment) provides a qualitative checklist for EIS review that recommends to identify risks of accidents and hazardous developments and to indicate preventive measures in the EIS (Scottish Executive Development Department, 1999) (cf. chapter 2.2.2.1).

Also from the UK came interesting examples for the use of risk thresholds in EIA. In some cases, thresholds with defined levels of acceptability of risks of accidents had been applied to nuclear facilities, airports and risks of accidents on runways. However, these threshold approaches to risk assessment appear to be derived from other decision-making frameworks outside EIA.

In overview, the following methods, tools, or techniques of risk assessment that are used in EIAs in the ten sample countries to a larger or smaller extent have been named explicitly by the interviewees. The list provided below is based solely on the statements of interview partners; naturally, depending on restrictions of personal knowledge, it may thus be far from complete.

Qualitative methods:

- expert judgment, verbal-descriptive assessment, brainstorming (Austria, Czech Republic, France, Germany, Portugal, Slovakia, UK);
- checklists (Austria, France, Latvia, Poland, Slovakia, UK);
- matrices (Czech Republic, Poland, Slovakia);
- decision trees, "what if" – analyses (Slovakia);
- descriptive discussion of accident scenarios, incl. worst case scenario (Austria)
- hazard mapping (floods, avalanches, some geogenic hazards) (Austria, Czech Republic, Germany)
- qualitative comparison of degrees of estimated risk significances, or other specific risk aspects (Slovakia, Sweden).

Semi-quantitative methods:

- scenario analysis (Austria, Germany)
- comparison with similar projects and extrapolation of risk estimates (Germany)
- multicriteria analysis (Czech Republic).

Quantitative methods:

- analogies, based on statistics of previous accidents (Austria);
- statistical frequency/probability analyses (Czech Republic, Latvia, Portugal, UK)
- fault-tree analysis (Austria)
- return probabilities of natural hazards (floods, avalanches, etc.), based on historical experiences and/or calculations and modelling (Austria, Czech Republic);
- calculation of dispersion pathways and dispersion rates for (accidental) releases of toxic substances (Austria, Germany, Czech Republic)
- toxicological and radio-ecological (health) risk assessment (Germany)
- dose-exposure relationships, calculation of reference dose and other specific parameters for health risk assessment (Czech Republic, Germany, UK)
- mathematical models, computer simulations (Austria, Czech Republic; rarely in France, Poland, UK)
- US EPA model of health risk assessment (four-step procedure) (Czech Republic, Slovakia);
- ecological risk assessment (one case in Slovakia);
- thresholds for acceptability of risks (UK).

Adequacy and effectiveness of methods

Interview partners were also asked about the adequacy of the applied methods of risk assessment. While basically many interviewees considered the methods used fairly adequate, their answers were also often differentiated and gave important indications of particular strengths and weaknesses.

One interviewee from Austria stated that quantitative measures of risk (e.g. death rate) are not very popular due to political reasons. With particular regard to health risks, some senior experts added that the description of the status quo is often done with impressive deliberateness, contrary to assessment and prediction of impacts where considerable weaknesses would exist. Czech interviewees agreed that the applied US EPA methods of health risk assessment were adequate and effective, because they are able to quantify the level of risk and to compare it with standards and thresholds. One interviewee from the Czech Republic stressed that the public has a large positive influence on risk assessment by actively pointing out to risks and stressing the need to tackle them, whereas another expert argued that the influence of public opinion and of interest groups could interfere with the scientific-technical risk assessment process and make it more complicated.

A German expert stated that the methods of risk assessment may be adequate in technical terms, but yet questioned the effectiveness of risk assessment in EIAs in terms of its relevance for final decision-making. He also passed criticism on a lack of awareness and reflection on part of EIA experts about the specific limitations, weaknesses and uncertainties that are inevitably inherent to each particular method of risk assessment, and that should be pointed out very carefully in each

EIS. Mostly, one technique is chosen, and then it is not questioned anymore. This would also argue against standardisation of any method in EIA. Asked about the weaknesses of current German EIA practice in terms of risk assessment, another German interviewee referred to findings of an empirical review he had published some years ago. According to Wende (1998), a sample of 11 case studies suffered from the following methodological shortcomings: a lack of systematic approaches; the consideration of the adverse consequences of potential accidents is restricted on human health effects, whereas effects on other biotic components of the receiving environment are largely neglected; while sources and probabilities of accidents may be analysed, their environmental impacts are often not assessed; potential effects of hazardous events are often described only in a qualitative way; often no probabilistic analyses of serious risks are undertaken (Wende, 1998).

In Latvia, despite most methods used were considered technically adequate, the effectiveness of risk assessment was questioned because clear definitions of, or standards for, “acceptable risks” are lacking, and thus decisions on acceptability of a risk are a pure matter of politics. While the largely quantitative risk assessment of major industrial risks in Portugal was considered generally adequate, there were considerable doubts if this was also true for EIA. It was also stated that proponents usually prefer to invest in safety measures rather than in risk assessment. Swedish respondents considered methods fairly adequate and effective, but it was criticised that synergistic and indirect risk effects (e.g. regarding chemicals) are not considered, and that there is a general tendency in examination of alternatives to investigate the “impossible” options, in order to make the proposed development appear less adverse and less risky. Some Slovakian interviewees mentioned that in particular more complex methods, including health risk assessment and ecological risk assessment, have been carried out mostly in order to live up to public interest. It was stated that coverage of all steps of risk assessment and risk management is required, as well as the need for quantitative methods. One interviewee from the UK argued that while the methods applied may have quantified the probabilities of occurrence of hazardous events, the environmental implications of those events occurring have rarely been investigated. One expert made a point stating that quantitative assessments are complicated and difficult to communicate to non-experts. Interviewees from several countries (Germany, Poland) emphasized that the effectiveness of risk assessment methods is difficult to determine because this would require EIA follow-up monitoring and retrospective evaluation, which are largely non-existent up to date.

Results from non-EU countries

In the **USA**, NEPA does in principle not prescribe what method is to be applied, but choice of methods depends strongly on the proposed action. Accident analysis and scenario analysis are frequently implemented in the EIA process, including the assessment of the impacts of an accident happening on the environment. Originally, "worst case" scenarios were required by EIA procedures, but this requirement has expired. However, the technique is still used by some agencies. There was no consent on the question if qualitative or quantitative methods predominated: while probability assessments appear to be not applied to transport infrastructure projects, others claimed that quantification of risk is used whenever possible. According to one interviewee, 'conservative' figures and indicators are often used in response to uncertainty.

According to one interviewee from **Canada**, "worst-case" scenarios are used, taking into account the acceptability of risks.

Selected quotations

The following quotations taken from the interview protocols are meant to illustrate some distinct views of interviewees:

"Both quantitative and qualitative methods are applied, depending on the situation. For toxicological and radio-ecological risk assessments, quantitative calculations are "standard". An often applied qualitative approach is the designation of risk zones, or referring to existing hazard maps. In my overall judgement and as far as I know, these methods are adequate from a technical point of view. But this does not say much about the effectiveness in terms of relevance for the final decision on project approval. [...] In my eyes, there is often too little reflection on the techniques of risk assessment; mostly one technique is chosen, and then it is not questioned anymore. One should be more aware of the fact that any method of predicting risks and impacts has its weaknesses. These methodological limitations, uncertainties and knowledge gaps should be pointed out very carefully in EIS, much more so than it is usually the case" [Germany].

"The methods have quantified the risk of an event occurring, for example, but when they've gone on to look at the implications of that event occurring its really quite rare that I've seen that carried through to the environmental implications of that risk. It's really about how many people might be killed or injured, but if they were sited near a Natura 2000 site doesn't really get a mention" [UK].

"In most cases where I've seen a comprehensive risk assessment carried out, the real agenda has been to demonstrate that there's not much of a risk (...) the most frequent occurrence I see of this is the health risk assessment where they're attempting to demonstrate that the dioxins or furans are so low that actually there's not a substantive risk compared to smoking or similar daily risks" [UK].

3.3.4 Screening procedures

Under the given theme "Screening procedures", mainly answers to the following questions have been evaluated:

Wording of the questions

Is risk used as a criterion in case-by-case examinations, or in the setting of criteria and thresholds in order to determine the need for an EIA (screening procedure)?

If yes, can you give examples for project types and categories?

Many interviewees from a number of countries had the assumption that extraordinary risks may have played some kind of role in the **setting of criteria and thresholds** for the project categories on the national or regional project lists, at least for certain project categories. However, most of those experts appeared to have no validated knowledge on that issue. A considerable share of missing answers to that question may also indicate a lack of knowledge on the considerations underlying the legislation-building process. Some interviewees indicated that the (mostly area-, size- or capacity-based) criteria and thresholds laid down in EIA legislation would probably reflect the risks associated with certain project categories in an indirect way. This view is expressed best in the statement of an expert from the UK, who argued that the project categories would be wide

enough to cover most of the risk issues. Only interview partners from one Member State (Poland) agreed that risk was no criterion at all for the fixing of criteria and thresholds.

Regarding the use of risk as a criterion in **case-by-case examinations**, as is required by Annex III.1 of the EIA directive, stakeholder opinions were more varied and differentiated. It must be mentioned that many interviewees from different countries expressed a lack of knowledge or experience about on what exact criteria screening decisions are usually taken; consequently, many answers indicated a large amount of uncertainty. In the case of a provincial state in Germany, even different authorities are responsible for screening decisions and for EIA procedures, and information flows between both authorities tend to be incomplete.

Answers often indicated that the risk of accidents, in particular in relation to technologies used and substances involved, would probably be given some consideration in screening decisions, but that it usually were not the most important aspect therein. This was made most explicit by interviewees from Austria and the UK, with the opinions expressed by UK experts ranging from "*abnormal risks tend to be part of the criteria used*" over "*risk is used not explicitly in screening procedures*" to "*not at all*". One interviewee from the UK added that only if a local community were very concerned would risks drive the EIA process. Some stakeholders from Austria and the UK expressed high confidence that all high-risk projects would be included in the list of project types that are subject to mandatory EIA, anyway, thereby reducing the need for risk-related considerations in case-by-case examinations.

While at least part of the interviewees from most countries had the impression that risk would be a criterion in determining the need for an EIA to some extent, there was no clear consent on that in some countries (e.g., Sweden), and in most countries more or less restrictions were made, which makes the deliberate application of risk as a screening criterion in case-by-case examinations appear rather the exception than the rule. Restrictions of partly positive answers most often included the following: use of risk as a criterion in screening decisions depends on project types; it depends on the authority that is responsible for screening procedures (Slovakia); it focuses on entire classes of project types, including mainly industrial projects (Portugal, Slovakia) and nuclear installations (UK), albeit in those cases EIA procedures are not the controlling force. For example, in Portugal – where no legal provisions for case-by-case examinations exist – risk assessment is stated to be done thoroughly within industrial licensing procedures, but only superficially for other projects that are subject to EIA. Experts from Poland were most pessimistic about that risk is not considered at all in screening decisions, with an exception having been indicated in case of chemical industries.

The German EIA act provides that in case of particular local conditions a limited number of projects can be subject to site-related case-by-case examinations, even if their size or capacity stays below defined thresholds. At the moment, there exist different interpretations if risk of accidents has to be considered in such cases, or rather only screening criteria related to site characteristics. However, the "*ecological sensitivity of the project location*" (Annex II, 2) is an important criterion that is to be applied in site-related case-by-case examinations. In theory, this criterion may include risk-relevant aspects of the site, such as susceptibility to natural hazards or the vulnerability of the project environment to damage, but it was doubted that future implementation of this quite new regulation in practice would conform to such an interpretation, because "*authorities and project developers in general have a tendency to keep projects out of EIA obligations*."

National EIA systems in France and Portugal do not have any case-by-case examinations, though Portuguese legislation does provide for the possibility to make particular projects below thresholds subject to EIA, which, however, appears to be rarely applied.

While in most sample countries screening appears to be an exclusively administrative task, both the Czech and the Slovakian EIA legislation provide for the possibility of public participation in the screening stage of EIA.

The following project types or situations to which risk was applied as a screening criterion to an increased extent were specified:

- chemical industries (Austria, Czech Republic, Poland);
- storage of fuels or chemicals in the vicinity of drinking water supplies or hospitals (Latvia);
- all industrial projects and technologies, in particular with regard to risks of pollution of drinking water, noise, air pollution, human health impacts (Slovakia);
- nuclear industry (Czech Republic, UK).

Results from non-EU countries

In the **USA**, there was no clear consent on the role of risk in screening decisions, with answers ranging from "no" over "only indirectly" to "yes, if it is relevant". Each competent agency in the United States tends to develop its own guidance on screening, but interviewees did not provide an indication that risk would be used as a criterion in that context.

In some **Canadian** Provinces, like British Columbia, there is no case-by-case screening, but experts did not provide a clear picture if risk was used for the setting of thresholds and criteria.

Selected quotations

The following statements are quotations from the interview protocols:

"Risk is used as criteria in case by case examinations, though usually risk is not the most important aspect therein" [Austria].

"The criteria for screening include also an estimation of risks and probabilities of impacts on human health. Screening in Slovakia is done by many affected authorities and it allows involving public in this stage of EIA. All sensitive receptors are taken into consideration" [Slovakia].

"Abnormal risks tend to be part of the criteria used in case by case examinations of whether a development needs an EIA and its scope. If a project has a high level of risk, then it's probably in Annex 1, and the other screening criteria in Annex 2 would include risk; so only if a local community were very concerned would these risks drive the EIA process. The project categories are wide enough to pick up most of the risk issues" [UK].

3.3.5 Effectiveness of risk assessment in EIA

Under the given theme "Effectiveness of risk assessment in EIA", mainly answers to the following questions have been evaluated:

Wording of the questions

Are mitigation measures taken to avoid, reduce or offset risks?

Precautionary measures for serious incidents?

Have projects been rejected because of unacceptable risk?

Risk mitigation measures

Interviewees from all countries answered that risk mitigation measures are a standard feature of EIA, but in many cases they were apparently not referring to specific risk reduction and control measures, but to mitigation measures for environmental impacts of a project in general. Moreover, it is often unclear if the implementation of risk management measures is a result of the EIA process as such, and if requirements for measures are based on results of a systematic preliminary risk assessment.

Technological measures integrated into the project design in order to prevent the occurrence of accidents and/or to reduce, limit and mitigate negative effects of an accident occurring were the category of measures most often named. Examples provided by Austrian interviewees included the limitation of the capacity of industrial plants, the implementation of special sequence control systems, the interruption of technological linkages, as well as fire protection plans and on-site safety measures to protect employees. One Swedish interviewee also mentioned self-rescue systems in tunnels. Alarm plans, emergency plans, evacuation plans and similar precautions for disaster management were less seldom mentioned explicitly. They are stated to be obligatory for projects located in earthquake risk zones and for most high-risk project types prone to accidents (nuclear power plants, industrial facilities, but also polder areas) in Germany, and although they are prepared mostly outside EIA procedures, they are usually referenced in the EIS. In Portugal, the focus appears to be on risk prevention measures rather than on precautions for cases of emergency.

Apparently, in general the standard of safety precautions is much higher for projects that are subject to Seveso II requirements. For example, in France the policy of major accidents prevention includes land use zoning regulations in the vicinity of hazardous installations to limit exposure of the population to consequences of a major accident. For a similar purpose, in the UK consultation zones are established to regulate land use in the neighbourhood of Seveso II establishments, and in Portugal, critical areas for which the project development may cause or increase risk are identified. Apparently, thereby the land use requirements of the Seveso II Directive are implemented. In Latvia, both assessment and mitigation of risks connected to industrial projects is stipulated by national legislation on Industrial Risk Assessment and Risk Reduction.

Interviewees from some countries (Austria, UK, and Sweden) stated that many risk-related project modifications are not an outcome of EIA procedures, but are integrated into the project design by the project developer before submission of the EIS or even before applying for development consent. In particular Austrian experts emphasized that usually an internal risk assessment is done

by the project developers before submission, or significant risk sources are recognized and eliminated as a result of preliminary consultations with authorities. If unacceptable risks are anticipated whose control or mitigation is not possible to the extent required, the project is usually either withdrawn in an early stage before submission of an EIS, or more suitable alternatives (e.g., alternative project location) are chosen. Similarly, one Swedish stakeholder referred to EIA's function to provide ecological self-control to project developers, suggesting that it was in the developer's own interest to assess risks and not to carry on with high risk projects. One UK interviewee said that often the real agenda of including risk assessment into the EIS is to demonstrate that risks have been designed out and are thus not an issue anymore.

Interviewees from the Czech Republic made the experience that public participation can have ambivalent effects on risk assessment in EIA: On the one hand, the public often actively points out to risks and stresses the need to tackle them, which may contribute to increasing the effectiveness of EIA; on the other hand, the role of the public was said to complicate the scientific-technical risk assessment process.

Factors limiting effectiveness

German interviewees made principal barriers to the effectiveness of risk assessment in EIA a subject. Even though risk mitigation measures may be regularly taken in cases where considerable risks have been identified, it all depends on the question if an adequate risk assessment providing for identification of hazards and proper estimation of risks has been applied before, because no useful measures can be taken for risks that stay unrecognized. And even in those cases where risks have been recognized and assessed in a technically adequate way, effectiveness completely depends on integration of assessment results in final decision-making. Contrary to the experience that timely consideration of risks can save costs and prevent damage, the actual relevance of risk assessment for decision-making was strongly questioned by German interviewees, saying that just "*producing more paper makes no sense*", and that additional assessment work in EIA must lead to consequences in terms of conditions and requirements for project realisation. One opinion was that effective risk mitigation measures need stronger legal requirements; otherwise, measures would depend on good will on part of the developers. Even if mitigation measures are to be found in the authority's decision notice, on account of missing post-project monitoring compliance with prescribed measures is seldom checked. Similarly, experts from Poland emphasized that any evaluation of effectiveness of EIA would require establishment of EIA follow-up monitoring systems, which are largely non-existent up to date.

Refusal of approval because of unacceptable risk

There appear to be few projects where unacceptability of extraordinary risks was the predominating reason for refusal of development consent. In one or two cases (e.g., Portugal), risk may have been used as a political argument for justifying rejections of applications, rather than having been its actual main cause.

In Austria, one particular project, the enlargement of the skiing resort "Mutterer Alm" in the Federal Province of Tyrol, has been rejected by the competent authority after submission of the EIS because of unacceptable geotechnical risks that were found to be incompatible with legal provisions by the Soil Protection Protocol of the Alpine Convention, which has been transposed

into domestic Federal law. In Portugal, a co-incineration project was rejected because of a public controversy about unacceptable health risks; however, in that context interviewees also passed criticism on the role of public risk perceptions in the EIA procedure, indicating that perceived health risks were not justified by the actual amount of "objective" risk. High risk was also a major reason for the rejection of gas storage facility, but spatial planning issues were said to have been more decisive for the decision. In Sweden, the extension of an oil storage and distribution centre at Stockholm harbour failed to get approval because of intolerable risk associated with one of the transport links. Currently, the EIA procedure concerning a new runway at the Airport Frankfurt in Germany has run into problems because the risk of hazardous incidents in relation to a chemical installation nearby has not been considered. Although the procedure is unlikely to fail because of that, the competent authority now has to deal with the problem. Regarding offshore wind parks, the risk of shipping accidents is at present an important issue in Germany. Although there is no case where a project has been rejected because of unacceptably high risk of accidents, one interviewee was convinced that in case of high risk potential no permission would be given. However, if high risk is an issue in the EIA process, this is usually clarified before EIS submission.

Results from non-EU countries

Referring to his experiences with energy-related projects, an **US** expert stated that in case of unacceptable risks generally a new project location is chosen. The role of land use planning in avoiding hazardous sitings was stressed.

Selected quotations

The following quotations give a flavour of the issues that arose from the interviews:

"Mitigation measures to minimize risk are applied whenever required. As usually an internal risk assessment is done by the investor before he prepares the EIS, measures to reduce risk are incorporated in the project design before an EIS is submitted. There is one project in Austria, the skiing area "Mutterer Alm" in Tyrol that was rejected because of unacceptable risks" [Austria].

"Public has a big influence in the assessment process, it actively points out to risks and stresses the necessity to solve them" [Czech Republic].

"Measures can be found in the decision notice, but the question is always if they will be implemented in reality. Problem is also the missing monitoring. [...] Mitigation measures only work where there are legal requirements. Or negotiation prior to submission of proposal helps to adapt project design. [...] Producing "more paper" makes no sense; additional considerations must lead to consequences" [Germany].

"Provided that considerable risks have been identified, I think, in general: Yes. [...] But the crucial question here is, if all significant risks have been identified and assessed adequately before.

Precautionary plans on what measures to take in case a hazardous accident actually occurs, alarm plans and evacuation plans are obligatory for most high-risk projects. Although these plans have to be prepared outside the EIA procedures, normally they are at least referred to in EISs" [Germany].

"In most cases where I've seen a comprehensive risk assessment carried out, the real agenda has been to demonstrate that there's not much of a risk, so I suppose the indirect answer to your question is yes, that they've designed out this risk and now they're trying to demonstrate that they've designed it out and therefore its not an issue" [UK].

3.3.6 Need for more coverage/deeper integration of risk assessment in EIA

Under the given theme "Need for more coverage/deeper integration of risk assessment in EIA", mainly answers to the following questions have been evaluated:

Wording of the questions

Do you think more coverage/deeper integration of risk assessment is needed:

– in general?

– for certain projects/activities?

– Yes – why?

– No – why not?

If yes, which are the main reasons that prevent or constrain better coverage of risk assessment in EIAs in your country?

Which risk issues do you consider most important to be included in EIAs in your country?

Need for more coverage

Positive and negative answers to the question on the need for more coverage and deeper integration of risk assessment in EIA were quite evenly divided between the sample countries. With the exception of most experts from the Czech Republic, who felt that the obligatory use of health risk assessment for all projects was 'overdoing', no interviewee advocated less need for risk assessment than is at present the case.

To a predominant part, experts from Austria, the Czech Republic, France, and Latvia saw no need for more risk assessment in EIA. This opinion was in most cases justified by the presence of requirements for risk assessment under other procedures outside of EIA. Other justifications included that risks are considered whenever relevant, or are taken into account already in the examination of alternatives.

While the answer "no" was mostly given categorically, the answer "yes" was in many cases more differentiated. Rather than advocating a general extension of coverage of extraordinary risks, most answers indicated that the need for more coverage depends much on project types (Germany, Poland, Portugal, Sweden, UK, senior experts from Austria) or on project locations (Germany). Most interviewees who advocated strengthening of risk-based considerations in EIA for certain projects mentioned project types involving high-risk technologies prone to accidents, such as nuclear industry (UK) and chemical industry (Poland). While interviewees from Portugal, Sweden and the UK were quite explicit in stating that a more comprehensive and systematic risk assessment is needed in EIA (Portugal, Sweden) and should be undertaken more often (UK), they also expressed concerns about overburdening EIA. In order to avoid such bureaucratic and

technical overloading of EIA, it was stressed that it must be ensured that EIA stays focussed on the significant issues (UK), that risk assessment should be mandatory only for certain project types (Portugal), and that considering all possible risks would make EIAs unmanageable (Sweden).

Pertaining to the specific national legislative framework, one German expert strongly recommended extending the application of risk assessment also to project categories that are not subject to the Federal Immission Control Act and its supporting Statutory Order on Accidents. The same expert also passed criticism on the currently prevailing practice of restricting risk assessment to human health risks and health-relevant exposure pathways (air, water, soil) and argued in favour of widening the field of application so as to include also risks to non-human biotic receptors (animals, plants) and ecosystem integrity. In order to facilitate ecological risk assessment, the risk assessment section in the EIS should be decoupled from the chapter on the protection object "humans". Another German interviewee related to the vulnerability of project locations by arguing that risk issues should gain more momentum in particular in areas of high population densities (cities).

Two interviewees from Austria and Slovakia stated that more coverage of social risks is needed, including development of new assessment methods and their use in the decision-making process of competent authorities. However, this remained a minority opinion throughout the great majority of all interviews.

Barriers

The barriers to a wider use of risk assessment in EIA that were identified by the interviewees across all sample countries were varied. Obstacles that were mentioned more frequently than others included deficits in knowledge, awareness, clarity of definitions, legal requirements, decision-making, and procedural and administrative coordination.

Barriers that are related to a lack of technical know-how in risk assessment were mentioned repeatedly by stakeholders from a number of Member States. These knowledge-related barriers included a lack of technical expertise in risk assessment methodologies, both on part of consultants and statutory bodies, absence of training, paucity of guidance, a lack of practical experience, and missing software equipment (Austrian senior experts, Germany, Portugal, Slovakia). In so far as methods or guidance do exist, there were complaints that little use is made of them (Slovakia). Evidence was also provided that risk may present a rather unfamiliar concept and a cognitive problem to many EIA practitioners, who might not be used to thinking in categories like probabilities, uncertainties, etc. Accordingly, an insufficient definition of risk in the EIA context was named as a barrier several times. One Czech interviewee stressed that there was a strong need to clarify what 'risk' exactly means within EIA, involving a clear definition of the types of risk that are inside and of those that are outside the scope of EIA; this should be regulated preferably on an European level.

One German expert pointed at a lack of awareness about hazards, stating that many risks are only recognized when they actually have occurred. Other awareness deficits concerned the ignorance of long-term risks and the non-existence of a culture of risk prevention (Portugal).

All German interviewees stated that legal requirements for risk assessment and risk management in EIA are insufficient, in particular for projects that are not subject to the Federal Immission Control

Act, but also for typical high-risk project types, such as nuclear power plants and airports. One French expert stated that a stronger emphasis on risk assessment in Community legislation was needed to facilitate corresponding national regulations. It was indicated that without legal requirements developers are reluctant to undertake risk assessments because of cost reasons and are too restrictive in their information policy towards authorities, but also competent authorities request risk assessment too seldom actively (Austrian senior experts, Germany, Portugal).

A number of interviewees from different countries suggested difficulties in integrating risk-based considerations in decision-making. It was stated that authorities often do not see the practical relevance of risk assessment results for decision-making or feel overstrained to decide on acceptability of risks, to some part because considerable uncertainties often make decisions hard to take and to justify, and because numerical risk thresholds or clear standards for risk reduction are largely missing. This makes acceptability of risk an ill-defined and "soft" matter, compared to e.g. air pollution, where emission and immission thresholds for human health exist (Austrian senior experts, Germany, Latvia, Portugal, UK). However, thresholds designed for human health are not necessarily applicable for ecological risks. Such difficulties raise also concerns about transparency of decisions: "*Especially people not involved in the decision-making process would question who decided how about what is acceptable*" (UK).

Experts from several countries considered a lack of procedural coordination and integration to be a main reason for better coverage of extraordinary risks in EIA. In Portugal, most project-related risk assessment work is done after EIA under a separate industrial licensing procedure. As these two procedures are not integrated, the results of the industrial (safety) risk assessment subsequent to EIA are not made accessible to the EIA procedure. The situation appears to be similar in Slovakia and the UK: Interviewees from Slovakia stressed the need for better cooperation with risk assessment experts that are involved in the Seveso II procedures, and the outcomes of risk assessment for nuclear projects in the UK tend to be withheld from the EIS or summarized in an incomprehensible and too cursory way. Apart from being a separate process, the focus in the UK appears to be on risk management rather than on assessment. In general, there was some complaint about a lack of communication between risk experts, EIA consultants, statutory bodies and competent authorities. In some of those countries where no separate agency or statutory body accountable for risk assessment exists, traditional institutional arrangements and unclear allocation of competencies were identified as factors being in favour of neglect towards risk issues in EIA procedures on part of authorities.

Increase in cost and duration of EIA procedures through deeper integration of risk assessment into the EIA process was mentioned only in Latvia. That inclusion of risks would complicate public participation was an issue in Latvia and in the Czech Republic.

Barriers that were mentioned with regard to health risk assessment included lack of baseline data, passive participation of health authorities in the EIA process, and a lack of awareness about the health consequences of environmental impacts. In particular in the Czech Republic, the number of (health) risk experts was considered too low.

Risk issues considered most important to be included in EIA

Most abnormal risks that were considered most important within EIA, or that would need more coverage in EIA, were technological risks with a focus on risk of accidents: chemical industries (including refineries), all risk technologies, in particular in densely populated areas (Germany); casualties from traffic accidents and fires (Latvia); industrial accidents (Portugal). A Swedish interviewee suggested widening the scope of EIA by including the products that are produced by processing industries. Natural hazards, in particular floods were considered most important in the Czech Republic, where this is a predominant issue in many EIAs already at present. One Portuguese interviewee mentioned ecosystems wellbeing and specific ecological risks, e.g. bird collisions with high voltage power lines. Many further risk-related issues that were said to need more coverage referred to human health risks, among them: high-frequency radiation, electromagnetic smog, radioactivity (in particular final storage of spent nuclear fuel). One Austrian expert missed coverage of socio-medical aspects related to cognitive psychology, arguing that subjective perceptions of risks by the public affected may cause illness even if there is at present no scientific evidence of cause-effect relationships, and although cause-effect relationships might be actually non-existent (e.g., knowledge of the presence of telecommunication transmitter stations may affect health only because current discussions about negative health effects of high frequency radiation cause strong concerns in this regard).

Results from non-EU countries

Stakeholders from the **USA** that answered this question agreed that there is no need for more coverage of risk assessment in EIA. One rather had the impression that at present there is a tendency to focus stronger on risk assessment than would be needed. Another interviewee preferred to have case-by-case decisions on how far risk assessment has to be incorporated, because such an approach offers more flexibility, compared to standardised guidance to apply it to all projects, which could easily lead to 'bad practices'. However, a manual on methods that would be regularly updated was strongly requested, including more guidance on assessment of socio-economic impacts.

Canadian interviewees were generally satisfied with the amount and quality of risk assessment that is done in EIA.

Selected quotations

The following statements from the interview protocols give an insight into a number of the more distinct answers provided by interview partners:

"The answer depends much on the project types. Generally speaking, I think that the legal standards for risk assessment are insufficient. This particularly applies to high-risk project types like nuclear installations and airports in densely populated areas.

Basically, application of risk assessment is restricted by methodological problems. Risk assessment is inevitably linked to uncertainties, knowledge gaps etc., which are problems that are difficult to handle. Man is not used to thinking in potentialities, probabilities etc., which makes risk a kind of cognitive problem. Many risks are only recognized when they actually occur (e.g. recent Tsunami in Asia)" [Germany].

"OK like it is, on the practical level. It would be helpful to have more emphasis on risk assessment in the EU regulation in order to get an own regulation on risk assessment in France; there is a need for such a regulation" [France].

"There ought to be a more comprehensive and systematic risk coverage. To begin with, the role played by the proponent who strongly disapproves for quantitative data disclosure, even if there are major risks posed by the project development. Additionally, there is a great lack of technical know-how on this subject, concerning both the consultant teams and the EIA Commission members. This lack of technical training also includes the risk assessment experts who, most of the time, have great difficulty in working together with the consultant team and the EIA Commission in a coordinated manner" [Portugal].

"Yes, but only for certain project types, and in these cases it should be compulsory. In other cases, where no significant hazards should be expected, the mandatory integration of risk analysis within environmental impact assessment would only increase the technical and bureaucratic load of the overall process. Barriers: There is no specific regulation for these matters in Portugal" [Portugal].

"Reasons that constrain better coverage of RA are: capacity of competent authorities (should be trained to understand the need), capacity of consultants (should be trained to do it properly), Ministry of Healthcare is not involved in EIA in a practical point of view, methods and techniques for risk assessment are not well known and used" [Slovakia].

"In my opinion, it is necessary to deepen risk assessment in EIA process. These risks should be assessed to a different degree in all types of projects with regard to the fact that each project brings certain risks. Bigger emphasis should be put on social risks that are not assessed at present. A methodology should be worked out specifying what risks should be assessed and by what methods" [Slovakia].

"Yes, more integration is needed as the risk assessment approach to EIA increases rigour. [In the UK] it is thought of as a different process and more of a management tool" [UK].

"Probably, risk assessment should occur more often but we need to develop an understanding of where the threshold is so that we're not starting to do risk assessments on so remotely unlikely events that's it's actually a bit of a waste of somebody's time doing the work or that the consequences of the event occurring are not that significant. [...] It's a wider point about my feeling about EIA; that we're very good at putting more things into it, but we're not very good at taking things out and making sure it stays focussed. Yes, risk assessments should happen more often but we have to make sure that we're dealing with significant issues. And for EIA, if that's one of the things it needs to focus on, then fine, but we need to make sure that it is one of the important things that it needs to focus on" [UK].

3.3.7 Coordination with risk assessment procedures under other licensing regimes

Under the given theme "Coordination with risk assessment procedures under other licensing regimes", mainly answers to the following questions have been evaluated:

Wording of the questions

Is there any project-related risk assessment separate from the EIA procedure in your country?

What relationship exists between risk assessment in EIAs and risk assessment under other environmental control regimes/licensing procedures, and how are they co-ordinated?

Please comment in particular to the implementation of the

– IPPC,

– Seveso II,

– SEA Directives.

3.3.7.1 Co-ordination of EIA with the IPPC licensing regime

Regarding the relationship between EIA and IPPC-related procedures, different models are in place within the sample countries. In general, coordination between the implementation of the EIA and IPPC regimes appears to be underdeveloped in many Member States. Where legal or procedural links exist, it is sometimes unclear how much coordination in terms of risk assessment there actually is on the technical level, compared to the formal level.

The degree of integration between EIA and IPPC procedures is strongest in Austria and Germany. Of all sample countries, only Austria has established an explicit legal linkage that provides for a single procedure to fulfil the requirements of both the EIA and the IPPC Directives. In the Austrian EIA system, EIA procedures are integrated materially with all other required consent procedures that accord to applicable federal and provincial sectoral laws within a so called ‘consolidated development consent procedure’ for EIA. This implies that EIA procedures usually comprise all relevant legal matters and licensing proceedings ('all permits in one'). It also implies that there is a single development consent procedure for projects that fall both under the EIA and the IPPC Directives. This would facilitate simultaneous coverage of risk-related aspects relevant to both legislations. As EIA thresholds are usually higher than IPPC thresholds, one single procedure is applied for projects above EIA thresholds, while beneath EIA thresholds a stand-alone IPPC procedure is undergone for IPPC-relevant projects. Since EIS reviewers of both fields are said to cooperate well, no need for further harmonisation is seen by the interviewees. However, senior experts added that sometimes authorities might rely too much on the premise that a sound administrative procedure would accomplish coordination on a technical level automatically.

While in German EIA legislation there is no explicit formal legal link between EIA and IPPC procedures, the special legislative character of the German EIA system nevertheless provides for a procedural connection in the implementation of both Directives. In Germany, EIA regulations are subsidiary to relevant sectoral laws, and EIA regulations are applied in particular when they go beyond consent requirements of those applicable other laws. Thus, EIA is not an independent procedure, but an integral part of other relevant (sectoral) licensing procedures. The IPPC Directive is implemented mainly by the Federal Immission Control Act. So, for IPPC-relevant projects that are at the same time also subject to EIA, the EIA procedure is a dependent part of the project

authorisation procedure under the Federal Immission Control Act, and consent requirements of both laws have to be met within the given procedure. However, there was some indication that in administrative practice separate documents for EIA and IPPC requirements are submitted. "*But if the EIS is a good one, than it refers to documents from procedures subject to the Immission Control Act and presents the most important outcomes, which are relevant to the EIS.*" It was also mentioned that early informal consultations between authorities and project proponents often have strong influence on project design in terms of systems engineering, thereby contributing also to reduction of pollution risks. On the other hand, some evidence was provided that on part of EIA consultants IPPC-related requirements are mainly seen as judicial problems with little influence on EIA practice.

In several new Member States (Czech Republic, Slovakia, Latvia), EIA and IPPC procedures are carried out separate in consecutive order, with the EIA process preceding IPPC procedures. It is either required or advised that the output of the EIA process serves as an input for the IPPC process. Both in the Czech Republic and in Slovakia, the EIA output is required for the IPPC permit, which in Slovakia is preceded by the Seveso II permit. However, interviewees from Slovakia stated that coordination is at present not satisfactory. Some evidence was provided that in the Czech Republic a more detailed risk assessment would be undertaken as part of the subsequent IPPC process. In Latvia, interviewees indicated a rather non-statutory relationship between the two processes, saying that the result of EIA *should* be incorporated into the IPPC licensing process.

In the UK, no formal integration of IPPC and EIA procedures in the form of a single procedure exists. IPPC is not part of the EIA regime. While EIA is implemented within the land use planning system, IPPC is regulated by Environmental Protection Legislation, which is administered by the Environment Agency. There is a hypothetical link in so far as the Environment Agency acts as a statutory advisory body for planning authorities, which are in charge of administering EIA procedures, and advises them on off-site environmental risks of proposed developments, including risks from accidents. EIA thresholds and criteria are mostly not the same as those laid down in Annex I of the IPPC directive. EIA exclusion thresholds are in general lower than IPPC thresholds. One interviewee claimed that cooperation and communication between IPPC and EIA procedures is improving.

In Portugal, a separate IPPC-related licensing procedure, which is regulated by specific legislation, is required for industrial project types. Procedures for industrial projects are independent from EIA, without relationship or formal co-ordination. There is a separate risk assessment procedure for industrial risks. EIA is usually done prior to IPPC assessments. However, interviewees did provide no indications that any effective coordination between EIA and IPPC regimes would exist in practice. There were some complaints that the performance of IPPC-related legislation was largely unsatisfactory so far, due to a lack of compliance on part of the industry and a lack of expertise on part of the authorities.

In Poland, a current Twinning project deals with EIA and IPPC issues. No conclusive information was provided by interviewees from France and Sweden, possibly indicating a strong lack of knowledge.

3.3.7.2 Co-ordination of EIA with the Seveso II licensing regime

In general, coordination between EIA procedures and environmental control regimes under the **Seveso II Directive** appears to be poorly developed for a majority of the sample countries. In legal terms, a variety of implementation approaches to regulating the relationship between EIA and the requirements of the Seveso II Directive exist on national level.

Similar to IPPC, the strongest formal links appear to be established in Austria and Germany. In Austria, the Seveso II Directive is implemented mainly by regulations in the Trade, Commerce, and Industry Regulation Act. Within the 'consolidated development consent procedure' for EIA projects, licensing requirements of the aforementioned Act are at least formally integrated with EIA procedures, warranting that projects that are subject to both the EIA and the Seveso II Directives must comply with requirements of both legislations within a single licensing procedure that is administered by the same competent authority. However, no further indication was provided by interviewees in how far results of Seveso II-related risk assessments were included, or referenced, in the EIS. Since EIS reviewers are said to cooperate well, no need for further harmonisation was seen by interviewees.

In Germany, the 12th Statutory Order on Accidents regarding the Federal Immission Control Act is the most important piece of legislation in relation to risks from major accidents. For all projects that fall under its regime and that are at the same time subject to an EIA, all Seveso II-related provisions apply, and all requirements of both EIA- and Seveso II-related legislation have to be met within the authorisation procedure under the Federal Immission Control Act. According to interviewees, this means in practice that usually separate documents have to be submitted and parallel procedures exist, but that one competent authority is in charge of approval. If the EIS is a good one, then the outcome of risk assessment under the Immission Control Act is presented or at least referred to in the EIS. The legal requirements of the 12th Statutory Order on Accidents are by far more explicit in terms of risk assessment and risk management than the national EIA act (cf. chapter 2.1.2). It is also the most important legislation for the assessment of health risks within EIAs. However, its scope of application is restricted to certain classes of projects that bear an increased risk potential in relation to hazardous substances. It has been judged as a shortcoming of the German legal system by one interviewee that risks of projects that are not subject to the Immission Control Act and its 12th Statutory Order do not have to be assessed within EIAs.

In France, the legislation on "classified installations" is the major legal instrument of risk assessment and risk management. Its focus is on technological risks (accidents), but consequences of accidents both on human health and on other environmental receptors in general have to be considered. For projects that are subject to classified installations regulations, both an Impact Study (EIS) and a Hazard Assessment Study [*étude les dangers*] for risks of accidents have to be prepared. Classified installations amount to half of the projects for which an Impact Study (EIS) is prepared and include Seveso-type industrial installations, but the coverage of classified installations legislation goes beyond Seveso II projects. The Hazard Assessment Study has to be submitted as a separate document along with the Impact Study. Its purpose is to identify sources of danger, to identify foreseeable accident scenarios, to evaluate consequences of an accident, and to justify measures for prevention and mitigation of effects. Also, a note is required that refers to compliance with health and personnel safety regulations. In 2003, a new Law no. 2003-699 on the Prevention of Technological and Natural Risks and the Repair of Damage has been enacted. It is an important legislative tool for the implementation of the Seveso II Directive and applies to high-risk (top-tier) Seveso installations. While the Hazard Assessment Study focuses on hazard

identification and evaluation of adverse consequences in case of an accident, the focus of Law no. 2003-699 is on risk management measures, such as safety reports, risk prevention plans, safety measures, emergency plans, on-site risk prevention, and containment measures. However, it would appear that procedures under Law no. 2003-699 are a separate process and are not part of the EIA regime. Interviewees provided no evidence of any effective coordination with EIA.

According to interviewees, in the Czech Republic, Latvia, Portugal and Slovakia risk assessment as far as required by the Seveso II Directive is a process separate from and subsequent to EIA, with apparently little or no coordination on a technical level and/or on the formal level. In the Czech Republic, projects that are subject to the legislation on the Prevention of Major Accidents have to undergo a risk assessment process separate from EIA, but normally some kind of reference to Seveso II-related regulations is made in the EIS. However, regarding the nature of those references, interviews suggested that the focus is mainly on mere indications if a certain project is Seveso II-relevant, and what project category according to the Seveso II Directive it is. It was also said that often a mean value of risk is estimated in EIAs, whereas any more detailed risk assessment is done within Seveso II-related procedures. In Latvia, Seveso II procedures for “Industrial Accident Risk Assessment and Risk Reduction Measures” follow the EIA process. Interviewees stated that health impact assessment is part of those procedures. Similar to Latvia, in Slovakia the procedures under the 'Act on Prevention of Major Industrial Accidents' also follow the EIA decision, to ensure that specific conditions of the development consent and exact project design are known. Seveso II procedures are then said to be mostly a purely technological domain of engineering disciplines. Project-related licensing procedures in Slovakia normally follow a chronological sequential order: SEA/EIA – Habitats Directive – Seveso II – IPPC. Interviewees were not satisfied with the level of coordination that has been accomplished up to; deficits were attributed to a lack of experience.

In Portugal, authorisation of industrial projects requires a separate industrial licensing procedure, which includes an assessment of industrial risks. For Seveso II projects, the industrial risk assessment leads to a “security notification” (*Notificação*). There was total consent among interviewees that EIA and industrial risk assessment are completely separated and independent procedures, with no relationship or coordination of any kind even for projects that require both permits. As far as there may be some kind of risk assessment within EIA, it is only conducted for those projects highly prone to occurrence of risk events, and it aims exclusively at the definition of mitigation measures. EIA is always done first. Since any assessment of the consequences of risk events happening is done only after EIA, it is difficult to achieve a valid risk characterisation in the EIA phase of project authorisation. On national level, two distinctly independent departments of the same public authority are responsible for the evaluation of EIA procedures and for the industrial risk assessment, with no linkage whatsoever between them. Only one interviewee indicated that sometimes there may be an informal relationship between both procedures, if the results from EIA are used by the project proponent to support presentation of the “security notification”. But in general, there is no integrated risk assessment, neither concerning the Seveso II nor the IPPC control regime.

In the UK, Health and Safety requirements under the Seveso II Directive have their own licensing procedures separate from EIA. Health and Safety assessments are governed mainly by the Health and Safety Executive (HSE), which would tend to get involved for all major industrial developments, and are outside the scope of EIA. In England, the Seveso II directive is implemented mainly by the COMAH (= Control of Major Accident Hazards) legislation and regulations, which like EIA have

been integrated into the land use planning system and comprise a set of Town and Country Planning Regulations, as well as by regulations under the Act on Health and Safety at Work. Before granting development consent, planning authorities have to consult with the HSE. For on-site health and safety standards, ALARP standards (reduction of risk to a level 'As Low As Reasonably Practicable') have to be applied. HSE also advises planning authorities on off-site risks to people, whereas the Environment Agency advises on risks to the environment. According to the Seveso II Directive, COMAH regulations require operators to prepare accident scenarios and to submit them to HSE. No need is seen in UK to replicate this in EIA. Apart from having adopted Annex III of the EIA directive, including 'risk of accidents' as a screening criterion, the official position in the UK is that the EIA Directive does not require consideration of unlikely events, such as 'extraordinary hazards' and unlikely hazardous incidents. So, at present coordination between EIA procedures and Health and Safety assessments under the COMAH regulations appears to be largely confined to the roles of the HSE, which acts as an advisory body to planning authorities in EIAs and administrates H&S procedures. However, there is non-statutory guidance which recommends that the Environmental Statement (EIS) should include indications of preventive measures against accidents and some reference to compliance with Seveso II-related licensing requirements. One interviewee said that cooperation and communication between the various regulatory agencies and regimes is increasing. Another EIA expert emphasized that there is promising potential for more coordination: what would be needed was to take the risk assessment work done for IPPC, Seveso II or HSE, which in some cases were potentially sufficient, and analyse the environmental outcomes of identified risks from an environmental perspective.

No specific information related to Seveso II and EIA was provided by interview partners from Poland. Without providing more details, Swedish interviewees had the general impression that at present there would be a lack of organised coordination between EIA and other procedures, and parallel assessments rather than integrated ones. In Sweden, separate legislation on accident prone project types was said to sufficient, with no need existing to duplicate risk assessment in EIA.

3.3.7.3 Co-ordination of EIA with SEA

As there is still a lack of experiences in the practical implementation of SEA in most Member States, few interviewees were able to make conclusive statements on the coordination between EIA and SEA in terms of risk assessment. Most stakeholders addressed general threats and opportunities of SEA in relation to EIA. One Austrian interviewee suggested making impacts on sustainable development, including social and socio-economic aspects, subject to SEA rather than to EIA, in order to avoid overloading EIA. In a similar context, it was suggested to move urban development projects from EIA to SEA. SEA was expected to help take pressure from EIA by reducing the number of EIAs. At the moment, some developments would require both procedures, which would lead to "double-checked" projects. In order to avoid such duplication of work, it was suggested to harmonise the Annexes of both legislations. One German interviewee stated that SEA could compensate for gaps in the project list(s) of EIA, thereby rendering to some extent obsolete discussions on extending the EIA project list(s). In German cases where SEA has been applied to offshore wind farms the risk of shipping accidents has been an issue in relation to the zoning of suitable areas. There was consent among all experts from Sweden that SEA has been interpreted very narrow by the government, which was said to have practised a "minimalistic" implementation approach. Legal implementation of SEA in Portugal appears to be unfinished by now, with interviewees calling it a "disaster" and complaining about little progress. In Slovakia and the Czech Republic, SEA has been transposed as part of the domestic EIA legislation. According

to one Slovakian interviewee, SEA has not been applied to hazardous developments yet. One expert from Latvia recommended that industrial risks should be considered not only on project level, but also in SEAs.

3.3.7.4 Co-ordination of EIA with other risk-relevant procedures

Specific separate project-related risk assessment procedures appear to be in place in most Member States. Particularly in Portugal and Sweden, risk assessment is said to occur for the greatest part under licensing regimes other than EIA, with little coordination with the EIA process. Independent risk assessment procedures that were mentioned included risk assessment for abandoned hazardous sites (Czech Republic, Slovakia), water quality and flood risk (France), dams (Portugal), GMOs, chemical substances and certain forms of air pollution (Sweden). In most countries where nuclear power plants exist separate risk assessment procedures are in place under the respective national atomic laws.

The above mentioned examples are specific applications that appear to have little or no connection to the EIA process. However, also two distinct ways of integrating health impact assessment into the EIA procedures were described. In the Czech Republic, a public health impact assessment, which may sometimes be a quantitative health risk assessment, must be carried out for any project subject to EIA, regardless of project type and likelihood of significant health effects. Coordination with the EIA procedure is done by using the EIS as the basis for health assessment. The health assessment itself is governed by the Board of Health; the legal requirements are based on the Law on Public Health Protection. There was much criticism by Czech interviewees that an obligatory health assessment would often be "overdoing" and affects negatively cost and duration of procedures. In Austria, health assessment is coordinated with EIA in a two-step process: emission levels are quantified in the EIS, which then is reviewed for the competent authority by an expert of environmental medicine, who is independent from the project developer.

Results from non-EU countries

In the **USA**, often separate risk assessments are undertaken independently from the EIA procedure, but the outcome of those studies is usually incorporated into, or annexed as a supporting document to, the EIS. Various risk assessment studies conducted on a general level or for different purposes, e.g. for pesticides, might become a relevant part of an EIA procedure. So, the EIA process often serves as *"an umbrella for all relevant studies and assessments."* Often, a risk assessment, for instance on multiple alternatives based on conceptual information, is undertaken before the EIA process starts. According to different risk assessment procedures at a general level, e.g. for toxic chemicals like pesticides, these results might.

Contrary to the USA, **Canadian** experts emphasised that all risk assessments are generally integrated into the EIA process; there is no separate project-related risk assessment in Canada. However, general risk assessments that are directly related to the project level may be taken into account in EIA when relevant. For some specific issues, e. g. cleanup of contaminated sites, separate legislation that requires specific risk assessment exists in many of the Provinces.

Selected quotations

The following statements illustrate the overall tendencies of many answers:

"EIA comprises all juridical proceedings, especially IPPC, Seveso and Natura 2000. As the reviewers of EIS cooperate very well, no further harmonisation is needed" [Austria].

"Separate legislation for risky installations exists: no need to develop this within EIA" [Sweden].

"Environmental impact assessment and IPPC and Seveso Directives application are distinct licensing procedures that are not, in any way, related. There is no integrated risk assessment as far as any of these control regimes are concerned, even if conducted under the same public authority (the Environment Institute). Regarding EIA procedures, risk assessment aims exclusively at the definition of mitigation measures, and only for those projects highly prone to risk occurrence" [Portugal].

"Potentially there is some crossover. Potentially, the risk assessment work for IPPC, Seveso or HSE in some cases is sufficient and maybe all we need to do is to take that work and ask: what are the environmental outcomes to this? Taking this on board is not necessarily a big ask; you just need an environmental professional to look at the outcomes of the risk assessment and start thinking what the environmental outcomes are" [UK].

"There is only little discussion on such issues in the German EIA community. Regarding the legal requirements of the EU Directives, these questions are mostly seen as judicial problems without much relevance for EIA practice. I am quite sure that not many EIA practitioners are aware of something like the IPPC Directive" [Germany].

"Necessary documents according to the Statutory Order on Hazardous Incidents are always separated. But if the EIS is a good one than it refers to documents from procedures subject to the Immission Control Act and presents the most important outcomes, which are relevant for EIS. Parallel procedures, but one competent authority for approval" [Germany].

"I would recommend to require deeper integration of risk assessment in EIA for certain projects and better cooperation of experts dealing with SEVESO Directive and EIA" [Slovakia].

3.3.8 Good practice examples

Under the given theme "Good practice examples", mainly answers to the following questions have been evaluated:

Wording of the question

Do you know good practice examples for risk assessment in EIA?

Few interviewees were able to point to good practice examples for applying risk assessment in EIA. For some countries (France, Poland, Germany, Portugal, Sweden), no concrete examples could be provided, but to some part general indications have been given. Most examples referred to project types related to industries, energy, waste management and high-ranking transport infrastructure (including decontaminating areas, airports, waste incineration, nuclear installations). Some project types indicate that risk assessment was required rather by specific legislation

(nuclear act, Seveso II, decontaminated areas) than by EIA legislation. They also suggest that toxicological and radiological risk assessments, possibly with a strong focus on human health risk, as well as safety risk assessments predominate among the mentioned good practice examples.

The following table provides an overview of the answers given:

Country	Answer
Austria	Flood protection project at the river *Salzach* near *Golling*)
	Waste combustion plant *Wels*
Czech Republic	Project *Postorna I* (flood risk)
	Plasma Incineration Plant in *Karvina*/*Barbora* (2004)
	Highway D 47 (noise)
	Decontaminating area in *Benesov* (2004)
	Decontaminating area in *Ostrava-Maranske Hory* (2005)
	Nuclear Power Plant *Temelin* (2000)
	Dry Spent Fuel Storage for Nuclear Power Plant *Temelin* (2004)
France	no example provided
Germany	few good practice examples exist, refer to Wende (1998)
Latvia	Kraft Pulp Mill in *Ozolsala* in the municipality *Krustpils, Riga* (2004) (health risk assessment)
Poland	not aware of any good practice examples
Portugal	(rejected) co-incineration plant (perhaps)
	general indications: projects concerning pipelines; production plants for explosives; industrial installations in general
Sweden	general indications: risk assessment for chemical hazards; fire risk in tunnels
Slovakia	decontaminating area *Banska Bystrica* (arsenic)
UK	Terminal 5 at airport *Heathrow*
	New runway at *Manchester* airport
	Farnborough airfield

Figure 51 Answers to the question on good practice examples for risk assessment in EIA

3.3.9 Major social risks

Under the given theme "Major social risks", mainly answers to the following questions have been evaluated:

Wording of the questions

Which risks of major social impacts are addressed in EIA, and to what extent?

There was far-reaching consent among interviewees from most countries that major social and socio-economic impacts are usually not at all considered in EIA, or only touched upon in a marginal way. There is no integration of social impact assessment into EIA in any of the sample countries. Social impacts may be mentioned formally in the EIS, but generally they are a side issue. In many cases only positive social or economic impacts, such as creation of new jobs, are mentioned in order to support projects and justify the need for proposed developments. However, although there is a tendency to exclude social issues systematically from EIA procedures, in some cases issues related to life quality or social conflict may yet enter the EIA process via public participation. In Germany, where the focus of the institutionalised EIA system is almost exclusively on

environmental effects in the narrower sense of the word, social aspects are dealt with in parallel sectoral planning processes, such as urban planning. In Portugal, social issues are said to be taken into account in the final licensing procedure subsequent to EIA, but not in EIA itself.

Some indications that major social changes are taken into account came only from a few new Member States (Latvia, Poland, Slovakia). Demographic and social effects of large projects, such as unemployment, migration, and resettlement, were mentioned in that context.

With only a few exceptions, there was much support for the view that the assessment of social impacts should be kept outside EIA procedures.

Results from non-EU countries

In the ***USA***, social risks are addressed under the term social and economic impacts. Stakeholder statements to some extent appear to reflect that there is an intense discussion at the moment on how far socio-economic impacts are a matter of EIA. In general, these issues appear to play a rather subordinate role in EIA, although they may be considered when relevant. Social impacts alone would not justify conducting an EIA. If and to what extent they are covered in EIA appears to depend strongly on the type of action that is to be assessed, e.g. it may become an issue if a highway crosses a community.

Referring to the **Canadian** province of British-Columbia, the provincial act contains strong requirements to consider social and economic impacts, whereas the federal act is less "all-inclusive". Consequently, in federal EIAs social risks are largely neglected, while in British Columbia it appears to be a quite prominent issue in procedures. Types of social impacts covered include, for instance, disruption of social structure by hired workers during construction phase. One federal expert stated his regret for the division of competencies between federal government and the provinces, which accounts for the exclusion of social and economic aspects from federal EIAs.

3.3.10 Summary and conclusions

Coverage of extraordinary hazards, risk and risk assessment in EIA

Risk assessment is often a side issue in EIA procedures, including the EIS. Generally, hazard-based and risk management-focussed approaches predominate. What hazard category is considered in EIA in what depth and deliberateness depends much on project types, less on project locations. There is considerable variability in the degree of regularity of hazard assessment between countries, ranging from "standard" to "rarely", as well as inconsistencies in the hazard categories reasonably regularly considered in individual countries. Natural hazards and accidents caused by technological failure are the hazard categories most regularly addressed in all Member States, whereas accidents due to human error and exposure of projects to external accidents are seldom considered. Sabotage is almost completely out of scope of EIA practice, even in the only sample country where a respective requirement in EIA-related legislation exists. Different national priorities are attributed to the kinds of natural hazards addressed, depending much on natural variation of environmental conditions and risk perceptions. While some natural hazard types are quite often assessed (e.g., floods, landslides, seismic risks), others are very seldom an issue (e.g., forest fires, heavy weather conditions). Natural hazards are often identified prior to submission of

the EIS, making use of hazard maps where existent, and avoided by choice of more suitable locations. Coverage of technological accidents, particularly of such incidents that are rated as "more likely", is often a matter of routine, but it is mostly restricted to large-scale high-risk project types and occurs in many cases under other authorisation regimes subject to non-EIA legislation. Impacts of a project on the hazard potential pre-existent at the site were hardly mentioned. Risk assessment is often restricted to accident-prone project types with a high technological risk potential (chemical industries, power and incineration plants, nuclear installations, fuel storage and pipelines, etc.) and to certain classes of project types subject to specific legislation outside EIA regulations. Some projects that were frequently felt to be missing on the EU and/or national project lists are risk-relevant. Most applications of (formalised or quantitative) risk assessment are human health risk assessments related to radiation or chemical hazards, but not necessarily associated with abnormal conditions. Effects on non-human environmental receptors are strongly underrepresented.

Applied methods and their adequacy and effectiveness

The methodological approaches applied to risk assessment in EIAs within the ten sample Member States appear to be varied, both between countries and on country-level, albeit similarities exist. In general, what method is employed depends much on project types, on the risk issues considered most important in particular situations, as well as on the involved EIA experts. In those cases where some form of risk assessment is applied, in general both qualitative and quantitative approaches are used, including combinations of both. Qualitative techniques are used much more frequently, both on EU-level and in most individual Member States. They range from simple ad-hoc approaches (e.g., verbal-descriptive argumentation, expert judgments, checklists, matrices, "what if" analyses) to more elaborate methods (decision trees, discussion of accident scenarios, etc.). The spectrum of (semi-) quantitative methods ranges from straight-forward approaches (accident statistics, extrapolation from other projects, etc.) to sophisticated tools (e.g., probability analyses, mathematical models); formalised quantitative risk assessment tends to be used for risk-prone industrial projects, focussing much on safety risk analyses. In a few new Member States, the US EPA model of health risk assessment is obligatorily applied; from there, also the only case example of applying a complete ecological risk assessment to EIA was reported. Use of risk thresholds for acceptability of risk were only reported from the UK, but for health and safety assessments outside the EIA regime. Many interviewees considered the applied methods fairly adequate, but also serious concerns were raised: Risk assessments may be technically adequate, but their effectiveness in terms of relevance for decision-making may be questionable. Often, systematic approaches are lacking, and too little attention is given to limitations and uncertainties inherent to each method. Too often, the environmental consequences of an accident happening are not assessed, or only for human health effects. Standards or criteria for evaluating the acceptability of risks are lacking. Problems regarding involvement of the public with risk issues were mentioned.

Risk in screening procedures

There are strong indications that the deliberate use of risk as a criterion in case-by-case examinations, as required by Annex III.1 of the EIA Directive, may be rather the exception than the rule. If it is given some consideration in screening decisions, it is usually not an important aspect. There was some confidence that all high-risk project types would be subject to mandatory EIA, anyway; however, there was a lack of knowledge on part of most stakeholders about what

selection criteria exactly had been used in setting thresholds and criteria for drafting of the mandatory national project lists. EIA systems in two new Member States provide for public participation in screening.

Effectiveness of risk assessment in EIA

Mitigation measures are a standard feature of EIA in all countries, but not necessarily specific risk reduction and control measures. It is often unclear if the implementation of risk management measures is a result of the EIA process as such, and if they are based on results of a systematic preliminary risk assessment. Technological risk prevention measures integrated into the project design (e.g., process safety systems) are more often implemented than precautionary measures to limit the consequences of a hazardous incident occurring (e.g., alarm and emergency plans), which focus on projects subject to Seveso II requirements. Risk sources are often identified and eliminated through internal risk assessments done by developers or as a result of preliminary consultations with authorities prior to EIS submission. However, risks that are not recognized because no assessment is applied cannot be mitigated. Sometimes mitigation measures in the EIS are aimed mainly at demonstrating that risks have been assessed and designed out. Public participation was perceived to be ambivalent: the public may actively point out to risk and stress the need to tackle them, but it may also complicate the scientific-technical risk assessment. In principle, effectiveness of risk assessment in EIA depends on integration of its outcome in decision-making; otherwise, it is a waste of time and money. Due to largely non-existent post-project monitoring, compliance with prescribed mitigation measures is seldom checked. Stakeholders could identify only a few cases where development consent had been refused because of unacceptable risks, partly because such risks are usually clarified in earlier stages of EIA procedures. However, these examples demonstrate that timely consideration of significant risks can save costs for developers.

Need for more coverage or deeper integration of risk assessment in EIA

Positive and negative answers to the question on the need for more coverage and deeper integration of risk assessment in EIA were evenly divided between the countries. No interviewee stated less need for risk assessment, with one exception: the obligatory use of health risk assessment for all projects in one country was felt to be 'overdoing'. Negative answers were given categorically and mostly justified with the existence of risk assessment requirements in other procedures. However, others strongly recommended extending application of risk assessment in EIA also to projects that are not at the same time subject to such requirements under specific legislation. Many experts stated that more systematic and comprehensive approaches were needed, but mainly for accident-prone technologies or dependent on locations. Yet, to avoid overburdening EIA and ensure that it stays focussed on the significant issues, risk assessment should not be made mandatory for all projects. More coverage in EIA was requested for technological risks (industrial accidents, all risk technologies) and for specific health risk agents (high-frequency radiation, electromagnetic smog, radioactivity from spent fuel), but distinctly less often for ecological risks (ecosystems wellbeing).

Barriers to wider application

The barriers to a wider use of risk assessment in EIA identified by stakeholders were numerous and varied. Obstacles that were mentioned more frequently than others included deficits in: knowledge, awareness, clarity of definitions, legal requirements, decision-making, and procedural and administrative coordination. Knowledge-related barriers included lack of technical expertise and practical experience in risk assessment, absence of training, lack of tools, paucity of specific guidance, and reluctance to make use of existing guidance. A lack of legal requirements for considering risks in EIA both on national and EU level is also seen as a barrier, as well as an insufficient definition of risks relevant in the EIA context. According to some experts, authorities are reluctant to request risk assessment actively and have difficulties to integrate risk-based considerations in decision-making, partly because they may feel overstrained by decisions on acceptability of risks and because clear risk thresholds and criteria are missing. Deficiencies in coordination and integration of EIA and other procedures were often identified as further obstacles. Assessment results produced under other authorisation regimes are often not made accessible to EIA, to a large extent due to unsuitable timing of procedures. There is some lack of communication between risk assessors, EIA practitioners, statutory bodes and competent authorities, partly due to unclear institutional arrangements. Hazards that have not occurred and caused severe damage recently tend to lack awareness. Inclusion of risk issues can complicate participation. An increase in duration and cost of procedures was only mentioned once.

Coordination with risk assessment under other licensing regimes

In general, most risk assessments are applied in procedures separate from, or parallel to, EIA, or they are required by legislation outside EIA. Obligations to consider extraordinary risks are much stronger under Seveso II- and IPPC-related licensing regimes than in EIA procedures; in addition, many sectoral regulations for specific project types exist (e.g., nuclear plants, contaminated sites). A variety of models of implementing the Seveso II and IPPC Directives are in operation in Member States, with differences in organisation and timing of procedures, institutional arrangements and working routines. Coordination between EIA procedures and Seveso II-/IPPC-related procedures is mostly poorly developed. This was recognized and regretted by many experts, although some saw no need to duplicate risk assessment in EIA. Formal legal linkages between procedures have been established only in a minority of countries, and in the one country where procedures have been formally integrated, effectiveness of coordination appears to depend to some extent on cooperation of EIS reviewers. In a few Member States, EIA is a dependent part of other procedures under applicable sectoral legislation; for projects that are simultaneously subject to EIA and certain subject specific regulations that require risk assessment, both an EIS and separate risk studies are submitted. However, in practice these are parallel processes and risk studies are seldom fully incorporated into the EIS, but mostly only referenced, or briefly summarized, or annexed to the EIS. In some Member States, EIA and IPPC/Seveso are completely independent procedures with no linkage whatsoever. In a number of countries, procedures follow a sequential order, with Seveso II and IPPC procedures subsequent to EIA and requiring the EIA permit. Thus, it is not possible to integrate the outcome of risk assessments under later procedures into EIA, and safety risks estimated for Seveso II, IPPC or other purposes cannot be evaluated as to their environmental consequences.

Good practice examples

Few interviewees could provide good practice examples for applying risk assessment in EIA. Most examples referred to project types related to industry, energy, waste management and high-ranking transport infrastructure, such as decontaminating areas, airports, waste incineration, and nuclear installations. Some of them indicate that risk assessment was not required by EIA legislation, but rather by specific sectoral legislation. They also suggest that toxicological and radiological risk assessments, possibly with a strong focus on human health risks, as well as safety risk assessments predominate among the mentioned examples.

Major 'social risks'

There was far-reaching consent among interviewees from most countries that major social and socio-economic impacts are usually not considered in EIA, or only touched upon in a marginal way. They may be mentioned formally in the EIS, but in many cases only positive socio-economic effects, such as creation of new jobs, are mentioned. Yet, sometimes social issues may enter the EIA process via public participation. There was much support for the view that the assessment of social impacts should be kept outside EIA.

4 CONCLUSIONS

4.1 Key findings

Based on the results of our desk research (cf. chapter 2) and our empirical studies (cf. chapter 3) on risk assessment in EIA on the EU and Member States level, the following key findings can be identified:

Key findings from desk research:

- Risk assessment and EIA as both a policy instrument and a technique of preventive environmental protection have strong affinities, and EIA itself is deeply rooted in a risk-based concept, but in practice the application of EIA has concentrated much on prediction and mitigation of impacts due to normal operation of a project.
- Assessment of extraordinary hazards and risks is within the material scope of the EIA Directive, but explicit manifestation of material interrelationships in the Directive in verbal terms is restricted to “risk of accidents” being a screening criterion (Annex III.1).
- The majority of the Member States examined closely in this study have adopted the narrow risk concept and the narrow field of its application from the EIA Directive. In those countries, “risk of accidents” is a screening criterion, but no further explicit legal obligations to consider extraordinary risks throughout the EIA procedure and in the EIS exist.
- However, a few Member States have implemented wider risk concepts and more comprehensive requirements for considering extraordinary risks in EIA in their national EIA legislation or in closely related sectoral legislation, respectively.
- There are inconsistencies in the project-level regulatory framework related to risk assessment. The EIA Directive, the Seveso II Directive and the IPPC Directive have divergent fields of application in terms of project types and different material scopes, as have national EIA regulations and national subject-specific legislations under the Seveso II and IPPC regimes. As the latter ones usually have stronger legal requirements for risk assessment than EIA, this creates threats that significant risks associated with projects that are only subject to EIA, but not simultaneously to Seveso-/IPPC-related control regimes are not considered in project licensing. Thus, there are potential gaps in coverage of risk-relevant projects.
- EC Guidance on EIA recommends considering various kinds of extraordinary hazards and risks in major stages of the EIA process, reflecting a wide interpretation of the Directive’s scope or an extensive understanding of good application of the Directive, respectively.
- In many Member States, albeit not in all, national guidance on EIA makes more explicit and more extensive references to the coverage of risks in EIA, often exceeding national legal requirements.
- No specific guidance on *how* to apply risk assessment in EIA exists.
- Literature on the linkage between risk assessment and EIA is rare, and few empirical evaluations of EIA have dealt with the issue up to now; those that did yielded evidence that EIA performance in terms of risk assessment is rather modest.

Key findings from empirical research:

- Risk assessment is very often a side issue in EIA practice. Yet, coverage of risks in many Member States appears to be better than obligatory requirements in national EIA legislation mostly would suggest.
- There are considerable inconsistencies in the ways extraordinary hazards are dealt with across all Member States: Large variability exists in the degree and regularity of coverage between different hazard categories in general (cross-hazard variability), between countries for the same hazard categories (country-to-country variability), and often on intra-national level for different and for the same hazard categories (intra-national variability).
- In general, natural hazards and internal accidents caused by technological failure are most regularly addressed, accidents due to human failure distinctly less often, exposure of projects to external accidents very seldom, and sabotage almost not at all. Some types of natural hazards are often considered, others seldom or not at all.
- Risk assessment is often restricted to projects involving accident-prone high-risk technologies or substances and/or to certain classes of project types, which in both cases are often subject to specific legislation apart from EIA.
- Most practical applications of risk assessment in EIA are human health risk assessments and technological safety risk assessments. Adverse effects on non-human biotic receptors and ecosystem wellbeing and integrity are seldom assessed, as well as the environmental consequences of accidents in general.
- Risk assessment in EIA is often hazard-based and oriented on a risk management approach. It often lacks systematic and deliberate approaches, methodical coherency, and completeness in terms of analytical key steps. Public participation, assessment of residual risk and decision-making on acceptability of risk appear to be the weakest feature of EIA with regard to risk assessment.
- Effectiveness of risk assessment in EIA in terms of project modifications appears to be limited, with consideration of accidents resulting most often in changes to the project design. Difficulties in integrating risk-based considerations in decision-making appear to limit effectiveness.
- Most risk assessments occur under other project licensing regimes parallel to, or separate from, EIA. There are often no or insufficient interlinkages between EIA procedures and risk assessments in other procedures, in particular under project-level authorisation regimes that are subject to the Seveso II and IPPC Directives. Due to inappropriate timing and organisation of procedures, institutional barriers and a lack of cooperation between involved experts and authorities, there is little effective coordination or real information exchange. Even in those few institutional and legal systems where some degree of integration of procedures exists, information exchange is often insufficient. The SEA Directive has not had much practical relevance for risk issues yet, but there is still a lack of experience in implementing SEA.
- Risk assessment in Seveso II procedures tends to focus on health and safety hazard assessments, i.e. on analysis of risk of accidents, and on risk prevention and control measures. The environmental consequences of accidents occurring tend to be not assessed.

- Stakeholders could not identify many good practice examples for applying risk assessment in EIA.
- Many stakeholders in about half of the Member States where interviews have been conducted see a need for more coverage of extraordinary risks in EIA, particularly for more systematic and comprehensive approaches. Most of those experts expressed their preference for case-based approaches instead of general obligations for risk assessment for all projects. Almost no expert saw less need for risk assessment.
- Numerous and diversified barriers to more coverage and deeper integration of risk assessment in EIA were identified. Barriers most frequently named by experts include, amongst others:
  - lack of specific technical guidance, know-how, expertise, and training;
  - missing legal requirements;
  - missing definition of the concept of risk in the context of EIA;
  - lack of adequate methods;
  - deficits in coordination with other procedures;
  - difficulties in integrating outcomes of risk assessment in decision-making processes, in particular with regard to evaluating acceptability of risk;
  - difficulties in communicating risk issues and handling them in public participation;
  - fears about overburdening EIA, increase in duration and cost of procedures;
  - lack of awareness for significance or probabilistic nature of many hazards;
- 'Social risks', i.e. major social and socio-economic impacts, are only a marginal issue in EIA practice, and most stakeholders would prefer to retain this status quo.

4.2 Discussion of key findings

In this chapter, selected key findings are interpreted and discussed by linking results of the desk research with results of the empirical studies, and crucial issues emerging from key findings are further analysed.

Risk in the context of the EIA Directive

In principle, the concept of risk is inherent to the EIA Directive. EIA deals with the possibility of future impacts on the environment, and while the scope of the Directive does include the possibility of positive effects, in practice its focus is on potential adverse effects (which are the focus of risk assessment). Thus, all vital elements required by the general definition of risk (cf. chapter 1.3.1.2) are present: hazards (associated with the existence of a project), the possibility of an adverse outcome (damage or harm to man and the environment), and uncertainty about the occurrence (likelihood) and magnitude of that adverse outcome. Main tasks of an EIA are the prediction of the impacts that are likely to be caused by a project, an evaluation of the significance of those impacts, which involves a judgment on magnitude and probability of impacts, and the development of mitigation measures to reduce negative impacts. These are also main tasks within a risk assessment and risk management process. Furthermore, the Directive uses many risk-related terms, such as "*magnitude and complexity of the impact*", "*probability of the impact*", and "*duration,*

frequency and reversibility of the impact" (Annex III.3). Therefore, the Directive itself is deeply rooted in a risk-based concept.

However, the EIA Directive mainly refers to risks under normal conditions, i.e. to impacts connected to planned – standard or routine – operation of a project. The scope of the EIA Directive is much less clear with regard to extraordinary, or abnormal, risks, i.e. with regard to the possibility that implementation of a project might lead to significant adverse environmental consequences under exceptional circumstances, under non-routine or non-standard modes of operation, or due to any unplanned hazardous incident. There are arguments in the Directive itself that speak for and against a wide interpretation.

There is much evidence that a close material interrelationship between the objectives of EIA, according to the Directive, and risk assessment exists. Article 3 and Annex IV para. 4 require EIA to assess the "*direct and indirect effects*" of a proposed project on, *inter alia*, the environment, human beings, and material assets resulting from, *inter alia*, "*the existence of the project*" and "*the emission of pollutants*". If such effects are caused by an accident within a project, e.g. by an accident leading to an unplanned release of pollutants, this may clearly be understood as a "*direct effect*". If negative impacts on the environment are caused by natural hazards or external accidents that may occur in the project environment and impact on the project, this may, at least, be understood as an "*indirect effect*", which would not have happened without the "*existence of the project*". Analogously, any environmental impact generated by sabotage or otherwise unauthorized interferences is an "*indirect effect*" of "*the existence of the project*". Thus, the Directive may be interpreted in the broad way that there is an obligation to consider *all* direct and indirect significant environmental effects that could arise from the implementation of a project, i.e. both impacts caused by its standard operation and such caused by extraordinary hazardous incidents.

The mere "*existence of a project*" may increase the hazard potential present at the site, either because an accident-prone project itself poses a technological hazard, or because a project is exposed to external hazards, which in case of their occurrence might in turn cause the project to release hazards into the environment. Such external hazards may either be natural hazards pre-existent at the site or man-made hazards (accidents) in other existing projects. Another mechanism through which a project could influence the hazard potential is by increasing the likelihood of occurrence of a natural hazard. For example, construction might destabilize a slope and increase the risk of a landslide, deforestation or soil sealing might increase surface water runoff and increase the risk of flood build-up in areas that may be far off, or changes to vegetation cover might increase the risk of avalanches and mudflows. If the implementation of a project increases the hazard potential of an area, this can be understood as a "*significant effect*" on man and the environment (Greiving, 2005).

Moreover, exposure of a project to an external – natural or technological – hazard increases the vulnerability of the area of project location to that hazard. Thus, through its mere existence, a project may increase the damage potential, or vulnerability, of the area where it is sited. Possible impacts of the environment on a project may lead to, amongst others, damage to, or destruction of, the project and injury or loss of lives of employees. Impacts of the environment on the project may also cause the project itself to become a hazard to the environment and residents, i.e. the project may become a risk source and a link in a 'risk chain': external hazards impacting on the project, which in turn causes "*significant effects*" on the environment. Thereby, an increase in the damage potential would result in the increase of the hazard potential of the project location area. If the

implementation of a project increases the damage potential of an area, this can also be understood as a "*significant effect*" on man and the environment (Greiving, 2005).

Annex IV.3, in accordance with Article 5 (1), requires the EIS to consider the "*aspects of the environment likely to be affected by the proposed project*." Likewise, Annex III.2 requires that "*the environmental sensitivity of geographical areas likely to be affected by projects must be considered*" in screening. Both, changes to the hazard potential and the damage potential, can be understood as "*aspects of the environment*" and as part of "*the environmental sensitivity of geographical areas*" areas likely to be affected.

The material interrelationships argued above provide evidence that is in support of the hypothesis that the concept of 'extraordinary' risks and their consideration and assessment in EIA is within the material scope of the Directive. However, these material interrelationships are to a large extent implicitly hidden in the Directive and do seldom become manifest in explicit verbal terms.

However, close analysis of the Directives' text also reveals much evidence that the manifest and explicit scope of the Directive in terms of extraordinary risks is limited: While the Directive does not exclude consideration of extraordinary hazards, explicit reference to the consideration of risks under non-standard operation of a project, or under exceptional conditions, is restricted to Annex III.1 to the Directive. Annex III, which has been introduced with the amending Directive in 1997 (Directive 97/11/EC), lists selection criteria that are to be applied in accordance with the provisions of the screening Article 4 (3). These criteria cover the characteristics of projects, the location of projects and the characteristics of the potential impacts. Under 'characteristics of projects', the screening criteria provided by Annex III.1 include the criterion

> "*the risk of accidents, having regard in particular to substances or technologies used*."

Apart from Annex III.1, no further explicit mentioning is made of extraordinary hazards or risks in the Directive.

Besides "risk of accidents", in an indirect way also the screening criteria listed under "location of projects" in Annex III.2 to the Directive bear potential relevance to risk-based considerations. By stating that the "*environmental sensitivity of geographical areas likely to be affected by projects*" must be considered in screening decisions, both the hazard potential and the vulnerability of the project environment, including the damage potential present at the site and its coping capacity, are implicitly touched upon (cf. above). By listing densely "*populated areas*", the "*existing land use*" and various types of naturally sensitive areas as screening criteria, Annex III.2 may be interpreted as making indirect reference to the exposure to hazards and to the magnitude of potential adverse consequences of a risk event occurring. However, none of these possible implicit meanings are stated explicitly in the Directive.

External impacts of the environment on the project are not mentioned explicitly in the Directive, either. These would include both natural hazards and accidents in other existing installations impacting on the proposed project. In contrast, the Canadian Environmental Assessment Act is much more explicit about that point by including "*any change to the project that may be caused by the environment*" (CEAA, 1992). Canadian guidance in EIA points out that *"potential effects of the environment on the project must be examined using the same criteria for significance as used in the assessment of effects of the project on the environment"* (CEAA, 1994). However, no such concept can be found in the EIA Directive.

The function of Annex III is to determine if an EIA is required. For that purpose, the relevant selection criteria must be considered by Member States when drawing up their legislation, i.e. in the setting of thresholds and criteria for projects subject to mandatory EIA, and/or by competent authorities when making screening decisions for Annex II projects, i.e. in deciding on the need for an EIA in case-by-case examinations. The field of application of Annex III is restricted to screening provisions or decision-making related to Annex II projects. Annex I projects, which are subject to mandatory EIA, are out of the scope of application of Annex III. An explicit obligation to apply the criterion "risk of accidents" throughout the entire EIA procedure and in particular to the identification, description and assessment of significant effects in the EIS is not present in the Directive. Thus, it may be concluded that the Directive does not require in a manifest way to consider “risk of accidents” in other stages of the EIA procedure than screening.

Similar to its field of application, on an explicit level also the concept of risk expressed in the Directive is narrow. Besides the “*risk of accidents, having regard in particular to substances or technologies used*”, no other risk category is mentioned. The risk concept appears to be confined to internal accidents within the proposed project that might cause the release of chemical hazards. Evidence gathered by the (IMP)3 project supports the hypothesis that there is a tendency among Member States and stakeholders towards such a narrow interpretation. On the other hand, the semantic meaning of the term "accidents" may also be interpreted in a much wider sense as meaning 'anything that can go wrong and might have significant effects on the environment', which would comprise various hazard categories that could affect a project, including external risk sources and sabotage. However, as neither the term “risk" nor the term "accidents” is defined or specified further in the Directive, it would appear that the European legislator has left his exact purpose largely up to discretion.

Consideration of the “*likely significant effects*” of a project, as required by Article 1.1, Article 2.1, and Annex IV. 4, is a key concept of the EIA Directive. Interpretation problems exist with regard to the issue of ‘risk’. The expression "*likely*" appears to be in contradiction to the inherent nature of risk, which are characterised by uncertainty and limited likelihood of occurrence, and are thus per definition more or less "unlikely". This wording of the Directive may be seen as excluding low probability risks from assessment, irrespective of the magnitude of potential adverse consequences, and it tends to favour and justify an interpretation that defines "extraordinary risks" as being largely out of the scope of the Directive[5]. There is solid evidence provided by national implementing regulations (cf. chapter 2.1.2, 3.3.7), as well as by the last five-year review of the implementation of the EIA Directive (EC, 2003a), that there are Member States that understand and interpret the Directive in the narrow way that there is no requirement in the Directive to cover hazardous incidents that can be rated as “unlikely” (while yet the same Member States still acknowledge that "risk of accidents" is a screening criterion).

Analysis suggests the conclusion that the EIA Directive is inexplicit in its wording about the need and extent to which extraordinary hazards and risks should be considered in EIA. This gives way to ambiguity, causes technical interpretation problems, and appears to be in favour of a large amount of discretion in handling the Directive on the part of Member States, national authorities and EIA stakeholders. Our empirical evidence suggests that such ambiguity and discretion is apparently not

[5] But also a wider interpretation could reasonably be argued: the English adjective "likely" carries semantic connotations in the sense of "possible", and there are officially approved translations of the Directive's text into non-English languages that in fact use this meaning.

in favour of a broad and consistent coverage of risks in EIA across the Member States. Contrary to that, EC's guidance on EIA (2001a, 2001b, 2001c) indicates that the Commission has a wider interpretation in mind than is explicitly stated in the Directive. It would thus appear that the policy design of the Directive is imperfect and produces 'pre-programmed' implementation deficits.

Relationship between EU EIA legislation and national EIA systems

Given the fact that the European EIA legislation is not very clear about its scope in terms of risk, it must not come as a surprise that a number of different risk concepts and varying requirements for consideration of extraordinary risks in EIA are to be found in EIA legislations of the Member States. Consequently, inconsistencies in coverage of risks in national EIA practices must not surprise, either.

Although differing types of implementation approaches do exist, nevertheless the majority of the Member States examined closely in this study have chosen to adopt the narrow risk concept and the narrow field of its application from the EIA Directive, i.e. to restrict explicit references in their EIA regulations to "risk of accidents" and to confine its application primarily to screening decisions.

However, some have used their discretion in transposing the Directive by implementing more detailed or more comprehensive requirements for risk assessment into their EIA legislation, or in closely related sectoral legislation, respectively. Albeit, most of these requirements do by far not fully reflect the wide risk concept put forward in EC's guidance.

Relevant provisions exceeding the explicit scope of the EIA Directive include:

- use of an extended risk concept in screening procedures;
- consideration of "risk of accidents" according to Annex III.1 to the Directive beyond screening, i.e. throughout the EIA process, including the EIS;
- definition of a wider and more detailed concept of risk beyond "risk of accidents";
- comprehensive requirements for applying a wide risk concept in all relevant stages of the EIA process that arise from other applicable legislation related to EIA in a few Member States, but these provisions do not apply to all projects subject to EIA.

Risk assessment is not a prominent issue in national guidelines on EIA. However, in many of the ten Member States investigated more closely, albeit not in all, references to risk issues in guidance go beyond requirements stated in EIA legislation. The most drastic differences between law and guidance can be found in particular in some of those countries that have only weak references to risk in their EIA laws, but strong recommendations for considering risk in their guidance. Compared to EC's guidance on EIA, very few Member States have issued recommendations that are similarly comprehensive and detailed. In this respect, the impact of EU guidance on Member States appears to have been rather limited.

Coverage of extraordinary hazards and risks in EIA practice

Empirical results have shown that there is considerable inconsistency in the coverage of most hazard categories across Member States, and possibly also within Member States. Variability in regularity of coverage of one and the same hazard category between and within countries could be explained by a number of factors:

- different requirements for consideration of risks in national EIA regulations;
- different recommendations in national EIA guidance;
- different regulatory frameworks, legal traditions, institutional systems, and established working routines in general;
- natural variation of environmental conditions;
- different numbers of typical high-risk project types that are submitted on national level;
- different risk perceptions;
- 'incidental' case-specific factors, dependent on project type, project location, involved EIA experts, public or political sensitivity towards certain proposed developments or environmental problems, etc.

In principal, our empirical results are difficult to compare with the results of our desk research. One main reason is that national EIA legislation and guidance often make divergent, if not drastically different statements on the issue of risk in EIA. Thus, it is in fact impossible to determine if EIA practice, according to our empirical surveys, is influenced stronger by legal requirements, or by indicative recommendations in guidance, or by none of the both. Another reason is that some countries where national documents allow for a clear picture are not represented well enough in the questionnaire date base.

In general it can be said that often risks are covered better in EIA practice as EIA legislation would suggest. As far as further statements can be made, comparison of the results of the review on national EIA legislation and national EIA guidance with the results of the empirical studies on national EIA practice does show some, but not too many parallels. In some countries, correlations appear to exist, but in others not. For example, there are countries where wider risk concepts and stronger requirements in EIA regulations correspond to some extent with comparatively good coverage of some hazard categories in practice. But there are also examples where such a relationship does not occur. Thus, the pattern is not clear enough to allow for generalized statements. However, one cautious conclusion may be drawn: the impact of neither legislation nor guidance on EIA practice appears to be strong enough to clearly translate into action on the ground. Moreover, it can also be stated that the two hazard categories that are addressed least often in almost all countries – namely, sabotage and exposure to external accidents – are also those hazards that are not at all or very occasionally mentioned in legislation and guidance.

Differences between countries in the degree to which natural hazards are dealt with could to some extent be explained by the dependence of the occurrence of certain natural hazards on the variation of natural conditions, such as geography, geomorphology, geology, climate, etc. For example, many gravitation-related natural hazards (e.g., avalanches, landslides, floods of mountain torrents) are an almost ever-present danger in an Alpine country like Austria, but may be comparatively neglectible in other countries.

Varying coverage of accidents, regardless of the respective causes, could be explained by national differences in the actual number of high-risk project types (technologies liable to accidents, hazardous substances involved) that are submitted for approval, but this assumption would have to be proved by further statistical analysis.

In some cases, questionnaire and/or interview results from one and the same country are highly contradictory even for a certain hazard category, indicating missing consent among respondents. Thus, it cannot be excluded that disparities in coverage of extraordinary hazards may also exist between regional EIA regimes on intra-national level. Unclear patterns of answers to a specific question from one country could as well reflect that there are differences in coverage of a given hazard category between individual projects within national EIA systems, possibly depending on case-specific factors such as project type, location, involved EIA experts, and public or political sensitivity towards certain proposed developments.

Inconsistent coverage between countries could as well indicate differences in risk perception between Member States. Comparatively good coverage of natural hazards and internal technological accidents in a number of countries, but not in others may to some extent be explained by biases in risk perceptions rather than by 'objective' differences in actual risks. Here, the so-called "availability heuristic" offers model for explanation. In simplified terms, this paradox of risk psychology says that people systematically tend to think that events are more probable if they can recall an incident of their occurrence, in particular if these events are associated with serious damage and strong emotions (Sunstein, 2002). As empirical psychometric findings have shown, the significance which is attributed to a potential risk source is strongly influenced by the cognitive availability of memories of recent risk events. The more recent and the more emotional such memories are the higher normally their spontaneous cognitive availability is (Tversky & Kahnemann, 1982). According to Sunstein (2002), not only cognitive behaviour of individual people, but also the responses of political, legal and institutional systems to risks are strongly influenced by the "availability heuristic", often in response to shifts in public opinion. The hypothesis may be put forward that the large-scale flood disasters that have hit large parts of Central Europe repeatedly in recent years, as well as some recent major industrial accidents, may have increased the priority that in some countries is assigned to the assessment of these risks in EIA. There is at least proof that this assumption holds true for the risk-related legislative process on EU-level: The last amendment of the Seveso II Directive in 2003 was prompted and argued by major industrial accidents (e.g., Toulouse, Enschede). Thus, developments in risk assessment and risk management appear to be often a disaster-driven process (Greiving et al., 2005).

This is an ambivalent phenomenon. On the one hand it demonstrates political and institutional learning aptitude. On the other hand, one must not overlook the intrinsic nature of risk in this context, which lies in uncertainty and probabilities. If recent disasters overshadow the perception of risks, this may cause selective risk perceptions. Biased risk perceptions may lead to a tendency of overreacting to certain risks, which are salient in mass media and memories, and neglecting other risks, which have not occurred recently but whose statistical probability of occurrence may be higher and whose potential consequences may be even more severe. There is a lesson here why risk-based decision-making requires sound risk assessment.

Sabotage, exposure of projects to external accidents, and accidents caused by human failure were shown to be addressed least often on EU-level as well as in most countries.

The weak performance profile of EIA in terms of sabotage and accidents due to human failure may be explained by methodological limitations that are inherent to the assessment of all risks directly connected to human actions. Human behaviour is typically characterised by high degrees of uncertainty, which makes them very difficult, or virtually impossible, to be predicted, estimated or quantified (Munier, 2004). So far, risk assessment has not succeeded in developing satisfactory methods for assessing these kinds of risk. Moreover, accidents typically result from an interaction of human failure (error, inattention, mismanagement, etc.) with technological causes, which are often connected by a chain of events. Quantitative risk assessment of such man-machine interactions would require complex methodologies, and is normally associated with high uncertainties. This suggests that the most appropriate way of handling risks related to human behaviour may be to apply the precautionary principle: identifying potential risk sources and to develop and implement precautionary measures to reduce the likelihood of human errors occurring. An high number of questionnaire respondents who had no opinion about the extent to which sabotage is considered in EIA, as well as the lack of references in the interviews, indicates that sabotage is still an unfamiliar issue in EIA.

Interview results indicate that one main reason for the poor coverage of the risk of external accidents is that they are much a matter of Seveso II regimes.

Coordination with other procedures

Both results of the desk study and of our empirical surveys have identified inconsistencies in the risk-relevant regulatory framework and have highlighted the need for better coordination of risk assessment under different procedures. This need arises from a number of reasons.

In general, most risk assessments are applied in procedures separate from, or parallel to, EIA, or they are required by legislation outside EIA. Obligations to consider extraordinary risks are much stronger under Seveso II- and IPPC-related licensing regimes than in EIA procedures; in addition, many sectoral regulations for specific project types exist (e.g., nuclear plants, contaminated sites). A variety of models of implementing the Seveso II and IPPC Directives are in operation in Member States, with differences in organisation and timing of procedures, institutional arrangements and working routines. Formal legal linkages between procedures have been established only in a minority of countries. Coordination between EIA procedures and Seveso II-/IPPC-related procedures is mostly poorly developed, with little real information exchange. In a few Member States, EIA is a dependent part of other procedures under applicable sectoral legislation; for projects that are simultaneously subject to EIA and certain subject specific regulations that require risk assessment, both an EIS and separate risk studies are submitted. However, in practice these are parallel processes and risk studies are seldom fully incorporated into the EIS, but mostly only referenced or briefly summarized in, or annexed to, the EIS. In some Member States, EIA and IPPC/Seveso are completely independent procedures with no linkage whatsoever. In a number of countries, procedures follow a sequential order, with Seveso II and IPPC procedures subsequent to EIA and requiring the EIA permit. There may be good reasons to favour an approach that would use documentation produced under EIA procedures as input for Seveso II and IPPC procedures (IMPEL, 1998). However, our empirical study has provided evidence that those national systems that practice a consecutive approach have particular difficulties in integrating the results of the different processes. Risks of accidents estimated for Seveso II or IPPC purposes tend to be not evaluated for their environmental consequences. On the other hand, the design of appropriate risk management measures under later procedures lacks information on the environmental effects of

hazardous incidents. An integrated or coordinated procedure would clearly favour material coordination, and the point of time at which documentation and information has to be presented is important to use synergies (IMPEL, 1998).

The fields of application of the EIA, IPPC and Seveso II Directives have both overlaps and discrepancies. Overlaps imply that certain projects are subject to two or more licensing regimes, which creates the threat of double work. Discrepancies imply that other projects are subject to only one procedure, which causes different threats: Since the field of application of the EIA directive in terms of project types is more comprehensive than that of the Seveso II Directive, Member States that rely much on Seveso II and IPPC procedures to address hazards and risks may fail to properly examine risks of such projects that are only subject to EIA, i.e. they are in danger of failing to cover all potentially risky developments. There is evidence that such tendencies exist in many Member States.

Moreover, the material scope of the Directives is different: The Seveso II Directive focuses on safety hazard assessments (risk of accidents) involving hazardous substances, as well as on response measures (accident prevention policy, emergency plans, inspections, etc.), with not much attention dedicated to the environmental consequences of hazardous incidents. The IPPC directive in practice focuses on optimisation of process design, technological project modifications, and Best Available Techniques. In contrast, the key characteristics of EIA are the assessment of environmental effects, impact prediction, and mitigation measures. As a consequence, Member States where risk issues are mainly within the scope of Seveso II-related procedures may tend to restrict risk considerations to safety risk analysis, with much less emphasis on the assessment of the environmental consequences of an accident occurring, which should be the main focus of EIA.

To make project-level risk assessment more efficient and to avoid gaps in coverage of projects, better coordination and streamlining of procedures would be needed. Proper timing of certain procedural stages, integration of relevant risk assessment results required under one procedure into the information and documentation submitted under another procedure, ensuring exchange of information and documentation between involved authorities in due time, and making it available to the decision-making process would be crucial.

Effectiveness of risk assessment in EIA

To obtain a broad picture of the effectiveness of EIA in terms of risk assessment, the questionnaire asked if stakeholders thought that application of risk assessment in EIA had modified project designs or otherwise influenced proposed developments before or after submission of an EIA. In the interviews, it was asked if and how often risk mitigation measures and precautionary measures to prevent risk events or contain their consequences, including such integrated into the project design, had been applied.

The concept of EIA effectiveness applied here is based on the perceived influence of EIA on project modifications prior, during and after formal EIA procedures. Project modifications prior and/or after EIS submission have often been used as an indicator of the performance and effectiveness of EIA (Wood & Jones, 1991, 1992, 1997; Wood et al., 1996; Kobus & Lee, 1993; Lee et al., 1994; Frost, 1994; Jones & Wood, 1995; Sadler, 1996; Reeder, 1994; Ortolano, 1993; Cashmore et al., 2004; Wende, 2001; Sager & Schenkel, 2003). As measuring the substantive outcome of the application of EIA in terms of its influence on environmental quality is hardly

possible, its influence on project designs and project modifications, including choice of project alternatives, selection of alternative project locations, and incorporation of mitigation measures into project designs, must be used as a surrogate indicator of EIA effectiveness.

The questionnaire results indicate that influences of risk assessment in EIA on project modifications exist, but that influences generally vary between medium, moderate and weak, depending on hazard categories and Member States. While no previous study is known that has investigated EIA outcome in terms of risk aspects, there are a number of studies on national and international level that have examined the influence of EIA on project modifications in general. Our results are basically much in accordance with the findings of those studies, which have repeatedly shown that the effectiveness of EIA is by far not as good as it could be. Various studies in the UK have found that modifications to project designs have been made during the EIA process in approximately one half to two thirds of cases (Kobus & Lee, 1993; Lee et al., 1994; Frost, 1994, 1997; Wood and Jones, 1991, 1997; Reeder, 1994). Similarly, a review of the Ministry of Housing, Spatial Planning and the Environment (1994) has shown that an influence on project development occurred in 50% of cases. These findings conform to an international EIA stakeholder survey by Sadler (1996), which has found that EIA was felt to be 'very' or 'moderately' influential in affecting project designs in 56% of cases, compared to 40% of cases with only 'marginal' or 'no' influence.

Our results do not allow an estimation of the environmental significance of project modifications in consequence of risk assessment in EIA. However, previous studies provide evidence that general modifications are relatively minor in many cases and often refer to comparatively modest fine-tunings of developments (Cashmore et al., 2004). According to data presented by Sadler (1996), EIA was relatively inefficient at ensuring that impacts were minimised and irreversible impacts were avoided. This is supported by the findings of Wood & Jones (1997), who observed that in 68% of cases where modifications did occur, they were often only of a minor nature. Following Cashmore et al. (2004), it could be argued, however, that restriction to modest fine-tunings is an intrinsic limitation of EIA that can hardly be overcome at project level. Adding an additional aspect, Reeder (1994) has shown for a sample of 8 projects that out of 34 modifications with mainly 'minor' environmental significance only 10 could be attributed to the EIA process, which illustrates that often a considerable part of project modifications is made anyway, independent of EIA.

Evaluation of the questionnaire provides the interesting opportunity to compare results for the coverage of extraordinary hazards in EIA with results for the perceived effectiveness of such coverage. Comparative analysis of country-level results shows that for the majority of those countries where consideration of all hazard categories except sabotage is rated similarly good, also the influence on EIA outcome is perceived to be similarly strong. This finding holds also true for a number of countries if coverage and effectiveness are compared for individual hazard categories only. Albeit, opposite examples do exist.

However, in general overall results for effectiveness are clearly outmatched by results for coverage, which implies that regular coverage of a hazard does not necessarily lead to improvement of project designs. Likewise, interview results have shown that decision-makers apparently often have difficulties in integrating the outcome of risk assessment into the decision-making process. This complies with assumptions of policy evaluation research: high output levels of policy implementations are usually a favourable, albeit not a sufficient precondition for high quality outcomes (Bussmann et al., 1997). There is no compelling causal linkage between the two. There is some discouraging evidence in EIA literature that even the quality of EISs has not a

significant influence on project modifications and decision-making: according to data presented by Lee at al. (1994), the number of projects modified as a result of the EIS was almost equal in cases where EIS quality was satisfactory and in cases where it was unsatisfactory.

However, one must remember that the final purpose of any risk assessment is to take decisions on risk management measures (cf. chapter 1.2.1.4): The main reason for wanting to assess and specify risks is to provide a sound information basis so that they can be prevented, reduced, managed or eliminated (Calow, 1998). Otherwise, risk assessment is virtually a waste of time and money.

Thus, if the aim is to increase the importance and weight of risk assessment in EIA, improving the coverage of hazards and risks and including risk sections to EIS is simply not enough. What is required is the proactive integration of the results of risk assessment into decision-making processes, provided that risk is considered significant. Cashmore et al. (2004) argue that the main reason why EIA is relatively inefficient in substantially influencing environmental decision-making is that it predominantly functions as a passive tool for information provision. Some reasons why decision-making on risk management can be difficult are that it involves evaluation of acceptability of risk and consideration of complex issues like societal values, public perceptions and preferences, costs and benefits, and technical feasibility, as well as their balancing, ranking and weighting, and often difficult trade-offs between them (Kolluru, 1996; DEFRA, 2000). An opportunity to increase the effectiveness of risk assessment in EIA could be to promote a wider use of decision-supporting methods for systematically comparing, evaluating and prioritizing alternative risk management options, such as cost-benefit analysis, cost-effectiveness analysis, trade-off analysis, multi-criteria analysis, and other techniques of options appraisal (ADB, 1997; DEFRA, 2000), as well as to train EIA decision-makers how to apply them. A proactive approach would also require strong feedback and iteration between risk managers and risk assessors (Brookes, 2001). Decision-makers need to adequately define their information needs and the required risk assessment output and to provide input for risk assessors to help them in problem formulation. Also, risk management options may need re-assessment to determine whether it reduces the risks to an acceptable level, and each option may introduce new risks (Calow, 1998; DEFRA, 2000).

Our empirical results provide some evidence that there is effectiveness of EIA in terms of influence on anticipatory project planning under the premise of EIA. Interviewees from a number of countries emphasized that many developers undertake internal risk assessments before application for approval, and that many risk-related project modifications are integrated into the project design prior to EIS submission. In particular high risks of natural hazards are often already identified in early stages of project development, either by project planners themselves or during preliminary informal consultations with authorities. In such cases, often a more appropriate alternative project location is selected before EIA procedures actually begin. Likewise, questionnaire results suggest that the 'business/private sector' has a more positive perception of the influence of risk assessment on project modifications. Since it must be assumed that project proponents and development planners have the best knowledge of project modifications in stages prior to submission of an EIS, higher levels of perceived effectiveness on part of the 'business/private sector' may be an indication of the influence of EIA in pre-submission stages.

Evidence from previous studies exists that the mere existence of EIA, i.e. the knowledge on part of project proponents that a given project will be subject to mandatory EIA, can cause anticipatory compliance with its requirements: according to an empirical study of 37 EIA cases in the UK by

Wood & Jones (1997), in approximately one third of cases project modifications took place solely prior to EIS submission, compared to modifications only after EIS submission in one sixth of the cases; in one fifth of cases modifications were made in both stages. In 72% of the cases where modifications occurred in the pre-submission stage, this was attributed to the work involved in EIS preparation. Similarly, Reeder (1994) has also shown for a sample of cases that more modifications were made in stages prior to EIS submission than in post-submission stages. Project modifications in early stages of the EIA process are generally highly favourable, because changes to designs in later stages may render obsolete impact prediction and mitigation proposals (Cashmore et al., 2004) and increase overall cost and duration of EIA. Awareness-raising could help promote such early integration of risk assessment in project planning.

Procedural and methodical aspects of risk assessment approaches in EIA

Empirical results show that risk-related considerations in EIA are often much hazard-based and heavily oriented on risk management, rather than relying on a comprehensive risk assessment that would involve analysing exposure and consequences and an evaluation and/or estimation of risk, including the residual risk after anticipated implementation of risk management measures. Results suggest that national approaches to assessing and managing significant extraordinary risks in EIA often lack systematic approaches, both in terms of coherency and deliberateness and in terms of completeness of an ideal risk assessment process. According to questionnaire results both on EU-level and on Member States-level, the two by far most often applied steps of risk assessment are:

- hazard identification, and
- measures to avoid, reduce or offset risks.

That hazard identification is the top-ranking option could be expected, because it is the first step of any systematic risk assessment process. That risk management measures – the final step of the risk assessment cycle – were rated the second-ranking step is an ambivalent result. On the one hand it would suggest high effectiveness of EIA, on the other hand it is difficult to design appropriate and effective risk control and risk reduction measures and to set the right priorities among them without having an estimate of the probability of a hazard occurring, a prediction of the nature and magnitude of adverse consequences, and a judgement about the significance of a risk. In formal terms, it means that a number of other integral analytical key steps of risk assessment in between hazard identification and risk management are missing.

The two procedural steps of risk assessment that are applied least often are:

- public participation in risk assessment/management, and
- assessment of the residual risk (based on predicted effectiveness of proposed risk control and risk reduction measures), including the appraisal of its acceptability or tolerability.

In a number of interviews from different countries it was also reported that public involvement with risk issues in EIA is seen as difficult. Risk information and risk communication towards the public appear to be underdeveloped in present EIA practice. This should raise concerns, given the fact that public participation is a key feature of EIA, whose significance has even been strengthened with the last amendment to the EIA directive. Involving the public in risk-related decision-making is particularly important because risk perceptions of experts, decision-makers and the public affected often are significantly different, and because evaluation of the significance of a risk entails value judgments and touches on social, cultural, and political factors (Covello, 1998). Risk-related issues

are usually highly sensitive to the ones who feel affected. A lack of involvement of the public can lead to distrust and threaten acceptance of projects.

Barriers

The determinants that impede and constrict extended coverage and deeper integration of risk assessment in European EIA systems are diverse and varied. The most often named barriers include the following:

- lack of specific technical guidance, know-how, expertise, and training;
- missing legal requirements for risk assessment in EIA;
- missing definition of the concept of risk in the context of EIA;
- lack of adequate methods;
- existence of risk assessment in other procedures separate from EIA, and deficits in coordination with other procedures;
- difficulties in integrating outcomes of risk assessment in decision-making processes, in particular with regard to evaluating acceptability of risk;
- difficulties in communicating risk issues and handling them in public participation;
- fears about overburdening EIA, increase in duration and cost of procedures;
- lack of awareness for significance or probabilistic nature of many hazards;

The significance of individual barriers on Member States-level varies to some extent. Given the national differences in terms of legislative systems, planning traditions, institutional arrangements, administrative working routines, etc., this is of little surprise. Therefore, specific national contexts must be considered when attempting to overcome barriers to risk assessment in EIA.

The barriers listed above are to a large extent self-explaining; many of them have been discussed in the paragraphs above. If the goal is to enhance the coverage of extraordinary risks in EIA, at least the most often identified barriers should be tackled in a deliberate approach. Bearing the importance of country-specific context factors in mind, strategies for deeper integration of risk assessment into EIA should focus on the following priority targets:

- development of technical guidance on how to apply risk assessment to EIA;
- enhancement of knowledge and technical expertise of all relevant EIA stakeholder groups;
- strengthening legally binding requirements for the consideration of extraordinary hazards and risks in EIA;
- development of practical, operational, cost-efficient, "real-world" methods, tools and techniques of risk assessment that are specifically suited to EIA application purposes;
- strengthening co-ordination between EIA and project-related risk assessments in other procedures under different regulatory regimes.

Integration of risk assessment into EIA

EIA offers an appropriate legal and procedural framework for the integration of risk assessment (Greiving, 2005). However, up to now risk assessment has not been widely used in European EIA practice. This may partly be due to a predominating view on part of the EIA community that risk assessment is complicated, difficult to understand and communicate, and usually costly. Yet, this is not necessarily the case. Risk assessment consists of highly adaptive and flexible tools that have many benefits to offer to EIA both as supportive and complementary techniques. If applied to particular problems, it may not need to progress as far as a detailed quantitative stage and therefore may not involve large costs (Brookes, 2001). Applying a tiered procedure where the level of effort and sophistication that is put into risk assessment is at each tier determined by the magnitude and significance of the risk studied, the sensitivity of receptors, and the quality of available data offers a pragmatic approach to integrate risk assessment into EIA. Depending on the outcome at each tier, a purely qualitative risk screening that is conducted at the screening and/or scoping stage of an EIA procedure may be sufficient, or it may be decided to apply a more detailed generic risk assessment or even a "full-blown" tailored quantitative risk assessment, provided that risk is significant, uncertainties are high and prudent for decision-making (Brookes, 2001; EA, 1997; ADB, 1997; DEFRA, 2000) (cf. chapter 1.3.2).

A broad variety of methods, techniques and tools exist that suit diverse application purposes. However, knowledge on how to apply risk assessment must be made available to the EIA community. At present, in Europe there is still a lack of professional expertise in risk assessment. On the one hand, specialised risk assessors and risk managers are not easily available in many countries, and on the other hand, both EIA practitioners and competent authorities often lack training and experience in issues of risk assessment, management and communication. This may also cause communication problems between risk assessors and EIA experts. There is clearly a need for both groups to familiarize themselves with each other's field of knowledge.

Moreover, though a wealth of methods for applying risk assessment to environmental issues exists, this knowledge needs adjustment to the specific requirements of EIA. There is a need for developing operational, practicable and cost-efficient "real world" methods to be applied in EIA and to elaborate specific technical guidance. This could be fostered by knowledge transfer from various fields of application that are more experienced and advanced in risk assessment, and targeted research aiming at cross-fertilization between EIA and risk assessment.

5 POLICY OPTIONS

5.1 General remarks

Based on the findings of this Work Package of the IMP3 project, this chapter presents a series of policy options that are designed to enhance integration of risk assessment in EIA, to improve the ways risks are dealt with in EIA, and to increase the consistency of approaches across the European Union. The policy options aim at tackling the identified weaknesses of the current European EIA practice in terms of covering extraordinary hazards and risks and at overcoming the most important barriers on the way forward. They also attempt to build on and advance the strengths that partly exist. The policy options represent a range of different courses of actions that the European Commission could take to better exploit the full potential of EIA to act as an effective instrument of preventive and precautionary environmental protection by identifying, assessing and managing project-related risks.

The development of a range of policy options, as opposed to a simple list of recommendations, is a more robust approach as it recognizes that different levels of action are possible and that each has advantages and disadvantages.

The policy options presented hereafter are addressed to the European Commission. Yet, eventually they are targeted at Member States and EIA stakeholders and are intended to influence actual implementation and application of EIA on national and regional level. Their main functions are to provide decision support to the policy making process on Community level, to assist informed decision-making on possible future amendments to European legislation, and to contribute to improvement of guidance on EIA application, but also to stimulate discussions within the European EIA community.

Building on the IMP3 research results, seven policy options have been developed:

0. Policy option 0: Zero option: ‘Do nothing’
1. Policy option 1: Guidance ‘light’
2. Policy option 2: Preparation of a new technical guidance package plus pro-active dissemination activities
3. Policy option 3: Set of supporting measures
4. Policy option 4: Launching of a risk assessment initiative with a broader perspective
5. Policy option 5: Minor amendment to the EIA Directive plus new technical guidance package plus support for implementation
6. Policy option 6: Major amendment to the EIA Directive plus new technical guidance package plus support for implementation

Each policy option is to be understood as an entire package or bundle of individual measures to be taken. These measures comprise both “soft” and legislative courses of action that are designed to operate mainly along three major axes:

- guidance,
- supporting measures, and
- regulatory or legislative measures.

Some options are located mainly on the same axes, but may be seen as being situated at different points of those axes regarding intensity and strength of intervention. With the exception of option 0, which excludes all other options, the logical relationship between the policy options is by no way exclusive or strictly alternative, but may rather be seen as complementary in the way that they allow combinations with each other. In fact, taking an additive approach and combining several policy options is not only possible, but may offer a variety of advantages and increase their effectiveness. This applies in particular to any amendments to the EIA directive, which are supposed to require at any rate accompanying supportive measures and additional guidance. Based on that rationale, additive combinations of some policy options, or of sub-sets of relevant actions of some policy options, are proposed.

The line from “zero action” to “major regulatory changes” may also be viewed as being interrelated to a time factor. Enhancement of guidance may be a rather short-term option, and supporting, coordination or complementary actions could be traced medium-term, whereas amendments to Community legislation can be expected to follow a rather long-term preparation process building on growing experience and knowledge.

Following the policy process model developed by Bussmann et al. (1997) and Windhoff-Heritier (1987), the policy options may also be seen as intervening at different stages of the EIA policy process or the EIA policy implementation cycle. Options that focus on changes to Community legislation pertain to the top-tier of the European EIA policy design. Those options that focus mainly on coordination of procedures under different licensing regimes on national level relate to a lower tier of institutional/administrative arrangements, as well as to the ways the implementation, execution and enforcement of national legislation are organized. Finally, those options that concentrate on enhancement of technical guidance aim at influencing the quality of the output of the EIA process and at the (cognitive and actual) behavior of the actors/stakeholders involved in that process, which pertains to stages located close to the bottom-tier of the policy cycle. Policy options that focus on or incorporate various supporting measures are more mixed and are directed at different stages of the implementation cycle, including the external framework conditions. However, the final purpose of any policy option presented here is to improve the final outcome of the EIA policy process, i.e. the effectiveness and efficiency of EIA systems as a whole.

Hence, the overall aim of each policy option is to increase the potential and likelihood that EIA fulfils its purposes and objectives. The objectives of EIA on an operational level are quite undisputed and are laid down explicitly in the EIA Directive and defined in the first articles of most national EIA acts. However, despite the fact that EIA is an established and globally practised tool, less far-reaching consensus exists concerning the substantive political purposes of EIA as an instrument of environmental policy. Here, a variety of interpretations appears to exist (Cashmore et al., 2004), and definitions are strongly determined by perspectives of different stakeholder groups (Morgan, 1998; Glasson et al., 1999), as well as by different national legislative systems, different

national traditions in terms of environmental planning and environmental legislation, and different national applications of EIA in practice.

Drawing on what appear to be the most commonly accepted definitions and interpretations, the following substantive political purposes may be attributed to EIA, as one of the most pivotal instruments of environmental policy:

1. Preventive and precautionary environmental protection: prospective and anticipative avoidance, reduction, mitigation and/or compensation of significant adverse environmental impacts of development proposals, as well as enhancement of positive impacts, by applying the preventive and precautionary principles, i.e. before a decision on development consent is taken. Thereby, EIA is expected to contribute to sustainable development. This objective is to be achieved by:
   - optimizing project designs, by means of environmentally sound modifications of project designs (either before or after submission of a proposal), appropriate mitigation measures, additional conditions or special requirements imposed by the competent authority, etc.;
   - rejection of development proposals which fail to fulfil legal requirements, have significant adverse effects on the environment, and cannot be optimized in environmental terms to the extent required;
   - safeguarding a level of protection for the affected environment, including human beings and the public concerned, that may exceed licensing requirements of sectoral laws.
2. Material and administrative-procedural integration: material and formal co-ordination across established political, legal and administrative sectors by:
   - applying an integrated approach to the assessment of all environmental impacts (including cumulative effects, interactions, secondary effects etc.);
   - contributing to cross-sectoral and interdisciplinary co-ordination between involved scientific disciplines, administrative bodies, sectoral laws, and different licensing procedures;
3. Administrative and political decision support: preparing and facilitating rational, informed decision making processes by:
   - providing all the relevant information on the environmental effects of a development proposal in a processed and structured way to support and facilitate rational, informed, optimised, competent and transparent decision-making by the competent authorities;
   - providing for stronger weighting of environmental interests in decision-making processes.
4. Ecological self-control of project developers: EIA provides the developer with timely information on potential environmental effects of a proposed project and thereby helps him to optimise project design in environmental terms at an early stage of development, to develop appropriate mitigation measures, to avoid possible costs from future liability claims, to make licensing procedures more time- and cost-efficient, or even to withdraw his proposal in due time, which may save money, time and effort (Gassner & Winkelbrandt, 1992).
5. Social and political acceptance: Apart from other advantages, through public participation EIA is able to function as a socio-political instrument of public discourse, conflict

management and consensus-building, which normally improves public acceptance of a project.

The underlying aim of the policy options presented below is to contribute to a better fulfilment of those substantive political purposes of EIA, with regard to risk assessment.

There are several reasons why amendments to the EIA Directive may not be on the short-term agenda of Community policy. First, a high number of infringement cases prove that EIA is one of the sectors of Community environmental law where Member States have a bad implementation record. At the time of publication of the last five-year review, about 30% of open infringement cases concerned gaps identified by the Commission in transposing the Directive into domestic law. 65% of infringement cases concerned bad application of the Directive in relation to individual projects (EC, 2004). This might speak against amendments within a short time and rather for giving Member States more time to fully implement the current requirements, in particular with regard to new Member States. Another reason is the recently adopted amendment (Directive 2003/35/EC) that introduces additional obligations with regard to public participation and access to justice according to the Aarhus Convention, and which has yet to be fully transposed by the Member States. A further reason is the adoption of the SEA Directive (Directive 2001/42/EC) that should have been transposed by Member States by 21 July 2004, but is still an ongoing process in some Member States. Also, authorities still have to gain experience in applying the SEA Directive in practice and in establishing effective linkages between the SEA and the EIA Directive.

However, an amendment to the EIA Directive is a strong regulatory approach with a high potential of initiating progress, and it may be necessary to enhance the fulfillment of the Directive's objectives, in particular with regard to risk assessment. Thus, any choice of policy options would be incomplete without including also regulatory courses of actions. Moreover, those policy options that focus on "soft" measures may be seen as intermediate actions that could improve the application of the Directive prior to any amendment, and that could be part of a long-term process in preparation of a future amendment.

For each policy option, a SWOT-Analysis has been conducted, which provides indicative lists of strengths and weaknesses, opportunities and threats. This form of a SWOT-Analysis is a simple, yet flexible and robust tool for decision-support that is meant as a basis for discussion. However, it can not substitute a more rigid cost-benefit-risk analysis to be done on part of the Commission.

Figure 52 on the following page provides an overview of the guidance, supporting and regulatory measures that are incorporated into the individual policy options.

Figure 52 Overview of policy options and measures

		Guidance		Supporting measures								Regulatory measures Amendment to EIA Directive		
												Other	Amendment to EIA Directive	
Policy option [European policy level]		**Upgrade**	**New guidance**	**(preparatory) consultation process**	**dissemination activities**	**Awareness-raising**	**training, education**	**knowledge-sharing**	**research**	**coordination of procedures**	**specific implementation support**	**New Directive on Hazard Mapping**	**Moderate**	**Major**
0	**Do nothing**	-	-	-	-	-	-	-	-	-	-	-		-
1	**Guidance 'light'**	X												
2	**Preparation of new technical guidance package plus pro-active dissemination activities**	(X)	X	X	X									
3	**Set of supporting measures**					X	X	X	X					
4	**Launching a risk assessment initiative with a broader perspective**			X				X	X	X		X		
5	**Moderate amendment to EIA Directive plus new technical guidance package plus support for implementation**	(X)	X	X	X	(X)	X	X	(X)	(X)	X	(X)	X	
6	**Major amendment to EIA Directive plus new technical guidance package plus support for implementation**	(X)	X	X	X	(X)	X	X	(X)	(X)	X	(X)	X	X

Legend: X ... obligatory measure; (X) ... may be useful as complementary measure

5.2 Policy Option 0: Zero option: 'Do nothing'

5.2.1 Description

The “zero option” represents the “business as usual” scenario. It assumes that no particular actions of any kind are taken by the European Commission, neither on the level of Community legislation nor along the axis of guidance enhancement nor regarding supportive measures, such as awareness-raising, knowledge-sharing, or targeted research.

It is anticipated that the full range of weaknesses and insufficiencies of European EIA practice in terms of risk assessment having been identified by the IMP3 project will continue to persist, including, *inter alia*, the following:

- extraordinary hazards and resulting risks for man and the environment will continue to be addressed inconsistently, with considerable variability in terms of coverage of different risk sources, and with significant differences in consideration of each hazard category both between and within Member Sates;
- methodological and technical approaches to the practical application of risk assessment and risk management in EIA will continue to often lack coherence, deliberateness, systematic coverage, technical soundness and adequacy;
- existing barriers to the enhancement of risk assessment in EIA will not be tackled systematically;
- coordination between EIA procedures and risk assessment under other development consent procedures that are subject to different regulatory and environmental control regimes will continue to be partly ineffective and inefficient, and the full potential of synergies will remain unexploited;
- even when risk assessment is applied in EIA, its effectiveness in terms of influence on decision-making, project designs, project modifications, and appropriate risk management measures to prevent, reduce, control and mitigate risks will remain limited.

The "zero option" would also imply that strengths and promising approaches that partly exist will not be consciously built on and encouraged. Member States whose EIA legislation or prevailing EIA practice on the ground already goes beyond legal requirements of the EIA Directive would retain their comparatively advanced position, but good practices will continue to stay largely unacknowledged by other Member States.

At large, the full potential of EIA to act as an effective instrument of preventive and precautionary environmental protection will remain unexploited.

Actions to be taken

None.

5.2.2 SWOT-Analysis

SWOT-Analysis Policy Option 0	
Strengths	Weaknesses
▪ No financial cost neither for Commission nor for Member States ▪ No additional effort required ▪ No political negotiations with Member States and economic interest groups required ▪ No change to existing national regulatory frameworks, institutional arrangements and working routines required ▪ Comfortable to most Member States as existing EIA systems can be retained unchanged	▪ The full range of existing weaknesses of current EIA practice in terms of risk assessment continues to persist ▪ No incentives for those Member States where good practices partly exist to develop and expand their strengths ▪ No progress, or progress is likely to be slow and incidental ▪ Commission fails to live up to its own principles of environmental policy ▪ Divergent and inconsistent approaches to risk assessment in EIA across Europe are likely to persist ▪ Risks associated to developments continue to be undervalued ▪ Barriers to integration of risk assessment into EIA are not tackled deliberately ▪ Lack of coordination between procedures under different risk-related Directives will persist ▪ Heterogeneous coverage of risks among Member States will continue to cause problems in the case of projects with serious risks with potentially transboundary consequences ▪ Commission does not take a leadership role in risk prevention and reduction
Opportunities	Threats
▪ Individual Member States who have progressed beyond legal Community requirements and are more advanced than others can continue their own path of action ▪ All Member States can develop at their own pace ▪ The present situation allows Member States a considerable amount of discretion in interpreting the Directive's requirements regarding risk assessment, which can be used to suit best national needs ▪ New Member States can gain further experience in applying the Directive in its present form	▪ Application of EIA fails to fulfill the substantial purposes of the Directive ▪ Failure to recognize and address serious risks adequately may cost many human lives and cause high financial and environmental costs, including liability claims to project operators ▪ Does not change anything about the insufficient policy design of the Directive ▪ Different levels of environmental protection across the European Union, as well as inequities between citizens in different Member States ▪ Divergences in the application of EIA in Member States may increase ▪ Differing national requirements for risk assessment in EIA imply incoherent conditions for economic development and may cause biases in economic competition between countries ▪ More advanced countries could cut back their requirements for risk assessment in EIA ▪ The longer present EIA practices persist, the harder it will become to change them ▪ "Double-checked" projects through obligations from other Directives and/or regulations increase costs of procedures for developers and governments ▪ Full potential of EIA to act as an effective instrument for the implementation of the preventive and the precautionary principles in environmental protection is not exploited
Concluding remarks	
This policy option does not generate any new benefits. It is very likely to conserve or aggravate most identified weaknesses of the status quo, but doing nothing also creates threats of its own. The substantive purposes of the Directive are at risk. Does also not live up to the conclusions and recommendations of the last five-year review.	

Figure 53 SWOT-Analysis of policy option 0: Zero option: 'Do nothing'

5.3 Policy Option 1: Guidance 'light'

5.3.1 Description

Policy option 1 concentrates on review and enhancement of existing EC guidance on EIA (EC, 2001a, 2001b, 2001c; EC, 1999), building on the comparatively broad concept of abnormal hazards and risks relevant to EIA that is already put forward by available guidance. It encourages an examination of the checklists on screening, scoping and EIS review that are at present provided by the Commission as to completeness, up-to-dateness and adequacy in terms of identifying, describing, assessing, and mitigating project-related hazards and risks. This would be done in the light of the key results of the IMP3 project as well as of other recent or current risk-related research (e.g., EU-funded research project ARMONIA within the Sixth Framework Programme). By incorporating essential research findings, existing guidance shall be upgraded, extended and advanced.

Compared to the EIA Directive, existing EC guidance on EIA is considerably more explicit in indicating that natural hazards are within the scope of EIA, and that the risk of accidents is not only a screening criterion, but should be examined throughout the EIA procedure (EC, 2001a, 2001b, 2001c). However, the checklists for screening, scoping and EIS review do not cover all aspects identified as important in this report. There is potential to highlight and emphasize the role of considering risks in EIA. Also, linkages to other risk-related Directives could be indicated, including in particular the SEA, IPPC, and Seveso II Directives. Extended definitions, key references, and links to relevant information sources could be added. While EC guidance is quite inclusive and comprehensive in recommending *what* should be considered in EIA, few indications are given on *how* this should be done. By supplementing the set of checklists with a further volume specifically for EIS preparation, additional practice-related support for EIA practitioners could be provided. An extension of existing guidance could include a "toolbox", which would provide an indicative list of well-proved methods for EIA, including methods for risk assessment, and references and links to further information sources.

Depending on the outcome of a thorough review of present guidance, the need for modifications may not be large, in particular if the Commission should decide to stay with plain checklists and leave any more detailed instructions up to the Member States.

Policy option 1 suggests the following actions to be taken:

Enhancement of existing EC guidance on EIA

- Review and upgrade of the EIA guidance on screening (EC, 2001a)
- Review and upgrade of the EIA guidance on scoping (EC, 2001b)
- Review and upgrade of the EIA guidance on EIS review (EC, 2001c)
- Review and upgrade of the guidelines on the assessment of indirect and cumulative impacts and impact interactions (EC, 1999)

5.3.2 SWOT-Analysis

SWOT-Analysis Policy Option 1	
Strengths	**Weaknesses**
▪ Marginal financial cost ▪ Little effort is required ▪ Simple in technical terms ▪ Builds on what already exists ▪ Does not require much political negotiations with Member States and economic interest groups ▪ Can be implemented within a short time ▪ Little resistance from Member States and stakeholders is to be expected ▪ Gives the Commission the opportunity to accentuate and strengthen its opinion on the Directive's scope without changing the Directive as such ▪ Guidance should be updated regularly anyway ▪ No change to existing national regulatory frameworks, institutional arrangements and working routines is required ▪ Would favor improvement of EIA practice and harmonization of coverage of risks between countries	▪ Guidance is non-binding and relies completely on good will and voluntary compliance, whose presence must not be taken for granted ▪ Even if Member States use enhanced guidance to upgrade their own national guidance, there is still no need for stakeholders to comply with it ▪ Existing guidance appears to be underused already at present ▪ Little impetus to counteract existing weaknesses of current EIA practice in terms of risk assessment ▪ Does not change anything about the insufficient policy design of the Directive ▪ No or slow progress in the majority of Member States may be anticipated ▪ Simply supplementing existing guidance has a low visibility impact ▪ Divergent and inconsistent approaches to risk assessment in EIA across Europe are likely to persist ▪ Barriers to integration of risk assessment into EIA are not tackled in a systematic and deliberate way ▪ Enhancement of existing guidance does not address the lack of coordination between procedures under different risk-related Directives ▪ Heterogeneous coverage of risks among Member States will continue to cause problems in the case of projects with serious risks with potentially transboundary consequences ▪ Lack of visibility on the European political agenda ▪ Leadership role of the Commission is minimal
Opportunities	**Threats**
▪ Member States can use enhanced EC guidance to upgrade their own national guidance ▪ Flexibility in implementation of the Directive would still be preserved ▪ Member States can continue to develop at their own pace and in a way that suits best their national needs ▪ Supports momentum of positive development that exists in some Member States ▪ New Member States are not overburdened with new needs to implement and apply new legal Community requirements	▪ Not enough impetus to overcome the inertia of established institutional systems ▪ Non-compliance with guidance will continue to persist ▪ The existence of updated guidance will be overlooked ▪ The most important barriers to integration of risk assessment into EIA remain untackled ▪ Application of EIA may still fail to fulfill the substantial purposes of the Directive ▪ Lack of coordination between procedures under other risk-related Directives are likely to persist ▪ If upgraded guidance will be followed by only some Member States, the different levels of environmental protection across the European Union, as well as inequities between citizens in different Member States, might increase ▪ If upgraded guidance will be followed by only some Member States, incoherent conditions for economic development and threats of biases in economic competition between countries might increase
Concluding remarks	
This policy option may be regarded as an ad-hoc approach that can be implemented short-term. Its impact on EIA practice appears might be rather marginal. Likelihood of effectiveness depends strongly on compliance of Member States with guidance. Could be an intermediate action before more serious measures are taken.	

Figure 54 SWOT-Analysis of policy option 1: Guidance 'light'

5.4 Policy Option 2: Preparation of a new guidance package plus pro-active dissemination strategy

5.4.1 Description

Policy option 2 relies on "soft" knowledge-enhancing measures to improve risk assessment in EIA. By pursuing a non-regulatory path of action, the practical application of the EIA Directive in its present form shall be enhanced, without changing anything about existing European legislation. Still, this option offers the Commission the opportunity to put forward and accentuate its interpretation of the Directive's scope in terms of risk assessment, building on the wider concept of risk as expressed in EC's existing guidance on EIA (EC, 2001a, 2001b, 2001c).

Policy option 2 suggests preparing a comprehensive new technical guidance package on practical application of risk assessment in EIA. It would be addressed to all relevant EIA stakeholder groups (project developers, EIA consultants, EIA consultees, EIS reviewers, competent authorities, regulatory agencies, and legislative bodies, administrative and political decision makers, NGOs, representatives of the public concerned). Guidance could be issued as an entire set of guidelines and textbooks for specific application purposes, focussing, amongst others, on natural hazards, technological hazards, and certain high-risk project types. Different to existing EC guidance, the character of new guidance should be much more that of a "how to do"-manual. It shall provide support with regard to the following main questions:

- What does 'risk assessment' mean in the context of EIA?
- Why to apply risk assessment in EIA?
- When to apply risk assessment in EIA?
- How to apply risk assessment in EIA?

According to empirical results of the IMP3 project, the main emphasis would be on the provision of technical expertise and know-how on *how* to assess risks in EIA.

Suggested contents would comprise, amongst others: clear definitions of terminology and of the concept of risk in the specific context of EIA, specification of hazard categories and risks that should be considered in EIA, methodological guidance on how to apply risk assessment and risk management approaches as complementary and supporting techniques in EIA, recommendations on procedural integration of risk assessment in the EIA process, a compilation of instructive good practice examples, as well as indications of typical pitfalls and limitations. As mitigation measures are a key element of the effectiveness of EIA, risk management would be an important topic. The appraisal of risks in the decision-making process would be addressed, as well as social and participatory aspects of risk assessment within EIA.

It is suggested that elaboration of new guidance would involve preceding collaborative efforts of the Commission, Member States and stakeholders. A pro-active dissemination strategy shall help to raise awareness about the existence of new guidance, to distribute guidance among Member States and EIA stakeholders, and to encourage its use in everyday EIA practice. "Pro-active" dissemination is to be understood as a strategy that uses all available information channels, rather than relying merely on electronic downloads on the official European Union website.

The proposed policy option acknowledges that substantial changes to the present situation may be accomplished without taking additional regulatory action. Placing a strong focus on technical guidance responds to the most important barriers to better coverage of risk assessment in EIA that have been identified by the IMP3 project, as well as to strong empirical indications that risk assessment within EIA in the Member States appears to often be unsystematic, incoherent and incomplete in terms of methodology. Policy option 2 also recognizes that issues of methodology are central to risk assessment.

Policy option 2 is based on the premise that knowledge enhancement through technical guidance on risk assessment in the context of EIA is a key strategy in improving EIA performance in this regard.

Based on a preparatory collaborative process, and supported by systematic dissemination activities, the new guidance package on risk assessment in EIA should provide support and advice on the key issues presented below:

Preparation activities

- Consultations with Member States and relevant stakeholder groups on policy-level.
- Establishment of an expert-level working group consisting of representatives of the Commission, Member States, EIA stakeholder groups, EIA experts, and risk assessment experts, to build on existing knowledge and experience.

Guidance package: key issues to be addressed

- General recommendations on interpretation and good application of the EIA Directive:
  - Recommendation to consider significant extraordinary hazards and risks in EIA, whenever they are relevant to a proposed project;
  - Recommendation to cover the entire range of extraordinary hazards that shall be considered potentially relevant to EIA.
  - Specification of those hazards and risk sources to which EIA shall be applied (natural hazards; internal accidents caused by technological failure, human failure, or a combination of both, and including different degrees of non-standard modes of operation; external accidents in other existing installations; sabotage).
  - Definition of those risk sources that are outside the scope of EIA (which may depend to some extent on national legislative systems)
  - Emphasis that assessment of potential adverse consequences of a hazardous event must not be restricted to human health risks, but should – with a similar degree of accurateness – also consider significant effects on other potential receptors, including non-human biotic components of the receiving environment (plants, animals), soil, water, ecosystem functioning and integrity, etc.
- Technical and methodological guidance on how to apply risk assessment approaches as supporting and complementary techniques within EIA should address and consider the following issues:
  - Clear definition of the concept of extraordinary hazards and risks in the specific context of EIA.

- Definitions of risk assessment terminology in the context of EIA.
- Description of models and frameworks for risk assessment and of key steps of a technically sound risk assessment process (e.g., hazard identification, hazard assessment, exposure assessment, risk characterisation, risk management), drawing references to established conceptual approaches, such as Environmental Risk Assessment, Ecological Risk Assessment, Health Risk Assessment.
- Description of a set of well-approved methods, techniques and tools for risk assessment that should comprise qualitative and quantitative approaches. In order to suit various application purposes within EIA, methodologies should cover a full range from cost-efficient "ad-hoc" methods for minor risks to more complex and sophisticated methods for cases when risk is severe, uncertainties are large and importance for prudent decision-making is high.
- Considering that knowledge transfer from other technical and scientific disciplines that are more advanced in risk assessment methodologies (such as human health risk assessment, engineering sciences, technological safety analysis, etc.) is indispensable, since risk assessment is still largely unknown within EIA. However, rather than just adopting existing approaches from other fields of application where risk assessment is more established, methods should be adjusted to suit the needs of EIA.
- Considering that no particular technique should be recommended as ‘standard’, ‘best practice’, or ‘state-of-the-art’, but that any standardisation bears considerable disadvantages and should thus be avoided. Instead, indications of the limitations, weaknesses, and uncertainties that are inherent to each method should be provided. A flexible approach towards choice of methods should be promoted, emphasizing that various assessment methods can be applied at different levels of sophistication, depth, intensity, and costliness, and that the selection of any method should be determined by, amongst others, the problem under consideration, the magnitude of adverse effects, and the significance of risk.
- Providing rough indications which method of risk assessment could be most appropriate for certain project types and certain hazard categories, taking into account that each specific step of the risk assessment process requires different methods.
- Providing guidance on the integration of risk assessment in EIA procedures, i.e. on when and how to use certain elements of risk assessment at different stages of the EIA process (screening, scoping, EIS, EIS review, public participation, decision making).
- Guidance on good application of the screening criteria of Annex III of the EIA directive, in particular with regard to the criterion "risk of accidents".
- Indicating how risk assessment under different project licensing procedures (IPPC-, Seveso II-, SEA-related regimes) parallel to or separate from EIA could best be coordinated, including a recommendation to incorporate documentation and assessment results from other procedures into the EIA procedure and into the decision-making process.

- Technical guidance on risk management:
  - Suggesting good practices for integrating risk assessment results in the decision-making process on response measures to existent risks, including guidance on options appraisal, cost-benefit-analysis, and evaluation of acceptability/tolerability of (residual) risks.

  - Guidance on specifying and applying the principle of ALARP (As Low As Reasonably Practicable) to risk reduction, including development of standards or guidelines for the process of weighing acceptability of risks against the effort, time and money needed to control it.
  - Presentation of an exemplary set of well-tried risk management measures for different project categories, including measures to avoid, reduce and control unacceptable risks and to mitigate, contain and manage negative consequences of hazardous events occurring.

- Technical guidance on risk assessment and public participation:
  - Advocating a pro-active approach to public participation by involving the public affected in stages of the EIA process as early as possible. This would include allowing the public concerned to express their concerns and perceptions about risks, to have a say in determining what hazards are relevant and what risks should be examined. It would require public participation in screening and scoping.
  - Promoting truly trans-disciplinary approaches by giving both expert judgements and risk perceptions of the affected public weight in the EIA process. This recognizes that subjective risk perceptions create strong realities of their own, can cause actual psycho-medical health effects, and are a source of non-acceptance of and resistance towards approved projects.
  - Guidance on how to apply findings of risk psychology to risk communication (towards the public, but also towards decision makers) to avoid typical pitfalls.
  - Guidance on handling typical psychological problems in the EIA process, such as differences in risk perceptions (e.g., between expert judgements and lay perceptions), phantom risks, psychological risk-modifying factors, cognitive barriers that cause characteristic biases in judging risks.

- Recommendation to strengthen scoping in order to help focus EIA on risks that are actually relevant and significant, whereby informational overload of EIS can be avoided and fears that risk assessment might put excessive demands on EIA in general can be responded to.

- Guidance on establishment of an effective post-project monitoring system (EIA follow-up process) in order to allow for quality control, evaluation of adequacy of risk estimates and impact predictions, evaluation of compliance with risk management measures, evaluation of effectiveness of mitigation measures, etc.

- Presentation of a compilation of good/best practice examples for applying risk assessment in EIA, making use also of non-European case studies.

- Collation of references and links to relevant literature, resources, institutions, websites, etc.

Pro-active dissemination strategy

- Development and implementation of a pro-active dissemination strategy to distribute new guidance among Member States and all EIA stakeholder groups (project developers, EIA consultants, EIA consultees, EIS reviewers, competent authorities, advisory bodies, regulatory agencies, administrative and political decision makers, NGOs, representatives of the public concerned) across the European Union:
  - Translation into languages of the Member States.

- Awareness-raising about the existence of new guidance via presentation at conferences, technical journals, circulation of newsletters and e-mails in the EIA community, etc.
- Dissemination of new guidance via the following channels: EIA gateway of DG Environment on the European Union website, posting on websites of relevant national and international organisations (public, NGO and private sector), circulation via e-mail, using national agencies, networks and key stakeholders as multiplicators, etc.
- By involving stakeholders already in the preparation phase, both awareness and acceptance of new guidance can be increased.
- Promoting the actual use and practical application of new guidance.
- Encouraging Member States to develop their own technical guidance on risk assessment in EIA that is in accordance with EC guidance and that uses its recommendations as minimum requirements for good practice, but may go further beyond.

5.4.2 SWOT-Analysis

SWOT-Analysis Policy Option 2

Strengths	Weaknesses
▪ Medium financial costs and medium efforts for the Commission, but less than in case of amendments to the Directive ▪ No legislative implementation costs for Member States ▪ Likely to be cost-efficient in terms of relationship between time, money and personnel involved and the likelihood of improvements ▪ Can be implemented within a medium-term time span ▪ Builds on existing strengths of current EIA practice and gives support on the way forward ▪ Builds on existing regulatory frameworks and institutional arrangements ▪ Comprehensive package approach that tackles many of the identified weaknesses of current EIA practice ▪ Responds directly to the barriers rated most important by stakeholders ▪ Provides strong knowledge support for all Member States and stakeholders willing to address risks in EIA in a serious manner ▪ Not much need for political negotiations with Member States and economic interest groups due to non-binding nature of guidance ▪ Political resistance from Member States and stakeholders is expected to be limited ▪ Gives the Commission the strong opportunity to make explicit its opinion on the Directive's scope without changing the Directive as such ▪ Creates the predisposition for more widespread use of risk assessment in EIA, by making the necessary knowledge available ▪ Allows to integrate, build on and advance good practices that already exist within some Member States ▪ Systematic, collaborative approach that appreciates the role of Member States in preparing new guidance and takes stakeholder perspectives seriously ▪ Technical clarification of definitions, of the concept of risk and of the field of application of EIA with regard to extraordinary hazards and risks ▪ New guidance is more likely to be noticed than changes to existing guidance ▪ Desired impact of new guidance is supported by systematic dissemination activities ▪ Puts risk assessment in EIA on the European political agenda with significant visibility ▪ Commission takes a significant leadership role	▪ Due to its non-binding nature, effectiveness depends on compliance of Member States with new guidance, which can not be taken for granted ▪ Even if Member States use new guidance to develop their own national guidance, there is still no need for stakeholders to comply with it ▪ Existing guidance appears to be underused already at present ▪ Impetus to overcome existing weaknesses of current EIA practice in terms of risk assessment is limited ▪ Progress is still likely to be rather slow in a number of Member States ▪ A certain amount of divergence in approaches to risk assessment in EIA across Europe is likely to persist ▪ Does not address all barriers to integration of risk assessment into EIA ▪ Lack of coordination between procedures under different risk-related Directives is not addressed actively ▪ Different interpretations of guidance could again lead to varied applications ▪ Lack of professional expertise in risk assessment can not be counteracted by providing guidance alone ▪ In most European countries, there is a lack of specialized risk assessors and risk managers, which may be still required for quantitative assessments and more complex problems ▪ All methods of risk assessment have inherent limitations of their own ▪ Technical guidance can not compensate for gaps in baseline data on toxic properties of specific substances or their compounds ▪ Decision-makers still need to integrate results of risk assessment into decision-making and to develop an appropriate understanding of risk, because risk assessment provides decision-support, but it cannot substitute decision-making

SWOT-Analysis Policy Option 2

Opportunities	Threats
▪ Member States can use new EC guidance to develop their own guidance on risk assessment in EIA that suits best their specific national conditions ▪ Flexibility and discretion in application of EIA would still be preserved, and Member States can continue to develop at their own pace and in a way that satisfies their national needs ▪ Strong support for the momentum of positive development that exists in some Member States ▪ Good compliance of Member States with new guidance can considerably improve harmonization of coverage of risks between countries ▪ New Member States are not overburdened with new needs to implement and apply new legal Community requirements ▪ New guidance could reduce conflicts arising from projects that generate risks with potential adverse consequences that would have transnational impacts ▪ Could go a significant way towards realizing the potential of EIA to identify, assess and reduce significant risks adequately ▪ Could be a medium-term step that prepares a future amendment to the Directive	▪ Increased cost for project developers in some cases can not be excluded ▪ Established systems and traditional working routines may prove to be too inert to be changed without new regulations ▪ Non-compliance with guidance could continue to persist, and application of EIA may still fall short of the substantial purposes of the Directive ▪ Lack of coordination between procedures under other risk-related Directives is likely to persist ▪ If new guidance will be followed by only some Member States, the different levels of environmental protection across the European Union, as well as inequities between citizens in different Member States, might increase ▪ If new guidance will be followed by only some Member States, incoherent conditions for economic development and threats of biases in economic competition between countries might increase ▪ Providing new guidance as a stand-alone approach may be a too passive approach to cause substantial changes

Concluding remarks

Comprehensive guidance package that relies completely on "soft", non-regulatory measures and is comparatively uncomplicated to implement. Focuses on creating or enhancing the technical capacity needed to assess risks in EIA. Similar to policy option 1, its effectiveness depends largely on willingness of Member States and stakeholders to comply with guidance and to use it in practice.

Figure 55 SWOT-Analysis of policy option 2: Preparation of new technical guidance package plus pro-active dissemination strategy

5.5 Policy Option 3: Set of supporting measures

5.5.1 Description

Policy option 3 comprises a comprehensive set of measures building entirely on “soft” strategies to support the integration of risk assessment in EIA practice, to promote its more widespread use and to enhance its technical excellence. The suggested activities focus on awareness-raising activities, knowledge-sharing and information, training and capacity-building, and targeted research. The package may be applied as an entire bundle of complementary activities in a concerted action. Though, some effectiveness can also be expected if actions are taken individually or are downsized to a reduced selection of measures. It may be particularly useful to combine policy option 3, or a sub-set of actions thereof, with any other option presented here, thereby increasing effectiveness of options reciprocally.

In detail, the measures of policy option 3 for supporting the use of risk assessment in EIA are the following:

Awareness-raising

- Development, funding and implementation of a long-term awareness-raising programme for EIA and risk assessment professionals from the public, private and NGO sectors on the links between project development and environmental risks that:
  - promotes interdisciplinary exchange of knowledge and experiences between EIA and risk assessment;
  - encourages inclusion of risk assessors in EIA teams;
  - raises awareness on the need for cooperation and coordination across traditional institutional and professional barriers;
  - raises awareness among EIA experts about the multiple benefits that integration of risk assessment in EIA has to offer and that, apart from gains in environmental quality and safety, may also include: reduction of cost and duration of EIA procedures through timely recognition of significant risks or obstacles to project approval; better informed decision-making; more economic allocation of resources and more efficient risk management measures because mitigation measures can be focused on the most significant risks; etc.;
  - promotes assessment of risks by project developers on a voluntary basis, which can avoid consequential costs due to hazardous incidents;
  - promotes assessment of risks in early stages of project planning and project design;
  - points out to the different risk perceptions and the differing levels of awareness of certain hazards between Member States, and counteracts the tendency that responses to risk are mainly a disaster-driven phenomenon (recent hazardous incidents that have caused damage receive more attention than other risks that may be more likely to occur and/or to cause even greater damage).

Training and education

- Development, funding and implementation of a systematic, widespread and long term training, capacity-building and educational programme for EIA and risk assessment professionals from the public, private and NGO sectors on risk assessment in EIA that:
  - familiarises EIA professionals with risk assessment;
  - familiarises risk assessors with EIA.

Knowledge-sharing and information activities

- Promoting international knowledge exchange on risk assessment in EIA, including with non-European countries, by:
  - initiating, funding and organizing international topical conferences that would bring together risk assessors and EIA professionals;
  - establishing international, interdisciplinary topical expert groups;
  - establishing a stakeholder dialogue that would include a series of workshops.
- Re-activation of national EIA centres to act as national focal points and links within and between Member States, and financial support to ensure their sustained existence and operation.
- Establishing an interactive internet platform, possibly accessible via the EIA gateway of DG Environment, which can serve as a forum for discussion, where questions can be posted and frequently asked questions would be answered by experts of DG Environment.
- Establishing and maintaining an electronic database on the website of DG Environment that should feature, amongst others, relevant official documents (legislation, guidance) provided by the Member States and an online collection of case studies and good practice examples, with regular updates of the material.
- Establishment of an EIA documentation centre on EU level, and making the information electronically accessible.

Research

- Funding of targeted research on EIA and risk assessment, and launching of appropriate research programmes, with a focus on:
  - methodological problems;
  - interdisciplinary knowledge transfer to EIA from other scientific and technical fields, such as health risk assessment, occupational health and safety, engineering sciences, technology impact assessment, etc., that are more experienced and advanced in risk assessment methodologies than EIA;
  - comparative “anatomical” studies of EIA procedures in European and non-European countries in order to improve procedural integration of risk assessment in EIA and to enhance coordination with procedures under other risk-related regulatory regimes;
  - risk communication, with a view to public participation;
  - pilot projects, in order to do practical testing of approaches to risk assessment in EIA and to provide future demonstration examples.

5.5.2 SWOT-Analysis

SWOT-Analysis Policy Option 3	
Strengths	Weaknesses
▪ Likely to be cost-efficient in terms of relationship between time, money and personnel involved and expected benefits ▪ Builds on existing strengths of current EIA practice and gives support on the way forward ▪ Builds on existing regulatory frameworks and institutional arrangements ▪ Comprehensive package that tackles many of the identified weaknesses of current EIA practice, as well as the most important barriers towards integration of risk assessment in EIA ▪ No need for political negotiations with Member States and economic interest groups ▪ High level of acceptance on part of Member States likely ▪ Creates a knowledge base for future improvements of EIA systems ▪ Allows to integrate, build on and advance good practices that already exist within some Member States ▪ Creates a sound information base for decision-making on possible future amendments to the Directive ▪ Strengthens cooperation between Commission, Member States and stakeholders ▪ Stakeholders and Member States are given the opportunity to participate actively, which is in favor of new governance and bottom-up approaches ▪ Can be expected to create added values for EIA far beyond the issue of risk assessment ▪ Puts risk assessment in EIA visibly on the European political and research agenda ▪ Meets requirements of the European Convention in terms of improving the system of information exchange between Member States and the European Union, supporting training schemes and providing for administrative cooperation, and conforms to the spirit of the Aarhus Convention ▪ Commission takes a visible leadership role	▪ Requires concerted, long-term efforts ▪ Requires sustained input of resources in terms of money, personnel and time ▪ Will be a long-term process until results become available for application in EIA practice, and hence any progress will be slow ▪ Until then, all weaknesses of current EIA practice will continue to persist ▪ Success depends on active interest and willingness of Member States and stakeholders to participate actively in the process ▪ Lack of coordination between procedures under different risk-related Directives is not addressed ▪ Does not change anything about the EIA policy design

SWOT-Analysis Policy Option 3

Opportunities	Threats
▪ Can improve awareness and understanding of risks and risk assessment in the EIA process ▪ Could have a high impact on thinking and behaviour of EIA stakeholders, and enhance early integration of risk considerations in project planning and project design ▪ Sharing knowledge and experience can contribute to harmonizing approaches across Europe without regulatory interventions ▪ Flexibility and discretion in application of EIA would remain untouched, and Member States can continue to develop at their own pace and in a way that satisfies their national needs ▪ Tackles systematically the lack of professionals for risk assessment in EIA by increasing the number of risk assessors with EIA expertise and of EIA professionals with risk assessment expertise ▪ Outcome of research and knowledge-sharing can serve as input to preparation of new technical guidance on risk assessment in EIA ▪ Could be an intermediate step in preparation of a future amendment to the Directive, or assist good implementation of such an amendment	▪ No guarantee that results of the process will ever be applied and become effective in EIA practice ▪ Member States who are satisfied with state-of-the-art will have little motivation to do research and to participate in knowledge-sharing, and might be resistant against awareness-raising efforts ▪ Established systems and traditional working routines may prove to be too inert to be changed without new regulations ▪ Supportive efforts as a stand-alone approach may be not sufficient to overcome identified weaknesses, barriers, and discrepancies between countries, and to accomplish better fulfillment of the substantial purposes of the Directive

Concluding remarks

This policy option comprises "soft" measures with a medium- to long-term perspective. May create many added values beyond the mere issue of risk assessment, but supportive efforts as a stand-alone approach are not likely to be sufficient for overcoming the identified weaknesses, barriers, and discrepancies between countries. Any progress on the ground would be rather slow and evolutionary. Could have particular benefits if combined with other options. Might be very useful for building knowledge on the way towards future amendment to Directive, and to support implementation of such an amendment.

Figure 56 SWOT-Analysis of policy option 3: Set of supporting measures

5.6 Policy Option 4: Launching a risk assessment initiative with a broader perspective

5.6.1 Description

This policy option suggests launching a strategic initiative on risk assessment in the broader context of a number of European Directives that play a major role in regulating the assessment and management of environmental risks associated to development proposals. Relevant Directives would include in particular the EIA, SEA, Seveso II and IPPC Directives, but other pieces of Community legislation may as well be worth considering in the given context, such as the Habitats Directive, Council Regulation No 1836/93 (EMAS), Directive 91/689/EEC on hazardous waste, Directive 1999/31/EC on the landfill of waste, Directive 2001/18/EC on the deliberate release into the environment of genetically modified organisms, and other risk-related legislation. Proposed activities would involve establishing a knowledge-building consultation process with Member States and a broad stakeholder dialogue to discuss and clarify the interrelationship, linkages, overlaps and discrepancies between EIA and other risk-relevant Community legislation. The various national approaches to implementation and application of Community law would be explored, placing particular focus on an in-depth review of the ways and models of coordinating procedures under the EIA, SEA, Seveso II and IPPC development consent regimes ("comparative anatomy" of procedures). The overall purpose is to identify and develop an integrated and coordinated approach to assessment and management of project-related risks under the different development consent procedures that is more effective and efficient than is often the case at present. This would require proper timing of certain procedural stages, integration of relevant risk assessment results required under one procedure into the information and documentation submitted under another procedure, ensuring exchange of information and documentation between involved authorities in due time, and making it available to the decision-making process. Better coordination of procedures is hoped to yield benefits like streamlining of procedures, exploitation of synergies, improving informed decision-making, elimination of duplicated work, saving of resources (costs, manpower), and tightening of duration of procedures. Establishing formal interfaces and institutionalising linkages between procedures would clearly be in favour of these goals. However, to accomplish them more research and knowledge-sharing is needed.

Eventually, the findings gained in the wake of the collaborative process outlined above could serve as information input for a possible future amendment to the EIA Directive as well as to other major risk-related Community legislation, aiming at strengthening linkages and interfaces between them.

Enacting a future Directive on hazard mapping, which has been envisaged by the Commission, would be an important complementary regulatory measure. Hazard mapping has a particularly high potential to be integrated into SEA (Greiving et al., 2005), because hazard maps can serve as an extremely useful tool to provide spatially explicit baseline information on existent risks that can be considered in land use planning prior to the project-level. Moreover, risk assessment and risk management can be in important instrument within SEA in general (Greiving, 2004). However, dependent on the scale of hazard maps, they can also provide useful information in early stages of the EIA process and help to optimize project planning, choice of alternatives and site selection, thereby facilitating hazard identification, risk screening and timely planning of appropriate mitigation measures. Hazard mapping is already practised by a number of Member States, but there is a need to harmonize methodological approaches in terms of scales, hazard categories mapped, definitions used etc. Many Member States, albeit not all, have also established authorities or

agencies that are responsible for risk assessment and management issues. It is assumed that adoption of this model by all countries would facilitate considerably cross-sectoral coordination and cooperation.

Policy option 4 consists of the following courses of action:

- Establishing a consultation process with Member States in the broader context of other major pieces of risk-relevant Community legislation (IPPC, Seveso II, SEA) in order to discuss and clarify their interrelationship, linkages, overlaps and discrepancies in terms of risk assessment, considering in particular:
  - fields of application of each Directive;
  - different national models of legal implementation;
  - different national approaches to coordination of procedures.
- Entering into a dialogue with relevant EIA stakeholder groups (members of national authorities, EIA practitioners, scientific community) to facilitate knowledge-sharing and exchange of experiences with particular regard to coordination of development consent procedures under the abovementioned Directives (via workshops, seminars, reports, electronic discussion platforms, etc.)
- Making use of the IMPEL network and building on its previous work.
- Clarifying the role of SEA in project-related risk assessment, considering:
  - the potential of SEA to relieve EIA from burdens regarding risk assessment;
  - the potential of SEA to strengthen coverage of 'social risks' (risk of major social and socio-economic impacts),
  - the opportunity to integrate social impact assessment into SEA.
- Comparative review of the different national approaches to organizing and coordinating risk assessment within development consent procedures under the abovementioned Directives, including legal systems, institutional arrangements, administrative practices and established working routines, with a view to identifying strengths and weaknesses as well as effective and efficient types of coordination (research on “comparative anatomy” of procedures).
- Based on the outcome of the collaborative process outlined above: development and promotion of a more integrated and coordinated approach to project-related risk assessment and risk management under the EIA, Seveso II, IPPC, and SEA regimes that aims at:
  - establishing efficient links between different procedures;
  - optimising the timing of crucial stages of the procedures that offer suitable interfaces;
  - ensuring exchange of information and documentation between different authorities;
  - avoiding duplication of work;
  - using synergies to the extent possible;
  - ensuring that significant environmental risks are not exempt from assessment due to the fact that the fields of application of the different Directives are not convergent.
- Reviewing the formal linkages in Community legislation, and considering possible future amendments to the EIA Directive as well as other risk-related Directives to strengthen

existent interfaces, in the light of the recognitions gained through the process outlined above.

- Promotion of better horizontal and vertical coordination between development consent procedures and risk assessment/risk management activities of sectoral policies, legislations, instruments and authorities (e.g., in the fields of land use planning, waste management, water management, etc.), taking into account that inter-sectoral and cross-sectoral coordination can be facilitated by the establishment of separate authorities on Member States level with a clear responsibility for risk assessment.
- Pushing forward the envisaged new Community Directive on hazard mapping, or – alternatively – encouraging national governments to undertake hazard and risk mapping on a voluntary basis and to use harmonised methodologies, preferably by applying a multi-hazard and multiple-risk approach, in order to provide baseline information on existent risks and facilitate hazard identification.

5.6.2 SWOT-Analysis

SWOT-Analysis Policy Option 4	
Strengths	Weaknesses
▪ Likely to be cost-efficient in terms of relationship between time, money and personnel involved and expected benefits ▪ Enhances knowledge and understanding on interplay of several risk-related Directives ▪ Raises awareness on need for better coordination of procedures under different Directives ▪ Promotes integrated approaches to risk assessment in particular and to project licensing in general ▪ No urgent need for political negotiations with Member States and economic interest groups on forthcoming amendments within a medium-term period of time ▪ Creates a knowledge base for future improvements of project licensing regimes ▪ Shifts need for action from Commission to Member States ▪ Creates a sound information base for decision-making on possible institutional and procedural re-arrangements on national level ▪ Creates a sound information base for decision-making on implementing stronger linkages into one or several Directives ▪ Strengthens cooperation between Commission, Member States and stakeholders ▪ Stakeholders and Member States are given the opportunity to participate actively, which is in favor of new governance and bottom-up approaches ▪ Can be expected to create added values for several licensing regimes beyond the issue of risk assessment ▪ Enacting a Directive on Hazard Mapping would enhance information on risks and facilitate optimized project planning ▪ Puts risk assessment in project licensing visibly on the European political agenda ▪ Commission takes a visible leadership role	▪ Requires concerted, medium- to long-term efforts until results will become available, and hence any progress will take time ▪ Until then, all weaknesses of current EIA practice will continue to persist ▪ Questions existing regulatory frameworks and institutional arrangements, which may cause acceptance problems on part of some Member States ▪ Does not tackle other weaknesses and barriers apart from coordination problems ▪ Success depends to some part on active interest and willingness of Member States and stakeholders to collaborate actively in the process ▪ The considerable differences between national legal systems, institutional arrangements and procedural practices aggravate a concerted approach on European level

SWOT-Analysis Policy Option 4

Opportunities	Threats
▪ Could result in streamlining of national licensing procedures and better exploitation of synergies ▪ Can contribute to more informed decision-making on development proposals ▪ Has the potential to save resources (costs, manpower) and tighten duration of procedures ▪ Could result in establishing more efficient linkages and formal interfaces between procedures ▪ Shifting risk assessment work to SEA would take some burden from EIA ▪ Member States can streamline their procedures according to their own specific needs and potentials, there is no need for a unified approach across the European Union ▪ Potential to contribute to more harmonized procedural approaches across Europe without regulatory interventions ▪ Provides the chance that all relevant projects will be subject to adequate risk assessment, regardless of the Directive that applies in certain cases	▪ No guarantee that results of the process will ever be applied and become effective in EIA practice ▪ Member States who are satisfied with state-of-the-art will have little motivation to collaborate in the initiative, and might be resistant against awareness-raising efforts ▪ Established systems and traditional working routines may prove to be too inert to be changed without new regulations on Community level ▪ Risk assessment initiative as a stand-alone approach may be not sufficient to overcome identified weaknesses, barriers, and discrepancies between countries, and to accomplish better fulfillment of the substantial purposes of the EIA Directive

Concluding remarks

This policy option is most likely to contribute to streamlining different licensing procedures, to enhance effective coordination and to ensure that the national ways of implementing the different risk-related Directives do not cause gaps in their respective fields of application with regard to risks. However, it tackles only a sub-sample of the identified weaknesses, which could be compensated for by combining it with other options. Pushing forward hazard mapping on a European level would also be useful as a stand-alone measure.

Figure 57 SWOT-Analysis of policy option 4: Launching a risk assessment initiative with a broader perspective

5.7 Policy Option 5: Moderate amendment to EIA directive plus new technical guidance package plus support for implementation

5.7.1 Description

Policy option 5 proposes limited changes to the EIA Directive in order to enhance the coverage of extraordinary hazards and risks in EIA. Technically speaking, the suggested amendments would mainly consist in specifications of existent wordings and in supplementing present provisions. The proposed changes would be targeted at widening the concept of risk expressed in the Directive, to make it more explicit and unambiguous, and to favour a broader, more comprehensive and more systematic coverage of risks in the application of the Directive. Modifications would build on the wider and more inclusive understanding of the Directive's scope that the Commission has put forward in its own guidance on EIA (EC, 2001a, 2001b, 2001c). It would also build on the present requirement stated in Annex III.1 of the EIA directive to consider "*risks of accidents, having regard in particular to substances or technologies used*" as a selection criterion in national screening regulations and screening decisions.

The intended purpose would be accomplished by providing clear definitions of the terms 'hazard' and 'risk' in the specific context of EIA, by making explicit references to the need for risk assessment, and by specifying relevant hazard categories and risk sources that are potentially relevant to the objective of the Directive beyond the risk of accidents. These complements would be designed into in the main body of the Directive as well as into the selection criteria of Annex III. There, also references to hazard potential pre-existent at the site and to the vulnerability of the area of project siting in terms of the present damage potential would be included in the characteristics of the project location to be considered in screening (Annex III.2). Thereby, the expression "*environmental sensitivity of geographical areas likely to be affected by projects*" would be concretised with regard to risk. Furthermore, a more explicit and wider reference to the assessment of significant extraordinary risks would be adopted in the main body of the directive, indicating that consideration of such risks is important, can be beneficial, is desired by the Commission, and contributes to good and complete application of the directive. Thereby, also the concept of "*likely significant effects of a project*", which is at the heart of the EIA directive, would be complemented in such a way as to include also significant risks due to extraordinary hazards, which are per definition not "likely". Taking up to some extent the approach laid down in the Canadian Environmental Assessment Act (CEAA, 1992), an explanation would be added that hazards that are connected with the proposed project are potentially significant if they could cause the project to cause adverse consequences on man and the environment, and that external impacts of the environment and of accidents in other installations on the project are potentially significant if they could cause the project to cause in turn adverse consequences on man and the environment.

Since risk is ever present and a situation of zero risk does not exist, what needs to be considered in EIA is, therefore, not the mere presence of risk, but whether there is a significant risk of and whether the consequences of a risk event happening would be likely to cause significant environmental effects (EC, 2003a). The amended wording of the Directive should make this point clear.

The underlying purpose of the suggested amendments is to narrow the discretion and scope of interpretation that the application of the directive leaves to Member States, and to both sharpen

and extend the concept of risk in a more explicit way. The changes would clarify existent interpretation problems concerning the scope of the Directive, straighten out incorrect understandings and prevent future cases of bad application. It would bring to legal terms the Commission's own interpretation of the field of application of the Directive in terms of risk assessment, as it has been quite clearly stated in existing European guidance on EIA (2001a, 2001b, 2001c). These checklists on screening, scoping and EIS review repeatedly recommend considering various abnormal events, including natural hazards and exposure of the project to man-made disasters (cf. chapter 2.2.1.1). However, on account of its non-binding character the impact of European guidance on EIA practice appears to be limited. Limitation of national discretion is also supported by past rulings of the European Court of Justice, who has consistently ruled that the Directive should be interpreted as having a wide scope and very broad purpose (EC, 2003a). Implementation of policy option 5 is expected to have a visible impact on EIA practice, while leaving still enough potential for countries to choose their own course of concrete application that suits national needs.

This policy option is based on the rationales provided in Chapter 4.2. It would strive at correcting the imperfect policy design of the Directive in terms of risk, which at present produces 'pre-programmed' implementation deficits, if measured against EC's guidance.

It is assumed that drafting of a new legislative proposal will require a preceding preparatory phase that involves bilateral consultations with Member States aiming at a consensus-building process and allowing for an informed and balanced policy design. This could include exploration of the legal, procedural and material linkages between the EIA Directive and other major risk-related Community Directives according to policy option 4.

Still, implementation deficits may occur at all stages of the implementation cycle, such as: conformity problems at the stage of transposition; interpretation and concretion deficits at the stage of drafting national implementing regulations on the sub-legal level; incidents of bad application; and full integration of new regulations into working routines and the awareness of EIA professionals. Therefore supporting measures should be taken aiming at preventing rather than correcting bad application. In order to support implementation of the outlined amendments, this policy option would include the new technical guidance package presented in policy option 2. In addition, EC is assumed to pursue a pro-active communication strategy and to take further supportive measures, in particular training and capacity-building, which would comply with the Commission's commitment to assisting the implementation of EC environmental legislation (EC, 2004; EC, 2002). For that purpose, combining policy option 5 presented here with policy option 3 and 4 would make particular sense. Concomitant activities may also represent appropriate sub-sets of the activities suggested for policy options 2 to 4, as required.

Based on these considerations, **policy option 5 incorporates**:

- the new technical guidance package described in policy option 2, plus
- appropriate measures of policy options 3 and 4.

In particular, policy option 5 proposes the following actions to be taken:

Preparatory activities

- Launching a bilateral consultation process with Member States to allow for proper consideration of national needs, requirements and suggestions and to facilitate an informed legislation-building process.
- Allowing relevant EIA stakeholder groups to express their views and contribute practical experiences.
- Review of related Community legislation and exploration of mutual linkages to allow for a maximum exploitation of potential synergies.
- Anticipation of implementation problems to facilitate enforcement-friendly design of additional regulatory measures.

Moderate amendments to EIA Directive

- Adoption of clear and unambiguous **definitions** of key terms vital to the concept of risk in the specific context of EIA, in particular of the terms "hazard" and "risk".
- Widening the explicit concept of risk beyond "risk of accidents" by **specifying** hazard categories that shall be considered in EIA, as far as they are relevant and significant, by adding the following potential risk sources to the main part of the Directive and to Annex III:
  - natural hazards (natural disasters);
  - internal accidents (accidents in the submitted project caused by technological failure, human failure, or man-technology interactions, including various degrees of non-standard/abnormal modes of operation that comprise disturbances of normal operation, events of fault, major accidents);
  - external accidents (man-made disasters in other existing installations in the project environment that could affect a submitted project; 'cumulative risk');
  - sabotage (interferences by unauthorised persons, vandalism, terrorism);
  - impacts of the proposed project on the hazard potential pre-existent at the site.
- **Defining** that hazards related to a project, including impacts of external hazards (impacts of the environment and of accidents in other installations) on the project, are potentially significant if they may cause adverse consequences on man and the environment. Stating clearly that both likely significant effects caused by the normal/standard operation of a project and significant risks due to extraordinary conditions are within the scope of the Directive.
- **Specifying** the expression "*environmental sensitivity of geographical areas likely to be affected by projects*" in Annex III.2 by adding the following criteria:
  - hazard potential pre-existent in the project environment, in particular the susceptibility of the location to occurrence of natural hazards;
  - vulnerability of the project environment (damage potential present at the site).
- Adoption of a more explicit and wider **reference** to the assessment of significant extraordinary risks in the main part of the directive which indicates that consideration of

such risks is important, can be beneficial, is desired by the Community legislator, and contributes to good and complete application of the directive.

Support for implementation

- Enhancement of effective transposition and national implementation of amendments by pursuing a pro-active communication strategy towards Member States, which may involve, e.g., bilateral contacts, seminars and meetings between the Commission and the Member States.
- Providing new guidance for good application of the amended Directive (guidelines, textbooks, good practice examples) to domestic authorities and EIA practitioners (according to policy option 2).
- Providing training opportunities and funding capacity-building activities for authorities and EIA practitioners (according to policy option 3).
- Monitoring of the legislative implementation process, checking if application of EIA on the ground complies with the added focus of the Directive and evaluation of effectiveness and efficiency by requiring regular reporting.

5.7.2 SWOT-Analysis

SWOT-Analysis Policy Option 5

Strengths	Weaknesses
▪ Member States are obliged to take action, but radical changes of national EIA acts will not be required ▪ Makes explicit what was already implicit in the Directive, and legalizes what appears to have already been the Commission's opinion on the scope of the Directive ▪ Corrects the imperfect EIA policy design in terms of risks on Community level ▪ Creates a legal basis for risk assessment in EIA ▪ Effectiveness of regulatory action on achieving change is expected to be higher than that of "soft" strategies ▪ Eliminates legal uncertainty and differing interpretations of the Directive's wording, and defines the field of application of the Directive in terms of hazards and risks ▪ Would be likely to improve incorporation of risk assessment in EIA and to promote its more widespread use ▪ Could be a significant step forward towards reducing divergent practices between Member States ▪ Responds directly to views of many stakeholders who stated that "a lack of legal requirements" is a main barrier to more coverage of risk assessment in EIA ▪ Builds on good practices that already exist within some Member States ▪ Combination of amendment with technical guidance and supportive measures facilitates implementation ▪ Provided that relevant actions of policy option 4 are also taken, coordination with risk assessment under other procedures is more likely to improve ▪ Puts risk assessment on the forefront of European EIA policy and practice agendas ▪ Demonstration of the Commission's commitment to objectives of environmental protection	▪ More efforts and resources required for the Commission than if guidance enhancement or supportive measures would be applied as stand-alone approaches ▪ Causes legislative implementation costs for Member States ▪ Amending the Directive is a long-term approach that will require considerable time for preparation ▪ More time will pass until amendments become fully effective in practice, because time lags will inevitably occur at all stages of the implementation cycle (transposition, integration into sub-legal implementing regulations, practical application, full assimilation into working routines and minds of professionals) ▪ Difficult political negotiations with Member States and economic interest groups can be expected, and reconciliation of interests may be hard to accomplish ▪ Some political resistance from Member States and stakeholders must be expected ▪ Some potential for conflicting interpretations on the amended Directive's actual implications and concrete requirements for EIA practice may remain ▪ Lack of professional risk assessors and risk managers, which may be still required for quantitative assessments and more complex problems, will persist ▪ All methods of risk assessment have inherent limitations of their own ▪ Decision-makers still need to integrate results of risk assessment into decision-making and to develop an appropriate understanding of risk, because risk assessment provides decision-support, but it cannot substitute decision-making

SWOT-Analysis Policy Option 5

Opportunities	Threats
▪ towards more effective risk control through EIA ▪ Deeper and more sustained progress in terms of anchoring risk assessment in EIA than guidance or supportive measures alone ▪ Involvement of Member States and stakeholder representatives in the preparation process is likely to increase acceptance ▪ Would strengthen the position of EIA against other environmental control regimes, and EIA could become the controlling force of environmental risk assessment on project level ▪ Leaves some flexibility and discretion in implementation and application to Member States ▪ Strong support for the momentum of positive development that exists in some Member States ▪ Harmonization of coverage of risks between countries decreases conflict potential due to risks with transboundary dimension ▪ Could go a significant way towards realizing the potential of EIA to identify, assess and reduce significant risks adequately	▪ Implementation deficits may still occur at all stages of the implementation cycle: conformity problems at transposition stage, interpretation and concretion deficits on level of national sub-legal regulations, incidents of bad application, full integration into working routines and awareness of EIA professionals ▪ More burden will be put on EIA, and EISs may tend to become more lengthy ▪ Increased cost for project developers, in particular in cases of serious risk that may require full quantitative risk assessment ▪ Decision-makers might get confronted with difficult decisions on acceptability of risk ▪ Established systems and traditional working routines may still prove to be inert and resistant against progress ▪ Improved output of EIA does not guarantee improved outcome/effectiveness ▪ Lack of coordination between procedures under other risk-related Directives might still persist

Concluding remarks

This policy option intervenes at the legislative level of the EIA policy design. Amending the Directive requires a rather long-term perspective, which applies to an even greater extent to the time until the amendment would become fully effective in practice. Makes much more explicit what appears to have already been implicit in the Directive, and implements into its wording the Commission's interpretation as expressed in its existing guidance. As is inherent to a regulatory top-down approach, acceptance on part of Member States may be low and political resistance high. Combination with new technical guidance and support measures complies with the Communication on better monitoring of application of Community Law (COM (2002)725 final, 2002) that expresses the commitment of the Commission to assist Member States in implementation of EC environmental legislation. More likely to accomplish sustained effectiveness in the long run than "soft" measures only.

Figure 58 SWOT-Analysis of policy option 5: Moderate amendment to EIA Directive plus new technical guidance package plus support for implementation

5.8 Policy Option 6: Major amendment to EIA directive plus new technical guidance package plus support for implementation

5.8.1 Description

Policy option 6 is based on rationales similar to those of policy option 5, but it goes considerably beyond in terms of substantial changes to the EIA Directive, resulting national transposition needs and anticipated effectiveness regarding integration of risk assessment into EIA procedures. While the moderate amendments to the Directive outlined in policy option 5 are focused on more explicit verbalisations of a wider risk assessment concept that the Commission has indicated before, this policy option would represent a much stronger regulatory approach. The suggested amendments would substantially broaden the scope of EIA in a statutory way, while at the same time limiting the discretion of Member States and implementing national authorities in terms of risk assessment to a considerably greater extent than would policy option 5. In addition to the changes of policy option 5, amendments would imply explicit obligations to consider extraordinary hazards and risks in EIA, and to identify, describe and assess them in the information provided by the project developer (EIS), whenever risks are relevant to a submitted project and their extent is significant. However, such requirements should not exclude the possible use of justified “no impact” statements in cases where the results of hazard identification and risk screening provide evidence that risks are not significant. Thereby, the threat of overburdening the EIA process with additional tasks and of overloading Environmental Impact Statements with additional information shall be avoided. This threat can as well be counteracted by strengthening the scoping stage, i.e. by identifying and defining those issues that are actually relevant for decision-making on a given project more carefully, and by focusing EIA more on the actually significant effects of a project.

The suggested changes to the directive would trigger the need for Member States to review and, if necessary, to amend their domestic EIA legislation, be it on the level of EIA acts or on the sub-legal level of (binding) supporting and implementing regulations (such as statutory orders, decrees, etc.). Policy option 6 would also encourage responding to the emergence of new project types and technologies with a high technological risk potential by reviewing the project lists of Annexes I and II for completeness and up-to-dateness, and by amending them, if required.

This policy option directly responds to empirical findings of the IMP3 project, which strongly indicate that lacking legal requirements to apply risk assessment in EIA is a main barrier to better coverage of risks, that compliance with guidance and indicative provisions is limited, that project developers are often reluctant to employ risk assessment without legal obligations, and that competent authorities too often do not request it. Policy option 6 also attempts to respond to the finding that there often is a wide-spread lack of effective coordination between EIA procedures and risk assessments under other relevant regulatory regimes.

It is assumed that the drafting of a new legislative proposal containing the suggested major amendments would require prior preparation activities on part of the Commission that are similar to the ones proposed in policy option 5, but perhaps more intense and deliberate. Analogously, it is assumed that the proposed major changes to the directive would require coordinated support measures to assist Member States and EIA stakeholders in implementing and applying the new requirements and to monitor compliance. A major amendment to the Directive would by any means have to be accompanied by the preparation of new guidance, training, and knowledge-sharing. For that purpose, policy option 6 presented here may be combined with all other policy options

mentioned before (except the “zero option”), or appropriate sub-sets of the activities suggested for policy options 1 to 4 may be chosen, as required. Pursuing an additive approach is based on the assumption that if the Commission should decide to take the considerable effort to amend the Directive, it would also practice an approach to prevent, rather than correct instances of bad application and to assist Member States in implementing the new requirements.

Policy option 6 incorporates:

- the moderate amendments to the EIA Directive described in policy option 5, plus
- the new technical guidance package described in policy option 2, plus
- appropriate measures of policy options 3 and 4, plus
- preparation activities and specific support measures for implementation similar to policy option 5.

In addition, policy option 6 comprises the following particular actions to be taken:

Preparatory activities

- similar to policy option 5

Major amendments to the Directive

- Inclusion of an **explicit requirement** to consider relevant extraordinary hazards and significant risks to man and the environment in EIA (e. g., in Articles 1 and/or 3), complementary to the likely significant effects of a project.
- Adoption of an **explicit obligation** to identify, describe and assess relevant extraordinary hazards and risks to man and the environment in the information provided by the developer (EIS), provided hazards are relevant to a submitted project and the extent of risk is significant (e. g., in Article 5.3 and Annex IV). This additional reporting requirement should not exclude the possible use of justified “no impact” statements in cases where, on the basis of hazard identification, risk screening and/or risk prioritisation during screening, scoping and EIS preparation, risks are found to be not significant, in order to avoid "informational overload" of EIA/EIS.
- Inclusion of an **explicit reference** to consider appropriate risk management and response measures for the prevention, reduction and control of significant risks, including measures to limit and contain adverse consequences of hazardous incidents occurring, as part of the mitigation measures mentioned in Article 5.3 and Annex IV.5.
- Introducing to the Directive an **explicit reference** encouraging that the documentation required by other risk assessment procedures under other relevant Directives (in particular, the Seveso II, IPPC, and SEA Directives) may be incorporated into, built on and supplemented by the environmental information required by the EIA procedure, and reciprocally, in order to avoid duplication of work, to increase efficiency and effectiveness of all procedures involved, and to enhance the quality of project-related risk assessments.
- Reviewing the **project lists** in Annexes I and II of the EIA Directive as to completeness and up-to-dateness with regard to the emergence of new technologies and project

categories that bear an increased potential of environmental and/or human health risks, and adding of missing project categories, if required.

Support for implementation

- similar to policy option 5

5.8.2 SWOT-Analysis

SWOT-Analysis Policy Option 6	
Strengths	Weaknesses
▪ Member States are obliged to take legislative action and to adjust their national EIA acts ▪ Makes explicit in the strongest way what has already been implicit in the Directive, and fully legalizes what appears to have already been the Commission's opinion on the scope of the Directive ▪ Corrects the imperfect EIA policy design in terms of risks on Community level ▪ Creates a strong legal basis for risk assessment in EIA ▪ Highest effectiveness of all options can be expected ▪ Eliminates legal uncertainty and differing interpretations of the Directive's wording, and defines clearly the field of application of the Directive in terms of hazards and risks ▪ Defines clearly the requirements for practical EIA application ▪ Leaves some flexibility in practical application, because it does not prescribe to Member States how provisions should exactly be put into practice ▪ Most likely to improve incorporation of risk assessment in EIA and to promote its regular use ▪ Provides most likely for harmonization of approaches between Member States ▪ Responds directly to views of many stakeholders who stated that "a lack of legal requirements" is a main barrier to more coverage of risk assessment in EIA ▪ Builds on good practices that already exist within some Member States and extends them to the entire European Union ▪ Combination of amendment with technical guidance and supportive measures provides maximum support of the Commission for implementation ▪ Puts risk assessment on the forefront of European EIA policy and practice agendas ▪ Strong demonstration of the Commission's commitment to objectives of environmental protection ▪ Commission takes a strong leadership role	▪ Considerable financial costs, high efforts and resources needed on part of Commission and Member States ▪ Causes highest legislative implementation costs for Member States ▪ Amending the Directive is a long-term approach that will require considerable time for preparation ▪ More time will pass until amendments become fully effective in practice, because time lags will inevitably occur at all stages of the implementation cycle (transposition, integration into sub-legal implementing regulations, practical application, full assimilation into working routines and minds of professionals) ▪ Difficult political negotiations with Member States and economic interest groups must be expected, and reconciliation of interests may be hard to accomplish ▪ Considerable political resistance from Member States and (some) stakeholder groups must be expected, acceptance for amendment may eventually be low ▪ Lack of professional risk assessors and risk managers, which may be still required for quantitative assessments and more complex problems, will persist ▪ All methods of risk assessment have inherent limitations of their own ▪ Decision-makers still need to integrate results of risk assessment into decision-making and to develop an appropriate understanding of risk, because risk assessment provides decision-support, but it cannot substitute decision-making ▪ Leaves little discretion in interpretation to Member States

SWOT-Analysis Policy Option 6

Opportunities	Threats
▪ Strong driving force for change process towards more effective risk control through EIA ▪ Deeper and more sustained progress in terms of anchoring risk assessment in EIA, compared to all other options ▪ Involvement of Member States and stakeholder representatives in the preparation process is likely to increase acceptance ▪ Would strengthen the position of EIA against other environmental control regimes, and EIA could become the controlling force f environmental risk assessment on project level ▪ Strongest support for the momentum of positive development that exists in some Member States ▪ Harmonization of coverage of risks between countries decreases conflict potential due to risks with transboundary dimension ▪ Threat of overburdening EIA can be counteracted by strengthening scoping and making use of “no impact”-statements in cases where risk is not significant ▪ Would most likely compensate for coordination deficits between different procedures and ensure for the largest possible number of project types that environmental consequences of hazardous incidents are dealt with (projects subject only to EIA, projects subject to the EIA and to the Seveso II or IPPC Directive) ▪ If environmental consequences of risks have to be considered for all project types subject to EIA (whose project lists are more comprehensive than the ones of the Seveso II and IPPC Directives), this would probably cause Member States to streamline and consolidate different licensing procedures out of self-interest to avoid duplication and overlaps, and to save time and effort for double/multiple risk assessments ▪ Significant step forward towards ensuring equal levels of environmental protection, and of safety and security for all citizens, across the European Union ▪ Contributes to creating equal conditions for economic development and economic competition on the European Market ▪ Very strong contribution by the Commission to the realization of the full potential of EIA to become an effective instrument of preventive and precautionary environmental risk policy	▪ Negotiation process on amendments could require unwanted trade-offs ▪ Implementation deficits may still occur at all stages of the implementation cycle: conformity problems at transposition stage, interpretation and concretion deficits on level of national sub-legal regulations, incidents of bad application, full integration into working routines and awareness of EIA professionals ▪ Potential threat of overburdening EIA with additional requirements ▪ EISs may tend to become more voluminous and more unreadable ▪ Increased cost for project developers, in particular in cases of serious risk that may require full quantitative risk assessment ▪ Decision-makers might get confronted with difficult decisions on acceptability of risk ▪ Established systems and traditional working routines may still prove to be inert and resistant against progress ▪ Cases of infringement and incidents of bad application might increase, causing lawsuits and conflict between Commission and Member States ▪ Improved output of EIA does not guarantee improved outcome/effectiveness

Concluding remarks

This policy option foresees a strong regulatory intervention and a major correction of EIA policy design on Community level. It would cause a significant widening of the Directive's explicit field of application in terms of considering extraordinary hazards and risks. A major amendment to the Directive will require a long-term perspective, both for preparing, negotiating and enacting it and until it would become fully effective in practice. Would confront Member States with new transposition and implementation problems, probably giving rise to new incidents of conformity deficits and bad applications. As is inherent to a regulatory top-down approach, acceptance on part of Member States may be low and political resistance high. Combination with new technical guidance and support measures complies with the Communication on better monitoring of application of Community Law (COM (2002)725 final, 2002) that expresses the commitment of the Commission to assist Member States in implementation of EC environmental legislation. It is the policy option most likely to accomplish sustained effectiveness in terms of strongly anchoring risk assessment in EIA, but it is also the strongest intervention.

Figure 59 SWOT-Analysis of policy option 6: Major amendment to EIA Directive plus new technical guidance package plus support for implementation

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Latvia

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Poland

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Portugal

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Slovak Republic

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Sweden

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Major sectoral EIA regulations:

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Highways (Assessment of Environmental Effects) Regulations 1988 (SI No. 1241), as amended.

The Electricity and Pipe-line Works (Assessment of Environmental Effects) Regulations 1990 (SI No. 442), as amended.

The Environmental Assessment (Afforestation) Regulations 1988 (SI No 1207) as amended.

Act on Health and Safety at Work 1974, as amended.

COMAH (Control of Major Accidents Hazards) Regulations (England):

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Canada

Canadian Environmental Assessment Act (1992, c. 37) of June 23rd 1992.

Related Regulations:

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Comprehensive Study List Regulations.

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USA

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24 CFR Part 51 – Environmental Criteria and Standards.

24 CFR Part 55 – Floodplain Management.

24 CFR Part 58 – Environmental Review Procedures for Entities Assuming HUD Environmental Responsibilities.

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Germany

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Canada

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USA

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Guidelines for Neurotoxicity Risk Assessment.

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Guidelines for Exposure Assessment.

Guidelines for Developmental Toxicity Risk Assessment.

Guidelines for Mutagenicity Risk Assessment.

Guidelines for Exposure Assessment.

Guidance on Cumulative Risk Assessment.

Radiation Risk Assessment Guidance.

The Hazard Ranking System Guidance Manual.