

**European Commission Directorate General
XI, Environment, Nuclear Safety and Civil
Protection.**

**Final Report on the Study on the Assessment
of Indirect and Cumulative Impacts, as well as
Impact Interactions within the Environmental
Impact Assessment (EIA) Process**

NE80328/D3/2

Volume 2: Research Study and Findings

May 1999

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EXECUTIVE SUMMARY

Introduction

The study has been commissioned by the European Commission, Directorate General XI (Environment, Nuclear Safety and Civil Protection), in order to investigate the assessment of indirect and cumulative impacts, and interactions between impacts within the Environmental Impact Assessment (EIA) framework of the European Union (EU). The aim of the study is to determine how the assessment of these impact types is undertaken by Member States within the EU and to identify what methods are used elsewhere in the world. The result of this research is the preparation of practical guidelines to assess indirect and cumulative impacts and impact interactions, which would assist EIA practitioners and those involved in training activities.

Volume 2 sets out the results of the investigations carried out with the aim of establishing the extent to which cumulative and indirect impacts and impact interactions have been included within the Environmental Impact Statements (EISs) produced in 5 Member States of the EU (Finland, Germany, Greece, Portugal and the UK). The research was based on a series of questionnaires and consultations with EIA practitioners within the EU. It also sets out the conclusions and recommendations reached as a result of the study.

Methodology

Research Structure

A total of 60 EISs, 12 from each partner country made up of 4 projects from Annex I of Directive 85/337/EC and 8 projects from Annex II, were reviewed as part of the study. A team of European Reviewers from each country assessed the reports. The authors of the Statements were asked to provide information by means of a questionnaire. In addition, academics and various relevant authorities were consulted to obtain their opinion on the coverage of cumulative and indirect impacts and impact interactions.

Three questionnaires were devised in total. Questionnaire 1 investigated the legislative requirement and procedures in each partner country. The results of this part of the survey have been integrated into Volume 1. Questionnaire 2 was used to obtain information from the EIS authors and Questionnaire 3 was used to review the sample EISs. Both the second and third questionnaires aimed to determine the extent to which indirect and cumulative impacts and impact interactions have been considered within the documents.

Case Study Selection

The Environmental Impact Statements were selected with consideration given to projects that were likely to involve cumulative and indirect impacts, or

impact interactions. In addition, reports were chosen which had been prepared relatively recently in the hope that these would contain more examples of best practice. Further, it was necessary to ensure:

- EISs selected for review complied with the requirements of Annex III of EC Directive 85/337/EC and subsequent amendment.
- A reasonable mix of project types were included and attempts were made to ensure that, where possible, an EIS for a motorway, a waste scheme and an extraction project were reviewed from each country.
- A project type that is known to be an issue in each particular country was also chosen e.g. pig rearing in Portugal and mineral extraction in the UK
- At least one project, which had been moved from Annex II to Annex I in the 1997 amendment to Directive 85/337/EC, was included.
- The inclusion of a project that is a poor example of the treatment of indirect and cumulative impacts as well as impact interactions.

Review Criteria

For each case study, a broad overview of the techniques and methodologies used for impact identification, scoping and the areas where indirect and cumulative impacts, as well as impact interactions can be overlooked was obtained from evaluation of a set of standardised criteria.

The review focused on the treatment of indirect and cumulative impacts and impact interactions within the EIA, with particular reference to:

- Indirect impacts from induced activity or ancillary developments (e.g. access roads, construction compounds, off-site materials, abstraction or waste disposal)
- Indirect impacts as a result of repercussive effects from a direct impact on a different environmental parameter (e.g. effect of alteration to a water table on ecology)
- Cross-media impacts (e.g. the effect of soluble air pollutants on water quality and hence aquatic ecology).
- Indirect impacts from mitigation measures (e.g. visual impact of noise attenuation barriers).
- Cumulative impacts of the project being assessed with other existing or proposed projects (e.g. combined noise or atmospheric emissions of more than one project)
- Cumulative effect of a number of different impacts affecting the same receptor
- Aggregation of impacts and calculation of overall impact.
- Avoidance of double counting impacts.

Results of Case Studies, Consultations and Discussion.

The results gathered from the questionnaires and other responses have been analysed using a variety of methods from qualitative descriptions and commentary on the response to basic statistical analysis of some of the questions on the returned questionnaires. In some cases, an analysis tree was used to assess the responses.

Questionnaire 2.

The questionnaire was aimed at the authors of the EIS case studies chosen for review. It attempted to discover how EIS authors approached the assessment of indirect and cumulative impacts as well as impact interactions. A total of 41 out of 60 authors responded. The main findings are summarised below:

Response to the questionnaire revealed that two groups dominated authorship of the selected EISs. Those written by engineers and those EISs that had not been written by a single author. It is also interesting to note that only two of all authors claimed to have specific training in EIA. Most EIAs (23) were undertaken by a mixture of in-house specialists and sub-consultants, fewer (13) were undertaken by a wholly in-house team from the lead consultancy, while the least used team was that of an assemblage of sub-consultants.

Results showed that just over half (22) of the respondents claimed that their EIS had been reviewed or verified by a recognised body. Most verification was undertaken by a variety of bodies in local or regional government.

During the processes of scoping and screening, most authors considered that they had comprehensively covered the assessment of indirect and cumulative impacts and impact interactions.

The techniques that were found to be most commonly used were checklists, consultation, best practice manuals and mathematical models. Overlay mapping, matrices and network analysis were also used.

The average time spent undertaking an EIA was 192 man-days. However, the variation in allocated resources was very wide, ranging from a short 15-man days to 750 man-days. Variation amongst fees paid was less, with an average fee earned of 39,477 ECUs.

Practitioners were asked whether they encountered any specific problems when undertaking EIA, which may have hampered their assessment of indirect and cumulative impacts as well as impact interactions. Just over half of the respondents did have some problems, which included:

- Lack of available baseline data
- Lack of experience of the EIA process
- Lack of design information
- Conflicts between developer and authorities at the scoping stage
- Late use of EIA in the planning process
- Public misunderstanding of the EIA process leading to complaints
- Project confidentiality
- Lack of information on future developments
- Constant changing of project design

Most of the authors that responded thought that they had adequately considered indirect and cumulative impacts as well as impact interactions. However, a few stated that they had not, due to the following reasons:

- indirect and cumulative impacts as well as impact interactions were not the key impacts and were, therefore not assessed;
- assessment of these impacts was not required by the planning authority;
- these impacts were assessed separately;
- lack of appropriate data;
- lack of resources;
- lack of appropriate methodologies; and
- lack of information due to commercial confidentiality

Questionnaire 3

The Reviewers used this questionnaire when examining the case studies.

The findings revealed that most of the EISs had sections that covered a discussion of the scoping activities, a discussion of the alternatives and a discussion of project design, although significant numbers did not have a discussion on any of the above.

Most of the EISs reviewed gave some consideration to the assessment of ancillary or induced developments. However, any assessment was very selective, covering only the immediate apparent or known impacts in a qualitative way.

The majority of EISs did mention the three terms “cumulative impacts”, “indirect impacts” and “impact interactions” and identified examples of these impacts at either a scheme-wide or project-specific level . However, substantially fewer of the EISs attempted an assessment of these kinds of impacts, with only a small number comprehensively evaluating them.

The majority of EISs did not manage to assess the level of sustainability of the project.

The majority of EISs reviewed did not have separate sections or chapters specifically concerned with indirect and cumulative impacts or impact interactions. However indirect impacts were more frequently covered than other impact types.

Numbers of EISs with post EIA monitoring programmes approximately equalled those without, although monitoring programmes discussed were rarely comprehensive in their scope.

A total of 31 of the 60 EISs were considered to have met the requirements of Annex III of the EIA Directive (85/337), while 29 did not.

The overall quality of the EISs differed significantly between those case studies selected. The majority of the projects were generally satisfactory and complete, with only minor omissions and/or inadequacies. A small proportion of the EISs were considered unsatisfactory with significant omissions and/or inadequacies.

Consultations with Academics, Statutory Consultees and Competent Authorities

As part of the evaluation of case studies consultants, specialist contributors to EIS, academics, statutory consultees and competent authorities were contacted to provide further case specific information or general comments on issues associated with the assessment of indirect and cumulative impacts and impact interactions.

Those consulted raised number of points, which can be summarised as follows:

- A lack of methodologies appropriate for analysing indirect and cumulative impacts and impact interactions was frequently cited as a reason for inadequate assessments.
- In certain cases the impacts involved in the assessment were considered too complex and hence beyond the scope of current scientific knowledge. e.g. the “greenhouse” effect
- The lack of early consultation between planning departments and environmental authorities was cited as a reason for poorly focused EIAs by both academics and statutory consultees.
- There was a preference for the use of ecological boundaries over administrative boundaries, wherever possible
- The confidentiality generally associated with the production of EISs was cited as one reason for the inadequate assessment of the interrelationships of impacts between neighbouring projects.
- It was suggested that one way to ensure the adequate assessment of impact types was to require that EISs contain separate chapters on cumulative and indirect impacts, and impact interactions.

- The measurement and assessment of environmental issues in a compartmentalised way (e.g. noise, air quality, landscape) was considered by one authority to be a significant reason for the inadequate consideration of indirect impacts and impact interactions.
- At present, the lack of consideration of cumulative and indirect impacts, as well as impact interaction is not considered as a strong reason for refusal of planning permission.
- Generally, it was recognised that there was a lack of consideration of the cumulative impacts of ancillary developments within the same region.

Conclusions

The assessment of indirect and cumulative impacts and impact interactions is, if undertaken at all, generally performed on a selective and site specific basis. There is much confusion amongst EIA practitioners within the EU, with respect to the requirements for the assessment of such impacts.

There is an apparent lack of sufficiently high quality data for comprehensive, scheme-wide assessments of indirect and cumulative impacts and impact interactions. This is true for environmental criteria and development criteria, such as the knowledge of future developments.

There are few methodologies that are suitable and practical for the assessment of indirect and cumulative impacts and impact interactions.

In countries outside the EU, the tendency is not always towards the analysis of indirect and cumulative impacts and impact interactions at the project EIA level. Instead these countries expound integrating the assessment of these impacts at a higher level through a system of Strategic Environmental Assessment (SEA).

Examples of good practice in assessing the impacts of cumulative and indirect impacts and impact interactions in a comprehensive manner are complex and resource/capital intensive, for example the use of GIS. However, the main problem with the assessment of these impact types originates with the lack of comprehensive, scheme-wide impact scoping.

Recommendations

The following recommendations are made concerning the improvement of assessing indirect and cumulative impacts and impact interactions within the EIA process.

1. Consider the implementation of the assessment of indirect and cumulative impacts and impact interactions into the EIA Directive and into a future SEA Directive. Implementation of the assessment of indirect and cumulative impacts as well as impact interactions into SEA is a more radical 'top down' approach which would require legislative change and

would therefore be a long term strategy. However, it is the preferred method suggested by much of the available literature and the Expert Panel for this study.

2. Clarify the requirements of the EIA Directive (85/337/EC) in terms of assessing indirect and cumulative impacts and impact interactions by the release of official guidance and by revision of the text.
3. Consider amending the text of Annex III of the EIA Directive to include a requirement for the inclusion of a specific chapter or section within every EIS covering the assessment of indirect and cumulative impacts, as well as impact interactions.
4. Develop a training policy, plan and programme for EIA practitioners covering general EIA legislation and requirements as well as specifics such as identifying and assessing indirect and cumulative impacts and impact interactions using and adapting methodologies and tools.
5. Develop an Internet web site specifically for the dissemination of EIA related information to practitioners in EU Member States containing legal requirements, guidance, case studies and examples of best practice.
6. Consider the linkage between the requirement for the assessment of indirect and cumulative impacts, as well as impact interactions in the EIA Directive and a requirement for the consideration of such impacts in a future SEA Directive.

Summary

The study concluded that within the five representative countries of the European Union, the authors of EISs consider that they are assessing indirect and cumulative impacts and impact interactions to an adequate level. However, review of the completed EISs reveal that although these types of impacts are generally identified they are, rarely, if ever, assessed in a scheme-wide and comprehensive manner. Many authors do attempt some assessment of indirect and cumulative impacts and impact interactions, but often they lack the means to do so effectively.

One reason for this discrepancy may lie in the lack of suitable methodologies available for the analysis of cumulative and indirect impacts and impact interactions at an early stage in the project. It appears that of the EIA methodologies available that are suited to the assessment of indirect and cumulative impacts, as well as impact interactions, practitioners commonly employ only mathematical modelling in the EU. The reasons for not employing other techniques could include lack of training in use of specific methodologies amongst EIA practitioners. Also highlighted, was the lack of an appropriate forum in Europe where practitioners can access EIA related information, such as best practice examples, guidance and legislation.

One particular concern highlighted by the study is that EIA practitioners in a number of EU countries are not aware that the assessment of indirect and cumulative impacts and impact interactions is actually required by the EIA Directive, and at least eight countries within the EU have not translated this requirement directly into their national legislation.

The inconsistency with EISs was also noted, especially with regards to indirect and cumulative impacts and impact interactions. There are still large discrepancies between EISs, with many not considering important issues such as the testing of sustainability and the need to avoid double counting of impacts.

The research ascertained that few of the techniques currently used in EIA are used for specifically assessing indirect and cumulative impacts and impact interactions. There are limitations, for example insufficient baseline data available for use in models, which would undermine any attempts to assess in an accurate and meaningful manner indirect and cumulative impacts, or impact interactions. Without access to basic information in the first place practitioners cannot undertake a comprehensive assessment of these more complex impact types.

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Section 1.0: Introduction

1.0 INTRODUCTION

This report is the second of three volumes issued as part of the Study on the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions within the Environmental Impact Assessment (EIA) Process. The study has been commissioned by the European Commission: Directorate-General XI, Environment, Nuclear Safety and Civil Protection and is being undertaken by Hyder Environmental, an environmental consultancy, in association with EURONET, a pan-European research and consultancy network. Additional input was provided by European partners based in Germany, Greece, Portugal and Finland and an Expert Panel made up of leading members of the European EIA Community provided input to the study as well.

1.1 Study Objectives

Council Directive 85/337/EEC on *the assessment of the effects of certain public and private projects on the environment* and its 19967 Amendment (11/97) require that, along with consideration of the direct impacts of a project, an EIA should cover any indirect, secondary and cumulative effects of a project as well as the interactions between the environmental factors listed within the Directive. Experience has shown, however, that these issues often fail to be included in the impact assessment. A survey, conducted as part of this study (described in this volume), has specified that most problems are related to the interpretation of interactions and to the lack of assessment criteria and methods to address these types of impacts.

The purpose of this study is therefore to investigate the assessment of indirect and cumulative impacts as well as interactions between impacts in EIA, within the European Union (EU). The study aims to determine how the assessment of these impact types is undertaken in the EU, with the overall aim to assist those involved in EIA practice or training activities to adequately address indirect impacts, cumulative impacts and impact interactions.

1.2 Report Structure

The Final Report is organised into three volume. The first volume introduces the reader to the concept of Environmental Impact Assessment (EIA), its background, development and techniques. Following this introduction the concept of the assessment of indirect and cumulative impacts and impact interactions is introduced.

The first volume also includes an investigation into the EIA legislation currently in usage throughout the fifteen Member States of the European Union (EU). The legislative review pays special attention to the legal requirements for the assessment of indirect impacts, cumulative impacts as well as impact interactions and how the relevant requirements of the EIA Directive (85/337/EEC) have been translated into national law throughout the EU. This section also looks at how legal requirements for Strategic Environmental Assessment (SEA), if any, have been developed by Member States independently from the EU. This volume also includes a discussion into how three countries outside the EU have approached the introduction of the assessment of these types of impacts into their EIA procedures.

Finally, this volume describes known methodologies for undertaking the assessment of indirect and cumulative impacts and impact interactions and discusses the problems currently experienced in the assessment of these impact types in the EU.

The second volume concentrates on the results generated by the questionnaire methodology developed for this study and discusses the findings from the questionnaires.

The third volume details the conclusions and recommendations that have been developed from this study and suggests means for correcting deficiencies in the current practice of EIA within the EU.

Section 2.0: Study Method

2.0 STUDY METHOD

2.1 Participants

Those involved in conducting this study were classified into three distinct groups, referred to as:

- The Core Team, consisting of personnel at Hyder Environmental and EURONET;
- The European Reviewers, the named consultants in Germany (Allan Busse), Greece (Euroconsultants S.A.), Finland (VTT), Portugal (Agri-Pro Ambiente S.A.) and the United Kingdom (Hyder Environmental) who undertook the review of Environmental Impact Statements (EISs) specific to their country;
- The Expert Panel, which consisted of European EIA experts who passed recommendations and comments on the questionnaires developed for this study and methodologies appropriate to the assessment of indirect and cumulative impacts and impact interactions.

2.2 Methodology

The approach to this study was divided into three stages:

1. Overview of legislation and methods used;
2. Analysis and evaluations of findings; and,
3. Development of suggested approaches.

For stages 1 and 2, there were two levels of investigation. Firstly, at the strategic, national level, through the review of legislation, procedures, guidance, techniques and research findings in the field of assessment of indirect and cumulative impacts and impact interactions. Secondly, at the project level, through the investigation and appraisal of case studies covering a variety of project types and sizes across both Annex I and II of the EIA Directive (85/337).

The study reviewed a total of 60 EISs, 12 from each partner country. Each European Reviewer had to choose 4 projects from Annex I of Directive 85/337 and 8 projects from Annex II, other selection criteria are discussed in Section 2.1.3 below. The European Reviewers utilised databases of EISs, both through their own organisations and through the EIA centres in their own countries, in selecting their case study projects.

The study was carried out by the European Reviewers with assistance from the Core Team based in the UK who visited all the reviewers in their own country. The case studies were

reviewed and assessed by the in-country experts, adopting a standard methodology developed by the Core Team and Expert Panel. The selection of case studies and the analysis and evaluation of results was primarily carried out by the Core Team, in consultation with the European Reviewers.

The Expert Panel was used in a review and advisory capacity throughout the project, with particular involvement at two key stages:

1. In the development and testing of the questionnaire methodology for the study; and,
2. In the formulation of suggested approaches for the assessment of indirect and cumulative impacts as well as impact interactions.

Following an inception meeting with the European Commission Directorate General XI (DGXI), the Core Team proceeded to develop a methodology to be used for assessing and evaluating selected case studies. This included detailed questionnaires for both reviewing the EISs and conducting interviews with the EIS authors (see Questionnaires 2 and 3 in C). The questionnaires also required the reviewers to contact, where feasible, various individuals and organisations involved in the EIAs, such as:

- the developer;
- the consultant or individual / organisation preparing the EIS;
- specialist contributors to the EIS, including academics that may have undertaken reviews of the EIS for research purposes;
- statutory consultees; and
- the competent authority.

A third questionnaire (see Questionnaire 1 in Appendix C) about the legislative requirement and procedures in each Partner Country was also included for the purposes of the study.

In tandem with the development of the methodology for the project the potential case studies were identified and selected. Each of the five European Reviewers liaised with that country's EIA Centre as well as others involved in the EIA process and produced a listing of potential projects, which also included EIAs carried out by their own organisations. To ensure objectivity, no projects were selected in which any of the European Reviewers had themselves been directly involved.

Following selection and approval from DGXI, each EIA was then reviewed using the questionnaires described above. The review focused on the treatment of indirect, secondary and cumulative impacts, and impact interactions within the EIA, by particular reference to:

- indirect impacts from induced activity or ancillary developments (e.g. access roads, construction compounds, off-site materials, abstraction or waste disposal);
- indirect impacts as a result of repercussive effects from a direct impact on a different environmental parameter (e.g. effect of alteration to a water table on ecology);
- cross-media impacts (e.g. the effect of soluble air pollutants on water quality and hence aquatic ecology);
- indirect impacts from mitigation measures (e.g. visual impact of noise attenuation barriers);
- cumulative impacts of the project being assessed with other existing or proposed projects (e.g. combined noise or atmospheric emissions of a new highway adjacent to an industrial estate, or two major adjacent projects which will be constructed during overlapping time periods);
- cumulative effect of a number of different impacts affecting the same receptor (e.g. the combined effect of construction noise, dust and increased severance on a residential area);
- aggregation of impacts and calculation of overall impact; and
- avoidance of double counting impacts.

Information was gathered for each case study from the individuals and organisations involved in the EIA, together with any responses to specific questions which arose from the EIS reviews. A broad overview of the techniques and methodologies used for impact identification, scoping and the areas where indirect and cumulative impacts can be overlooked was obtained from evaluation of a set of standardised criteria.

In parallel with the case studies, the project team reviewed more general information at both European and international level concerning the assessment of indirect and cumulative impacts as well as impact interactions, this included:

- legislation and procedures;
- governmental guidance notes;
- EIA manuals produced by governments, competent authorities, donor agencies, large companies, NGOs;
- text books, research papers, reviews; and
- training courses and guides.

The review aimed to particularly identify:

- means of ensuring such impacts are addressed;
- methods of identifying such impacts at the scoping stage;
- techniques and methodologies for assessing such impacts; and
- description and illustration of these issues in EISs.

After completion of the case study reviews the Project Manager visited each of the European Reviewers to discuss the EIAs and the results of the questionnaires. The aim was to assimilate an overall picture of the situation in that country, focusing on current guidance and practice, deficiencies and recommendations for improvement.

A list of different methodologies has been compiled (see Volume 1) from a literature search and the extensive EIA knowledge and experience of the Expert Panel has been used in appraising appropriate methodologies, assessing their relative advantages and disadvantages. The evaluation included, *inter alia*, the following criteria:

- adaptability to project types;
- adaptability to environmental conditions;
- adaptability to the various EIA systems operating in the Member States;
- adaptability to Annex I and Annex II projects;
- cost effectiveness; and,
- international acceptance / credibility.

Following the above comparative analysis, the prioritisation of action areas where the current EIA system is seen to be deficient (see Volume 3), results of the case study reviews and the review of existing practice in EU nations (see Volume 1), suggested approaches to the assessment of indirect and cumulative impacts and impact interactions have been prepared (see Guidelines). As required by the brief, these have taken the form of suggested approaches rather than prescribed methods.

The results of this study are due to be presented to a group of experts at a workshop forum.

2.3 Selection of Case Studies

Selection of EISs for review needed to take into account the following requirements of the Terms of Reference which stated “consideration of the following issues should in particular, *inter alia*, be investigated”:

1. Indirect impacts arising from other types of induced activity (e.g. ancillary development);
2. Interactions between a project’s impacts and between impacts of a proposed project and other, existing or proposed, projects;
3. Cross-media evaluation of environmental impacts;
4. Consideration of impacts from mitigation measures;
5. Predicting the magnitude of impact interactions (with reference to indicators used and uncertainty analysis undertaken);
6. Avoidance of double-counting impacts;
7. Evaluation of significance of the project’s total impacts and testing of its sustainability;
8. Links to other consent procedures that affect impact interactions, such as industrial pollution prevention and control.

In addition, the EISs selected for review were produced recently for the following reasons:

1. There is a greater likelihood that those involved in its commissioning, production and review would be available to discuss the EIS under consideration; and
2. That examples of best practice are more likely to be contained in recent EISs.

Further, it was necessary to ensure that:

1. All EISs selected for review complied with the requirements of Annex III of EC Directive 85/337;
2. A reasonable mix of project types were included - the selection process attempted to ensure that no more than two of the same project types from each country should be reviewed and that as a minimum an EIS for a motorway, a waste scheme and an extraction project were reviewed;
3. A project that is known to be an issue within each country was selected, such as pig rearing in Portugal and mineral extraction in the UK;

4. At least one project which has been moved from Annex II to Annex I in the 1996 amendments to the Directive (85/337) is included for review; and,
5. The inclusion of a project that is a poor example of the treatment of indirect and cumulative impacts and impact interactions.

In the course of the study it proved difficult for the European Reviewers to meet these selection criteria for a variety of reasons, such as, Finland, having only recently joined the EU, did not have a wide variety of EISs to choose from. However, the projects finally selected for the study as a whole fulfilled all the criteria. A complete schedule of the case study projects can be found in Appendix A of this report.

2.4 Definitions Used for the Purposes of this Study

A fundamental problem of this study was how to define cumulative impacts, indirect impacts and interactions between impacts. The definitions of these three types of impact overlap and, consequently, most of the literature available on the subject classifies indirect impacts and impact interactions as components of cumulative impact. However, there are no agreed definitions as to what constitutes a cumulative impact, despite a number of worthwhile attempts being made, notably from Canadian and American sources.

For the purposes of this study which identifies cumulative, indirect and interactions as discrete impact types, definitions were developed which can be found below. Included with the definitions are examples of specific impacts that fit the definition. Although the definitions overlap, they proved useful in this study in identifying impacts discussed in the case study reviews.

2.4.1 CUMULATIVE IMPACTS

The assessment of impacts on the environment that result from incremental changes to environmental parameters when added to changes brought about by other past, present or reasonably foreseeable actions.

Adapted from US Council on Environmental Quality Regulations, 1978

Cumulative impacts are additive in nature - the sum of all impacts aggregate together to affect a receptor in a holistic manner. Sometimes referred to as *compound impacts*.

Example (1): The combined noise of a new highway built adjacent to an industrial complex may have a

- cumulative effect on certain receptors.
- Example (2): Incremental noise from a number of motorways.
- Example (3): The total effect of all development impacts on a household, such as noise, dust, visual and so forth.
- Example (4): Further severance of land from different transportation routes.
- Example (5): Positive impacts as a result of reduction in air and road travel as a result of a shift to rail travel.
- Example (6): Several golf courses developed in the same area may, individually, be insignificant but their cumulative effect on the local ecology and visual amenity may be highly significant.

2.4.2 *IMPACT INTERACTIONS*

The reactions between impacts whether between the impacts of one project or between the impacts of more than one project.

Adapted from Morris & Therivel, 1995

- Example (1): Two major developments being constructed adjacent to one another and during overlapping time periods will have many interactive impacts, from land-use issues to construction and operational noise.
- Example (2): Encroachment of development land into land set aside for other purposes; development impacts may interact with the environment external to the development area and jeopardise its desired purpose.

Impact interactions cover a broad spectrum of effects and can, therefore, be further sub-divided into two distinct groups (adapted from Morris & Therivel, 1995):

SYNERGISTIC	The sum of all impacts total more than the sum of the individual impacts affecting a receptor. Example (1): The combination of individually insignificant noise and visual impacts results in a significant effect on the amenity value of a heritage feature.
ANTAGONISTIC	The sum of all impacts total less than the sum of the individual impact affecting a receptor. Sometimes referred to as <i>neutralising impacts</i> . Example (1): Two effluent streams produce chemicals which have significant environmental impact, when reacted together the results are far less significant than their effects taken in isolation.

It should be noted that impacts may interact to produce a cumulative effect.

2.4.3 *INDIRECT IMPACTS*

The assessment of impacts on the environment produced away from or after the initial perturbation or by a complex pathway.

Adapted from Sonntag *et al*, 1987

- Example (1): A development alters the underlying water table and consequently a nearby designated area of natural heritage dries up and alters the ecology.
- Example (2): Secondary developments impacting on the environment that are constructed as a consequence of the first development, such as construction compounds and access roads.
- Example (3): Soluble air pollutants will impact on water quality and hence aquatic ecology issues.
- Example (4): The use of a noise attenuation barrier as a mitigation measure has implications for visual impact.
- Example (5): Traffic increases generated by development of a new road.
- Example (6): Effects of groundwater drawdown, air turbulence and other microclimatic effects on natural habitats.

It should be noted that some of the given examples could be classified under another of the definitions, this is due to the inherently overlapping nature of impact types under consideration.

Section 3.0: Results of Case Studies, Consultations and Discussion

3.0 RESULTS OF CASE STUDIES, CONSULTATIONS AND DISCUSSION

As outlined in Section 2 above, the majority of the information for this study was gathered by questionnaires referencing each Partner Country's legislative requirements in EIA and reviewing twelve EISs case studies chosen from each country involved, namely Finland, Germany, Greece, Portugal and the UK. A full list of the case studies reviewed for this study can be found in Appendix A.

Each EIS was examined from the point of view of the EIS author and an independent reader (see Section 2.1). From these questionnaires the treatment of cumulative impacts, indirect impacts as well as impact interactions within the EIA process was analysed according to the requirements of the Terms of Reference.

When reviewing the EISs, the European Reviewers were asked to identify and describe any examples of the assessment of indirect and cumulative impacts and impact interactions which represented, in their opinion, *good practice*. The term *good practice* indicates examples of EIA practice, such as particular techniques or concepts used, that were considered interesting or particularly useful to the assessment of indirect and cumulative impacts as well as impact interactions by the European Reviewer.

Additionally, comments and opinions were obtained from regulators and statutory consultees involved in each of the selected EIS case studies their comments are recorded in Section 3.4 below.

Full versions of all three of the questionnaires used in this study can be found in Appendix C.

3.1 Analysis of Results

The results gathered from the questionnaires and other responses have been analysed using a variety of methods from qualitative descriptions and commentary on the responses to basic statistical analysis of some of the questions on the returned questionnaires. One method used to assess how well cumulative impacts, indirect impacts and impact interactions were covered in each of the selected EISs is the use of an *analysis tree*.

3.1.1 ANALYSIS TREE METHOD

The analysis tree has been used to assess the results from three key questions from the questionnaire completed by the EIS reviewer and one question answered by the EIS author. This method of analysing the results has been adapted from McCold & Holman (1995) and requires the questionnaire answer to be moved along the pathways of a decision-tree until classified by a statement indicating how cumulative impacts or indirect impacts or impact interactions were assessed. Schematics of the two analysis trees developed for this study can be seen in figures 3.1 and 3.2.

The analysis tree was used for question 3 of questionnaire 2 (see Appendix C) which asked the authors of the selected EISs to comment on whether or not they considered cumulative impacts, indirect impacts or impact interactions in their screening (if relevant) or scoping of each project. This analysis tree was very simplistic having only two levels of analysis and resulting in the simple classification of whether the author believed they had considered these impacts or not.

The analysis tree was used more extensively to assess parts (b), (c) and (g) of question 3, questionnaire 3. As can be seen from Figure 3.2, this tree was far more complex, incorporating seven levels of analysis, two distinct pathways and was used to assess the degree to which each EIS covered cumulative impacts, indirect impact and impact interactions. Each of the impact types were assessed using the same tree but considered separately.

The results of using these analysis trees are discussed below using data from all the questionnaires received

3.2 Questionnaire Findings

This section deals with each of the three questionnaires in turn.

3.2.1 QUESTIONNAIRE 1

This questionnaire examined the legislative background to EIA procedures in each of the European Partner countries. The results of these questions have been incorporated into the European legislative review and can be found in Volume 1.

3.2.2 QUESTIONNAIRE 2

The second of the three questionnaires was aimed at the authors of the EIS case studies chosen for review in this study. The questions sought to discover how EIS authors approached the assessment of indirect and cumulative impacts as well as

impact interactions within the context of undertaking an EIA. Responses were received from 41 of the 60 authors, although, as can be seen from the results below, not every author answered every question.

Question 1

This question referred to the background and experience of the EIS author(s) and how the team undertaking the EIA was organised. The questions were divided into three constituent components. The first part of the question referred to the qualifications of the EIA author. The responses were categorised into general professional groupings and are presented below:

Professional Group	No. of Authors
Environmental Scientist	4
Engineer	14
Geographer	2
Hydrologist	2
Landscape Architect	1
No single author	14
Sociologist	1
Town & Country Planner	4

From the table above it can be seen that two groups dominate the authoring of EISs, engineers and those EISs that have not been written by a single author. No other professional group has a significant number of EIS authors. It is interesting to note that only two of all the authors claimed to have specific training in EIA, both were environmental scientists.

The second part of this question referred to how the people who undertook the EIA were organised. The results are presented below:

Composition of Team	No. of Responses
In-house	13
Assemblage of sub-consultants	5
Mixture	23

As can be seen from the above table, most (23) of the EIAs were undertaken by a mixture of in-house specialists the lead consultant and sub-consultant specialists. Fewer (13) EIAs were undertaken by a wholly in-house team from the lead consultancy. The least used team was that of an assemblage of sub-consultants.

The third part of this question examined how the EIS was written, whether it was written by a single, lead author, compiled from separate reports or otherwise. Most (21) of the EISs were written by a single, lead author. Fewer (15) were compiled from separate reports. A few (5) were written using another system such as a combination of compiling reports and lead authors or a co-operative approach by several authors from the lead consultancy.

Question 2

This question gauged whether the EIS was subject to any external checking or verification under legislative procedures or recognised quality standards. Just over half (22) of the respondents claimed that their EIS had been reviewed or verified by a recognised body. Most verification was undertaken by a variety of bodies in local or regional government.

Question 3

This question sought the views of the EIS authors themselves as to whether or not they considered that they had addressed indirect and cumulative impacts as well as impact interactions in a comprehensive manner. The data generated from this question was analysed using the Analysis Tree method (see above) and the results can be seen in Figure 3.1. The results demonstrate that most authors consider that they had comprehensively covered the assessment of indirect and cumulative impacts as well as impact interactions.

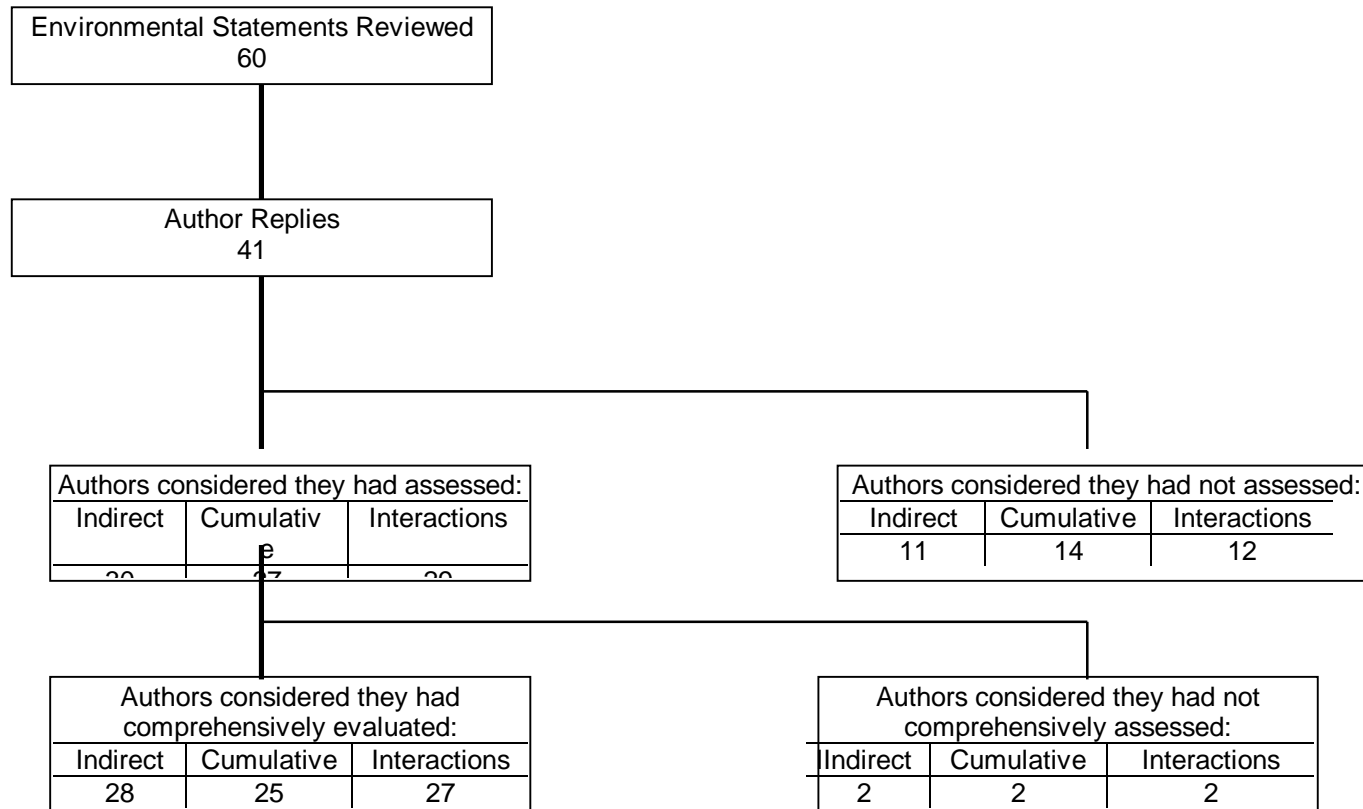


Figure 3.1: Analysis Tree showing how the Authors of Environmental Impact Statements considered they had treated the analysis of Cumulative Impacts, Indirect Impacts and Impact Interactions

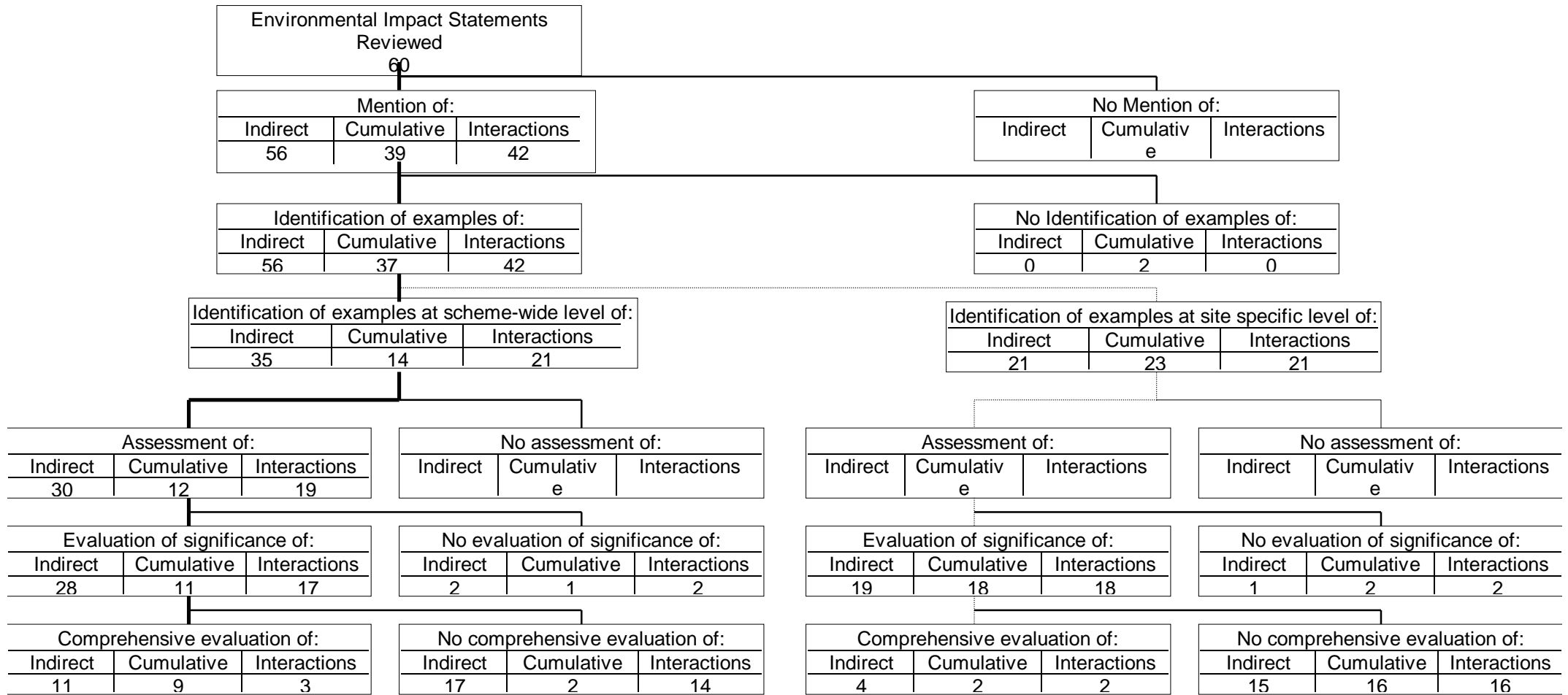


Figure 3.2: Analysis Tree showing how Cumulative Impacts, Indirect Impacts and Impact Interactions were reported in Environmental Impact Statements

Question 4

The question ascertained which EIA techniques were used in the selected EISs. EIAs generally used three or four techniques throughout an assessment and the results table below reflects this:

Technique	Times Used	Technique	Times Used
Checklist	30	Matrix	15
Weighted Matrix	6	Network	12
Overlay	14	Physical Model	9
Mathematical Model	22	Best Practice Manuals	28
Consultees	29	Other	6

The most dominant techniques are checklists, consultees, best practice manuals and mathematical models. Other techniques used included, resident questionnaires, aerial photography, multi-criteria analysis, verbal argument and no technique at all.

Of the techniques identified in Volume 1 that are suitable and capable for undertaking the assessment of indirect and cumulative impacts and impact interactions, only the mathematical, or simulation modelling, appears to be relatively frequently used (22 occasions) by the EIS authors, compared to other documented techniques.

Question 5

This question attempted to gather some general information about the amount of time that assessors were allowed to undertake an EIA and the amount of financial resource they has at their disposal. Not all of the respondents provided this information

The average time allowed for an EIA was 192 man-days, although the variation in time allocated resources was very wide, ranging from a short 15 man-days to 750 man-days. Variation amongst fees paid did not vary so significantly with the average fee earned being 39,477 ECUs.

Question 6

This question ascertained whether or not EIS authors encountered any specific problems when undertaking their EIA and which may have hampered their assessment of indirect and cumulative impacts as well as impact interactions. Just over half of the respondents (21) did have some problems. Their responses included:

- lack of available baseline data (6);
- lack of experience of the EIA process (4);
- lack of design information (4);
- conflicts between developer and authorities at the scoping stage (1);
- late use of EIA in the planning process (1);
- public misunderstanding of the EIA process leading to complaints (1);
- project confidentiality (1);
- lack of information on future developments (1); and
- constant changing of the project design (1).

Question 7

This question asked the opinion of the EIS author as to whether or not they covered indirect and cumulative impacts as well as impact interactions within their EIA. Most of the authors (31) thought that they had adequately considered these types of impact. However, a few (9) of the authors stated that they had not done so for a variety of reasons, including:

- indirect and cumulative impacts as well as impact interactions were not key impacts and were, therefore, not assessed;
- assessment of these impacts was not required by the planning authority as they were considered to be of minor importance;
- these impacts were assessed separately;
- lack of appropriate data;
- lack of resources;
- lack of appropriate methodologies; and
- lack of information due to commercial confidentiality.

3.2.3

QUESTIONNAIRE 3

The final of the three questionnaires was designed for use by the European Reviewers as they assessed the selected case studies for the treatment of indirect and cumulative impacts as well as impact interactions. All 60 of the selected case studies were reviewed and the results are reported below.

Question 1

This question asked some general background questions about the EIS being reviewed, such as project description, which Annex of the EIA Directive it fell under and so forth. The question aimed to get the reviewer to fully understand the nature of the EIS and check that the author had written the EIS in a clear and comprehensible manner. The responses are not relevant to the aims of this study and have, therefore, not been included in this report.

Question 2

This question aimed to discover how much consideration was given to indirect and cumulative impacts as well as impact interactions in the early stages of each project in terms of impact scoping, discussion of alternatives and the project design/description. The question also provided the opportunity for the European Reviewer to highlight examples of good practice or interesting methods for the assessment of indirect and cumulative impacts as well as impact interactions found within each EIS. The highlighted examples can be seen below.

The question was divided into three parts, with the first referring to scoping activities, the second to alternatives and the third to project design. The results can be seen in the table below:

Question	Yes	No
Discussion of scoping activities?	36	24
Discussion of alternatives?	43	17
Discussion of project design?	37	23

As can be seen from the results, most of the EISs reviewed had sections that covered all three aspects, scoping; alternatives and design, although significant numbers did not have a discussion on scoping or project design.

Question 3

This question was at the heart of the study where reviewers were asked to interpret how the EIS covered a variety of issues including the assessment of cumulative and indirect impacts as well as impact interactions. The question was divided into nine parts which are described below:

The first part of the question, (a), referred to the assessment of ancillary or induced developments associated with the project subject to the EIA. Most of the EISs reviewed gave some consideration to the assessment of ancillary developments, however, any assessment was very selective covering only the immediately apparent or known impacts in a qualitative way.

The analysis tree method was applied to parts (b), (c) and (g) of the question as they referred specifically to the consideration of impact interactions, indirect impacts and cumulative impacts respectively. The results of this analysis can be seen in Figure 3.2.

Question 3(d) referred to the assessment of impacts induced by mitigation measures associated with the development. Similar

to the assessment of ancillary development, mitigation measures are only assessed selectively within the chosen EISs.

In question 3(e) it was revealed that the majority (34 EISs) of the projects reviewed did not assess the magnitude of impact interactions against standard indicators or by use of uncertainty analysis.

Question 3(f) asked about the avoidance of impact double counting within the EISs, most (34) managed to avoid double counting. However, just under half of the EISs (26) did not use any means to avoid impact double counting.

Question 3(h) asked if the EIS has managed to test the development project's level of sustainability, most (37) did not use any method to test the sustainability of the project, although a significant number of EISs (23) did use some method for testing sustainability of the project.

Finally, question 3(i) sought to discern if the EIS linked to any other consent procedure, just over half of the EISs (34) did link to another consent procedure, they included:

- legislation protecting water resources;
- air quality legislation;
- nature conservation regulations;
- waste management legislation;
- mineral planning and mining regulations;
- legislation relating to transport, such as shipping and highways;
- legislation regulating the electricity industry;
- general environmental protection legislation; and
- industrial planning applications.

Question 4

This question looked at whether or not the EIS discussed indirect impacts, cumulative impacts and impact interactions in a deliberate and organised way by including a dedicated section or chapter in the EIS to include any or all of these types of impact. The results can be seen in the table below:

Section / Chapter on...	Yes	No
Indirect Impacts	28	32
Cumulative Impacts	21	39
Impact Interactions	23	37

As can be seen from the results the majority of the EISs reviewed did not have sections or chapters on indirect impacts,

cumulative impacts or impact interactions. However, indirect impacts were more frequently covered than the other impact types.

It is worth noting the somewhat anomalous nature of these results, given that no evidence of sections or chapters were provided by the European Reviewers except in a few cases.

Question 5

This question aimed to determine how many of the EISs reviewed included a post-EIA monitoring regime, an essential part of the EIA process without which predicted impacts cannot be validated nor mitigation measures checked for their effectiveness. Numbers of EISs with monitoring programmes (30) equalled those without (30), although monitoring programmes discussed were rarely comprehensive in their scope. Instead most concentrated on a few impact types on a few environmental criteria.

Question 6

This question sought to determine if any of the selected EIS case studies failed to meet the requirements of Annex III of the EIA Directive (85/337). The EIS sample was split between those that did meet the requirements of Annex III (31) and those that did not (29). Some of the reasons for not meeting the requirements of Annex III include:

- lack of non-technical summary;
- lack of assessment of cumulative impacts, indirect impacts and impact interactions;
- no indication of forecasting methods used;
- no detailed mitigation measures;
- no consideration of alternatives; and
- lack of information concerning identified impacts

Question 7

The penultimate question required the reviewer to provide an indication of the quality of each EIS. There were five categories to choose from, roughly analogous to the Lee & Colley (1990) grading system. A complete review, however, was not required but an indication in the reviewer's opinion as to the quality of the EIS. The results are shown in the table below:

Overall Quality of EIS	Number of EISs
Relevant tasks well performed, no important tasks left incomplete	13
Generally satisfactory and complete, only minor omissions and inadequacies	28
Can be considered just satisfactory despite omissions and/or inadequacies	11
Parts are well attempted but the EIS must, as a whole, be considered just unsatisfactory because of omissions and/or inadequacies	4
Not satisfactory, significant omissions or inadequacies	3
Very unsatisfactory, important task(s) poorly done or not attempted	1

As can be seen from the above table, most of the EISs reviewed (52) were classified as satisfactory or better, with only a few (8) falling into the generally unsatisfactory or worse categories.

Question 8

The final question asked the reviewer to list anyone else who they had contacted in relation to each EIS reviewed. A list of these contactees can be found in Appendix D.

3.3 Consultations

As part of the evaluation of case studies the core project team contacted the various individuals and organisations involved in the EIA of individual projects. Those contacted included:

- consultants or individuals/organisations preparing the EIS;
- specialist contributors to the EIS;
- academics;
- statutory consultees; and
- competent authorities.

Contact with those preparing the EIS took place through telephone conversations and the issuing of questionnaire 3 (See Appendix C) which required contributors to review their own EIS. The results of the questionnaires and subsequent analysis are given above.

Other consultations took place through telephone interviews or by letter; the results of which are summarised below. The comments contained in the following sections have not been attributed to individuals for reasons of confidentiality, although a list of all those contacted as part of the exercise is presented in Appendix D.

3.3.1 *CONSULTATION WITH ACADEMICS*

The academics consulted frequently cited the lack of available methodologies appropriate to the impact types under consideration as a reason for inadequate assessments. These issues are usually ignored or not treated as a separate issue. For example, impact interactions are usually treated peripherally in single issue discussions.

The problems involved in identifying and then quantifying cumulative and synergistic impacts were highlighted during consultations. An example of the problems encountered in assessing these impacts in relation to a highways scheme was given in which it is known that certain road traffic pollutants combine to cause the "greenhouse" effect although the ability to quantify the effect is beyond current scientific knowledge.

The lack of early consultations between planning departments and environmental authorities was cited as a reason for poorly focused EIAs. In Germany, the administrative guideline to EIAs (UVPVwV) has suggested the principle of "Konzentrierung der Genehmigung" which introduces a mechanism for all responsible licensing departments to elect a lead authority with which the developer consults. This mechanism was considered by one academic to be an ideal solution not only for improving the scoping of environmental issues but effective in reducing cost and time wastage

The attempt to produce definitions of impact types was considered by one academic to be responsible for the compartmentalisation of environmental issues. The consultation revealed a preference for ensuring that definitions were kept as general as possible to provide a holistic view of the environment.

As might be expected, a preference for ecological boundaries over administrative boundaries was highlighted during consultations. It was suggested that for each environmental issue and for each receptor an impact area could be developed which could be overlain in order to identify critical areas. The example of air pollution from industry in northern England leading to acid rain in Norway was given as an example of how the identification of critical areas would be of use.

The confidentiality generally associated with the production of EISs was cited as a reason for inadequate assessment of the interrelationship of impacts between neighbouring projects. The lack of formalised training of EIA practitioners and those

administrators involved in the consideration of EIAs was also highlighted.

With regards to sustainability, the aim to conserve the environment for future generations would be facilitated if EIAs were conducted in conjunction with strategic EIAs. The issue of how far an EIA for an individual project should look into the future was, however, identified as a potential problem in achieving this goal.

One practical method of ensuring the adequate assessment of impact types was to require that EISs contain separate chapters on the issues under discussion. For example the requirement for a separate chapter on cumulative impacts would be a simple and effective way of ensuring their consideration. Similarly, if those undertaking reviews of EISs and/or determining applications on the basis of EISs submitted were encouraged to include the assessment of cumulative, indirect and impact interactions in their review criteria those preparing the EIS would become aware of the need to specifically assess these issues.

One of the academics consulted is presently supervising a thesis developing the indicator concept. This is an American participatory approach to promote transparency by involving the population, local industry and all interested parties in discussions on future developments in the region. This also approaches the concept of a social impact assessment which is becoming increasingly important as part of the EIA. The same academic also wished to see links established between EIA, the Environmental Management and Audit Scheme (EMAS) and Integrated Pollution Prevention Control (IPPC). Such links would promote environmental protection through self-regulation in contrast to the present policing structure between industry and regulators.

3.3.2 *CONSULTATIONS WITH STATUTORY CONSULTEES*

During consultations with statutory consultees the advantages of early meetings to discuss the potential impact types was highlighted. This comment was common to the approach favoured by certain academics and highlighted above.

One statutory consultee provided details of how such a meeting could work in practice suggesting that the developer should, at the outset of the project, formulate a working team of interested parties. The team should meet at the project initiation stage so that the developer can explain the project and give interested parties the opportunity to comment on potential impacts of

concern to them. With interested parties being in one forum together, they will be aware of impacts identified by each party and will be able to assess whether the potential for indirect, cumulative or impact interactions exists within their own particular area of concern.

An alternative method suggested was to work at the strategic level. The example of the planning of flood defence schemes and undertaking Flood Defence Strategies and SEA was given. The strategy and SEA initially identifies a system as a whole (e.g. a river catchment area) before dividing the system into individual projects. In this way, cumulative, indirect and impact interactions can be identified and environmental objectives for the system set. The strategic guidance is then applied to each individual project.

3.3.3 *CONSULTATIONS WITH COMPETENT AUTHORITIES*

The measurement and assessment of environmental issues in a compartmentalised way (e.g. noise, air quality, landscape) was considered by one authority contacted to be a significant reason for the lack of consideration of cumulative impacts and impact interactions.

Another authority considered that in their experience cumulative and indirect impacts are rarely assessed in any detail, if at all, in EIAs whilst acknowledging that they are often difficult to assess. In addition, the authority commented that it is not clear how detailed any assessment needs to be, and debatable how relevant such matters are to determining planning applications on a particular site. The authority considered that a poor EIA which does not look in detail at areas which may be considered optional is not a strong reason for refusal of a planning application.

A common problem identified during consultations with competent authorities was the lack of consideration in EISs of the cumulative effects of several developments of the same project type within a region. A reaction to the lack of consideration of such effects has prompted one of the local authorities consulted to combine with other adjacent authorities to undertake a survey of air quality. The results have been used in conjunction with work carried out by a local medical practitioner who has undertaken a comprehensive study on the effects of open cast coal mining on respiratory diseases in the local community. The intention is that the information gained will be used to inform the competent authority in making decisions as to the adequacy of information presented in future EISs.

3.4 Summary Discussion

From the above analysis several important points pertaining to the assessment of cumulative and indirect impacts as well as impact interactions within the EU EIA process can be identified. Firstly, it can be said that within the five representative countries of the European Union used in this study, the authors of EISs consider that they are assessing indirect and cumulative impacts as well as impact interactions to an adequate level (see Figure 3.1). However, review of the completed EISs reveal that although these types of impact are generally assessed they are, rarely, if ever, assessed in a scheme-wide and comprehensive manner (see Figure 3.2).

The reasons for this discrepancy between what the EIS author considers to be an adequate assessment and the level of assessment perceived to be appropriate by the reviewer for these types of impact are manifold. However, the evidence points to the fact that many authors attempt some sort of assessment of indirect and cumulative impacts as well as impact interactions but they do not do so in a comprehensive way. Therefore, if a method were available that caused authors to consider these impact types at an early stage in the EIA process then a comprehensive assessment could be undertaken. An early assessment would be cost-effective as potential indirect impacts, cumulative impacts and impact interactions could be discounted at an early stage through a FONSI (Finding Of No Significant Impact), allowing more time and resources to be allocated to those impacts that are of significance.

Secondly, linked to the lack of a comprehensive methodology being applied in EIA, there is also only a limited application of techniques for indirect and cumulative impacts and impact interactions being utilised by EIA practitioners in the EU. Evidence for this comes from Questionnaire 2, question 4 which indicates that mathematical modelling, or simulation modelling, is the only commonly employed EIA technique that is capable of assessing indirect and cumulative impacts as well as impact interactions (see Volume 1).

The reasons for not employing applicable techniques are, probably, interrelated with the lack of application of methodologies and can be linked to the lack of EIA training amongst EIA practitioners and the lack of available information throughout the EU. The most disturbing aspect is that EIA practitioners in several EU countries are not aware that the assessment indirect and cumulative impacts as well as impact interactions is required by the EIA Directive. Perhaps even more disturbing is that at least 8 EU countries have not

translated this requirement directly into the their national legislation (see Volume 1).

Thirdly, what is also revealed in the above data is the inconsistency in the writing of EISs, especially in relation to indirect impacts, cumulative impacts and impact interactions. Ignoring the anomalous results given in Questionnaire 3, question 4 concerning the inclusion of specific sections or chapters concerning indirect impacts, cumulative impacts or impact interactions, the results of which were not supported by any evidence. Many European EISs are now of a satisfactory quality, there are still large discrepancies between EISs with many missing important features, such as avoidance of double-counting and testing of sustainability, that are important aspects in the assessment of cumulative and indirect impacts as well as impact interactions. This failing could be attributed to a general lack of EIA training as underlined in this questionnaire study: from a sample of sixty EISs, which attempted to include specifically good examples of EISs, especially in relation to the assessment of indirect and cumulative impacts and impact interactions, only two were written by authors with any formal EIA training.

Related to the lack of EIA training is the lack of an appropriate forum in Europe where practitioners can access EIA related information, such as best practice examples, guidance and legislation. Several authors cited their lack of experience or lack of basic EIA knowledge as a problem in writing an EIS. Given the complexity of assessing indirect and cumulative impacts and impact interactions, if practitioners cannot access basic information then they cannot be expected to undertake and extensive and comprehensive assessment of these, more complex, impact types.

The study ascertained that EIAs use a variety of assessment techniques, few of which are appropriate and capable of predicting and evaluating indirect impacts, cumulative impacts and impact interactions, such as mathematical modelling. However, many EIAs appear too limited in their coverage of environmental criteria using these types of techniques. These limitations could be attributed to a lack of baseline data that can be used in models. The lack of baseline data is a fundamental flaw in any attempt to accurately and meaningfully undertake an assessment of indirect impact, cumulative impacts or impact interactions which all require a very high level of environmental information to be assessed successfully and comprehensively.

3.4.1 *IPPC AND OTHER LINKAGES TO EIA*

The evidence gathered from the answers to Questionnaire 3 (question 3.i) indicates that some linkage occurs between EIA and other authorisation procedures. These include industrial so called integrated pollution control applications, generally made to the relevant authorities in the Member States for the licensing of industrial operations. The publication of Council Directive 96/61/EC concerning *integrated pollution prevention and control* (IPPC) sets out a framework by which Member States must take into account environmental information when considering the development of new industrial plants and re-licensing of existing plants.

New plants that are covered by the IPPC Directive may also fall under the jurisdiction of the EIA Directive. The two Directives overlap in their requirements. Firstly, both Directives require the collection and analysis of information concerning the emission of pollutants, nuisances and waste streams from the proposed integrated process plant. The justification behind this data collection differs between the two Directives.

Data collection under the EIA Directive is primarily for planning purposes and forms part of a wide information gathering exercise aimed at assisting the development consent decision-making process. Whereas, data collection in accordance with the IPPC Directive is for pollution control purposes and is intended to allow the relevant authority in the Member State to ensure that the proposed plant will be operated to reduce or even eliminate pollution. Where the information is required under both Directives, data is only collected once, whereupon it is included in both submissions to the competent authorities.

The second area of overlap between these Directives concerns the issue of conditions on polluting emissions. The relevant planning authority may be able to issue conditions covering emissions, whereas the pollution control authority must attach constraints to polluting emissions as required under the IPPC Directive.

This study has revealed that information gathered for an EIA is also used for other authorisation processes, such as water protection legislation, points to processes and linkages to these regulations similar to those linking the IPPC Directive to EIA. It is likely that these parallel applications follow a similar course to that of an IPPC application, but it is beyond the scope of this study to investigate these processes.

However, what is of interest to this study is the issue of so-called *cross-media* impacts in IPPC, investigated by the Network for the Implementation and Enforcement of Environmental Law (NIEEL) in their 1996 report on the *Cross-Media Evaluation of Environmental Impacts from Industrial Installations*. Cross-media impacts referred to in the NIEEL report can be considered to be indirect impacts and, perhaps, impact interactions in the context of this study.

The NIEEL report identifies three Member States, specifically Germany, the Netherlands and the UK, that claim to have procedures for the assessment of cross-media effects in place. This is despite all three of these Member States citing, “the lack of assessment criteria and methods” as a practical problem in the implementation of the EIA Directive in relation to cross-media evaluation of environmental impacts from industrial installations. Moreover, both Germany and the Netherlands claim that another problem with implementation is the concept of “interaction” of effects.

However, in the case of the two Member States identified as having specific advice on cross-media impacts for IPPC applications and used in this study, Germany and the UK, neither of the European Reviewers for these countries identified the IPPC documentation of cross media evaluation as being applicable to EIA in Questionnaire 1. Thereby demonstrating that the linkage between EIA and IPPC is not as strong in practice as it is in theory as EIA practitioners are unaware of guidance that may be applicable from other disciplines. This is further underlined by the results of Questionnaire 2, in which none of the EIS authors claimed to have used the guidance given by the relevant pollution control authorities for assessing indirect impacts or impact interactions.

The advice provided in Germany and the UK is discussed in more detail in Volume 1.

Linkages and cross-over between IPPC applications and EIA are theoretically possible, however the flow of information between the two procedures needs to be improved especially in terms of experience and use of techniques and methods in data collection, analysis and evaluation.

Additionally, there is case for further extending the linkages of IPPC and EIA, especially to industrial developments, to an Environmental Management System (EMS). Similar to the relationship between data collection for IPPC and EIA, the requirements of an EMS, such as EMAS (Eco-Management and Audit Scheme), are often based on information that is gathered,

analysed and evaluated in an EIA. For example, the Register of Effects required by an EMS, listing all potentially polluting processes and their environmental effects, could be compiled from information gathered at the scoping, baseline data collection and impact identification stage of an EIA.

Section 4.0: Conclusions and Recommendations

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This study has revealed a great deal about how indirect impacts, cumulative impacts and impact interactions are assessed within the European Union under the remit of the EIA Directive (85/337). From the results of this study it can be said that:

1. The assessment of indirect and cumulative impacts as well as impact interactions is, if undertaken at all, generally performed on a selective and site specific basis.
2. There is much confusion amongst EIA practitioners within the EU about the requirements for the assessment of indirect and cumulative impacts as well as impact interactions. At one extreme, many authors perceive that they are already undertaking comprehensive assessments for these impact types although there is limited evidence for this from the content of published EISs. At the other extreme, practitioners remain unaware that there is a requirement for the assessment of these impact types within the EIA Directive or their own national legislation.
3. There is an apparent lack of data sources of sufficiently high quality for comprehensive, scheme-wide assessments of indirect and cumulative impacts as well as impact interactions. This is true for environmental criteria and developmental criteria, such as knowledge of future developments.
4. There are few methodologies that are suitable and practical for the assessment of indirect and cumulative impacts as well as impact interactions.
5. Other countries outside the EU do not, or do not propose to, undertake the assessment of cumulative and indirect impacts as well as impact interactions at the project EIA level. Instead these countries expound integrating the assessment of these impacts at a higher level through a system of Strategic Environmental Assessment (SEA).
6. Examples of good practice in assessing the impacts of cumulative and indirect effects as well as impact interactions are few, especially within the EU.

7. Techniques for undertaking the assessment of cumulative and indirect impacts as well as impact interactions in a comprehensive manner are complex and skill and/or capital intensive, for example the use of GIS. However, the main problem with the assessment of these impact types originates with the lack of comprehensive, scheme-wide impact scoping as even site specific impacts are often assessed comprehensively.

4.2 Recommendations

In respect to this study the following recommendations can be made concerning the improvement of assessing indirect and cumulative impacts as well as impact interactions within the EIA process:

1. Consider the implementation of the assessment of indirect and cumulative impacts as well as impact interactions into the EIA Directive and in a future SEA Directive. Implementation of the assessment of indirect and cumulative impacts as well as impact interactions into SEA is a more radical 'top down' approach which would require legislative change and would therefore be a long term strategy. However, it is the preferred method suggested by much of the available literature (Court, Wright and Guthrie, 1994) and the Expert Panel for this study. The most significant conceptual, technical and administrative problem of dealing with indirect and cumulative impacts as well as impact interactions are the consideration of smaller projects and changes, none of which have impacts to warrant the assessment of indirect and cumulative impacts as well as impact interactions individually. There is therefore a clear role to be fulfilled by the planning process.
2. Clarify the requirements of the EIA Directive (85/337/EC) in terms of assessing indirect and cumulative impacts as well as impact interactions. This could be done in the short term through the release of official guidance and in the long term by revisiting the text of the now amended Directive (see also point 5 below).
3. Consider amending the text of Annex III of the EIA Directive to include a requirement for the inclusion of a specific chapter or Section within every EIS covering the assessment of indirect and cumulative impacts as well as impact interactions.
4. Develop a training policy, plan and programme for EIA practitioners covering general EIA legislation and requirements as well as specifics such as identifying and assessing indirect

and cumulative impacts and impact interactions using and adapting methodologies and tools.

5. Develop an internet website specifically for the dissemination of EIA related information to practitioners in EU Member States, similar to one developed for the Australian EIA Network. The website could include legal requirements, guidance, case studies, examples of best practice and so forth covering the whole spectrum of EIA process and practice not just limited to the assessment of cumulative and indirect impacts as well as impact interactions.

4.3 Areas for Further Study

This study has identified several areas where further study and more information are required in order to capitalise on the findings of this study and the discrepancies it has discovered within the EIA process of Member States, and to ensure that the assessment of indirect and cumulative impacts as well as impact interactions improves. Studies could include:

1. A comprehensive testing of the methodologies recommended in this study. The methodologies could be tested in an area of intensive development but where there is a large amount of information available. An area such as north Derbyshire in the UK could be ideal for a staged retrospective study due to its variety of developments but domination of one project type, open cast coal mining, in a small area. Such a study would not only demonstrate the practicality of using the recommended methodologies but also highlight informational deficiencies in the regional database.
2. An investigation into the national legislation of the EU Member States to identify the exact shortcomings in translating the requirements for the assessment of indirect and cumulative impacts as well as impact interaction into their EIA procedures. This investigation may be more complex than it appears due to the great number of national laws that the requirements of the EIA Directive have been implemented in some Member States.
3. An investigation into the extent and quality of data resources in the EU in terms of environmental and developmental criteria. It is essential for the comprehensive assessment of indirect and cumulative impact as well as impact interactions that the correct types of information are available at whatever level this type of assessment is implemented.

4. An investigation into good practice case studies in the assessment of cumulative and indirect impacts as well as impact interactions throughout the world in a similar vein to the 1994 SEA study conducted for DGXI. Such research could be used in the development of guidance documents given the very limited experience of assessing these types of impact within the EU.
5. Development of a programme of follow-up studies monitoring existing projects that are recognised as having a range of indirect impacts, cumulative impacts and impact interactions. Small pilot studies should be developed at first to concentrate on specific issues. As knowledge is assimilated, the studies could then be expanded to investigate bigger and more complex projects and impacts. These studies would be essential to improving the technical and scientific understanding of the assessment of indirect and cumulative impacts as well as impact interactions (Cooper & Canter, 1997).

4.4 Deficiencies and Action Areas to Improve the Current Application of the Assessment of Indirect and Cumulative Impacts and Impact Interactions in the European Union

Figure 4.1 below highlights deficiencies which have been identified during the course of this study on the treatment of cumulative and indirect impacts as well as impact interactions in the European Union. Deficiencies are identified under the "Problem" heading, with the "Action Areas" column suggesting the activities which could be implemented to address these problems. Finally, the "Resolution" boxes suggest, where applicable the actions that could be taken to resolve the problems identified in the previous columns and the main actors involved in implementing the resolutions.

Key to Actors	
CA	Competent Authorities and review bodies
EC	European Commission
EIAC	EIA Centres
LA	Local Authorities
MS	Member States
RA	Regional Authorities

4.5 Guideline Methodologies

The Guidelines are intended for use by the Environmental Impact Assessment practitioner and developer. The aim is to provide guidance on practical methods and approaches to assess indirect and cumulative impacts of a project and impact interactions. The Guidelines are not intended to be formal or prescriptive but are designed to assist EIA practitioners in developing an approach which is appropriate to a project, and to consider these impacts as an integral part of the EIA process. Volume 1 identifies 15 specific methodologies or approaches to the assessment of indirect and cumulative impacts and impact interactions, which have been taken from the literature review, review of published guidance for EIA and the case studies. The methodologies were then examined against criteria which included adaptability to different project types, adaptability for different environmental conditions and the potential cost of using the method.

There were two similar methods that were considered to provide the best and most adaptable basis for the analysis of indirect and cumulative impacts and impact interactions within the EIA process. These were the Seven Steps methods developed by Clark and Damman. They set out the various steps to follow for incorporating the assessment of such impacts at the project and more strategic level.

The approach to the assessment of indirect and cumulative impacts and impact interactions that has been developed for the Guidelines has a number of stages in common with the Seven Step methods. Both follow the logic of the assessment process, including the stages of data collection, identification of potential impacts, and the analysis of impacts.

A number of the other methodologies identified in Volume 1 have been considered further and developed for use in the Guidelines; these include checklists, modelling interactions pathways and networks and expert opinion. Within the Guidelines the methodologies or tools have been divided into two different types; those that identify the indirect or cumulative impacts or impact interactions, and those that evaluate the impacts. Some methods can be used for both purposes. The literature review also classified methods for the assessment of such impacts into two different types. Both were, however, types of impact evaluation using either scientific or planning methods.

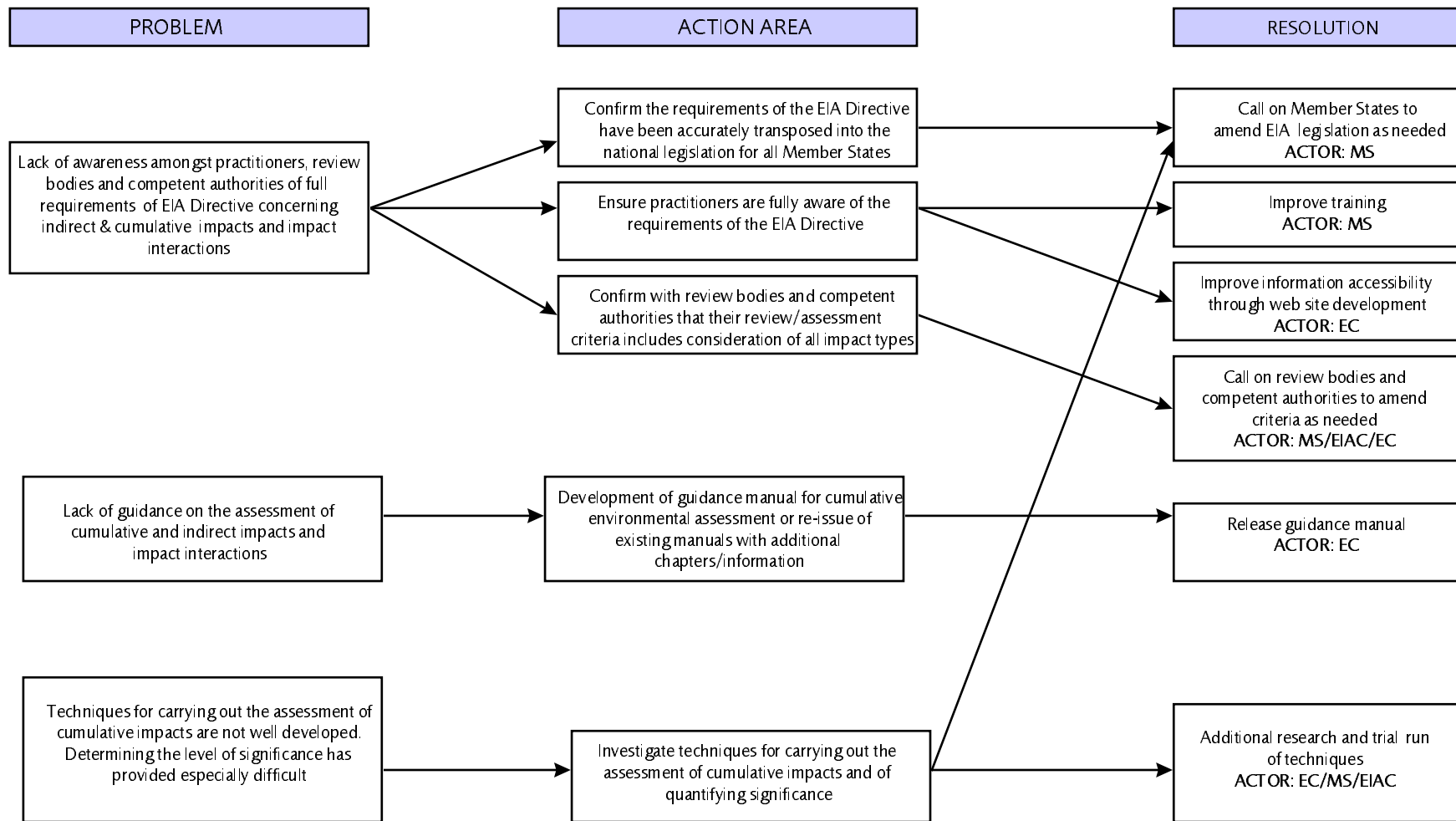


Figure 4.1: Flow charts showing the problems, action areas and resolution of deficiencies identified in the EIA System of the European Union

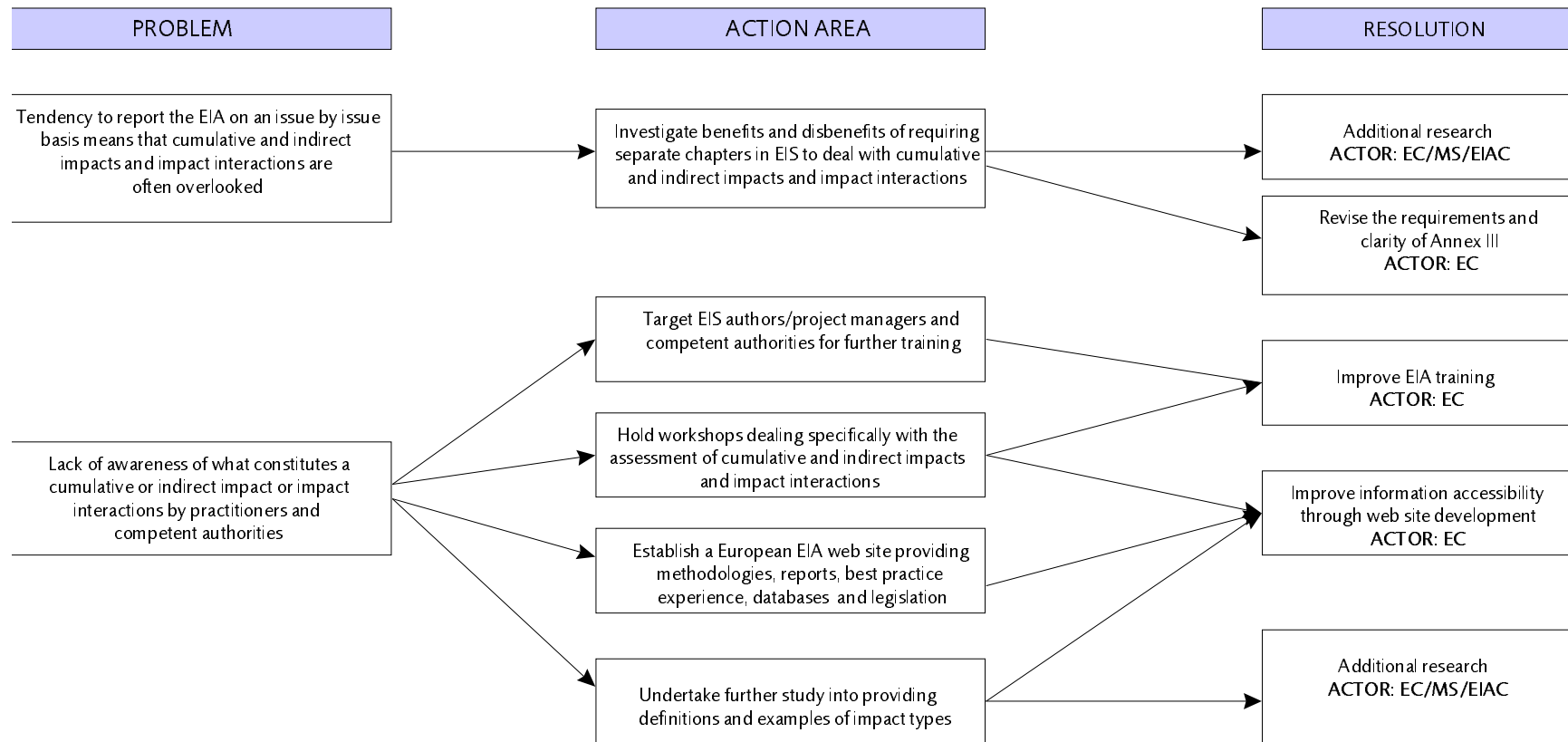


Figure 4.1: Flow charts showing the problems, action areas and resolution of deficiencies identified in the EIA System of the European Union (continued)

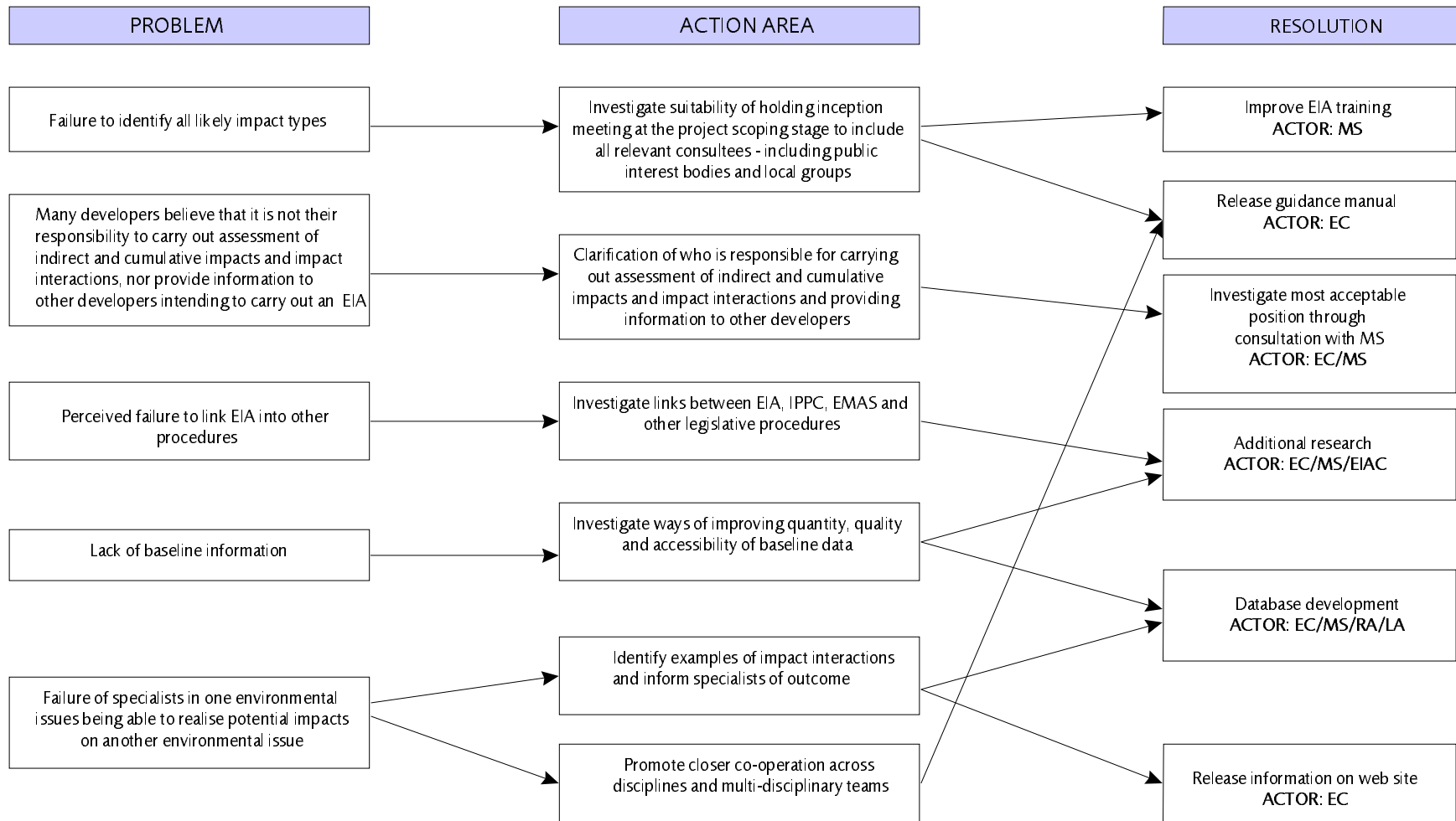


Figure 4.1: Flow charts showing the problems, action areas and resolution of deficiencies identified in the EIA System of the European Union (continued)

Appendix A: Summaries of the Selected Case Studies

Summaries of the Selected Case Studies

Finland

FINLAND		
	Project Title	Project Type
Annex I		
1	Development of the Highway E1 to a motorway between Lohja	Highway
2	Additional Railroad, Luumaki - Vainikkala	Rail infrastructure
3	The Vuosaari Harbour Enterprise, Helsinki	Ports infrastructure
4	Inkoo Coal-fired Power Plant	Energy
Annex II		
5	Heaping Area for Calcium Sulphate Sediments for KEMIRA Pigments Oy in Pori	Extraction
6	Location of the Regional Waste Facility of East-Savo	Non-Annex I waste project
7	Kelukoski Power Plant in Kitinen, Lapland	Non-Annex I energy project
8	Enlargement of Outokumpu Tornio Stainless Steel Production Mill, Lapland	Amendment to Annex I Project
9	Tuovila-Ventusneva 400 kV Power Line	Electricity transmission lines
10	Central Wastewater Refinery Plant, Turku	Non-Annex I waste-water project
11	Isterinsuo, Yli-li, Peat Extraction	Non-Annex I extraction project
12	Peat Extraction, Salosuo, Ranua	Non-Annex I extraction project

DEVELOPMENT OF HIGHWAY E18 BETWEEN LOHJA AND SALO

Extensive EIA of 63 km of highway between Lohja and Salo. The main impacts of the study were identified as being impacts on the natural environment, such as fragmentation of fields and woodlands, crossing of waterways and the threat to groundwater resources. Impacts to the human environment included noise

pollution and the benefit of improving the transport links between the towns along the highway route.

The EIA employed a wide variety of techniques to identify and assess environmental impacts, including matrices, checklists and modelling, however, so specific methodology was employed to identify and assess cumulative impacts, indirect impacts or impact interactions. Despite this a number of cumulative and indirect impacts as well as impact interactions were identified. The most extensive of these assessments was the consideration of the interactions between impacts to local communities and land-use. Quite extensive assessment of the regional interactions between communities, economic life and employment were undertaken, although no specific technique was identified for undertaking this assessment.

This EIA had the longest duration of all the projects reviewed as part of this study, 750 man-days against an average of 192 man-days. Additionally, the project carried a fee value of 277,270 ECUs, substantially above the average of 39,477 ECUs. Additionally, during the general planning stages of the project, several pilot EIAs were undertaken requiring another 300 man-days and carrying a fee value of 119,000 ECUs. The EIA was undertaken by a mixture of in-house expertise from the lead consultant and external, specialist sub-consultants. The EIS was a compilation of specialist reports with the lead consultant taking an editorial role.

ADDITIONAL RAILROAD LUUMAKI - VAINIKKALA

Development of 50 km of railway between Luumaki and Vainikkala in Finland. The main impacts of the study include cuts through eskars (ridges) and hills, fragmentation of wild forests and the treat to groundwater resources. Scoping of potential effects on the human environment identified the potential effects of noise, land use and mobility as significant impacts.

The EIA utilised several techniques to identify and assess impacts including, weighted matrices, overlay techniques for design and environmental impact maps, and mathematical models for noise assessment and accident risks. No specific methodology was used to assess cumulative or indirect impacts or impact interactions.

The EIS contains a specific section on the assessment of the indirect impacts between landscape elements and cultural heritage. The proposed railway was considered to have some unavoidable negative impacts on certain open, cultural landscapes. Although, the rail alignments considered mainly avoided culturally and historically significant receptors, certain historical buildings would, in the long term, lose their cultural importance.

The EIA was shorter in duration to the average EIA reviewed for this study, approximately 140 man-days as opposed to the average of 192 man-days. No fee value was recorded for the EIA. The EIS was compiled and written by an entirely in-house team.

A NEW CARGO HARBOUR FOR HELSINKI

Proposed development of 159 ha of water front to improve the existing harbour at Helsinki. Potential impacts of the development included disturbance of a nearby valuable natural area, dredging, extraction of sea-gravel and consequent heaping of this material, heavy land traffic noise and utilisation of the existing harbour areas for housing.

The EIA employed a wide range of techniques and methods, including matrices, overlay techniques and mathematical modelling for certain environmental components, such as noise. In addition to these more traditional methods and techniques, the EIA also employed a questionnaire to obtain the opinions of residents living in the study area and a MAUT (see Volume 1, section 2.6) technique, Stochastic Multiattribute Acceptability Analysis (SMAA) to compare all project alternatives and their impacts simultaneously. The SMAA method used a common valuation scale of 11 criteria was developed, however, this method is somewhat experimental and was deployed from the findings of a doctoral thesis.

The EIS had specific sections on cumulative impacts and indirect impacts. Cumulative impacts considered included:

- air emissions - an assessment of the total regional emissions was made using verbal argumentative techniques. The overall contribution of the project was considered to be small and emissions are considered to decrease through the construction

of the new harbour and increase if the existing harbour is expanded;

- transport impacts - traffic forecasts were made for the area surrounding the new harbour and assessments made using verbal argumentative techniques;
- noise effects - were modelled using mathematical techniques, however, noise impacts to the downtown area of Helsinki were assessed using only verbal argumentative techniques;

Indirect impacts were generally considered using verbal argumentative techniques and included the assessment of:

- impacts on workplace areas and employment - only rough estimations were made;
- impacts on the landscape;
- impacts on housing development - the possible transfer of the harbour to a new area would make it possible to convert existing harbour buildings into residential properties. An assessment was made considering different population densities;
- impacts on services; and
- impacts on marine recreational activities.

The EIA was approximately twice the average in terms of its cost and duration, when compared to other EISs reviewed as part of the study; the lead consultant who wrote the final EIS was allocated some 520 man-days and took a fee of over 80,000 ECUs. Specialist sub-consultants were used in addition to the lead consultant, however, their costs in time and fees are not recorded.

INKOO POWER PLANT

Development of up to 14 ha for a power plant. Potential impacts included cooling waters and waste water discharge may affect local fish and fishing industry; increased shipping traffic may affect a nearby archipelago by erosion; increased acid rain may affect nearby lakes and ponds of the Nuksio National Park; increased carbon dioxide emissions may affect agreed air quality agreements; and , the positive impact on employment generated by development of the power plant and associated traffic.

The EIS reported a number of cumulative and indirect impacts. The EIS included a specific section on cumulative impacts from sulphur deposition. Other cumulative impacts addressed included:

- impact of cooling waters on sea temperatures, assessments were made using mathematical modelling; and
- impacts on the quality and biology of sea waters surrounding the plant.

Certain indirect impacts are also addressed, including:

- indirect impacts to the local fishing industry;
- impacts to winter weather conditions such as fog and sea ice formation;
- impacts of power generation by-products, such as heaping effects, and the disposal of ashes and calcium sulphate;
- impacts from the development of a natural gas terminal; and,
- consideration of socio-economic impacts.

No specific methodology was described for the assessment of these impact types.

The EIS was written and compiled wholly by an in-house team of consultants. The EIA duration was close to the average length of time taken to conduct an EIA from this study group: 200 man-days whereas the average duration was 192 man-days.

HEAPING AREA FOR CALCIUM SULPHATE SEDIMENTS FOR KEMIRA PIGMENTS OY IN PORI

Project to develop 26 ha of land for a heaping area. Identified impacts included potential increase in the acidity and metal content of the water affecting the local fishing industry; increased traffic movements transporting sediments; possible change in humidity conditions after the construction of the heaping area; dust pollution affecting the local vegetation; and, fragmentation and disturbance of the local ecology.

The EIS had a specific section describing indirect impacts on the biodiversity of the region from the proposed development. These impacts were assessed using verbal argumentative techniques and were considered to be quite small. Other indirect impacts, also assessed using verbal argumentative techniques, included indirect impacts on the local fishing industry and socio-economic effects.

Certain cumulative impacts were also assessed within the EIS, such as the total noise impacts generated by the heaping operations and the proposed link road.

The EIA was conducted by a mixture of in-house expertise from the lead consultant and external sub-consultants. The EIS was compiled by the lead consultant.

LOCATION OF THE REGIONAL WASTE FACILITY OF EAST-SAVO

Development of up to 120 ha of land for a waste facility. Identified impacts included eutrophication of waters, impacts on groundwater and flora and fauna. Other impacts included impacts on recreation area and nearby settlements. There was no specific assessment of indirect and cumulative impacts or impact interactions undertaken as part of the EIA.

The duration of the EIA was very short in comparison with the other EIAs reviewed as part of this study constituting only 45 man-days opposed to the average duration of 192 man-days. The fee value of this EIA was also well under the average value of an EIA found in this study: 6,400 ECUs against the average value of 39,477 ECUs. The EIA was conducted by a mixture of in-house expertise from the lead consultant and external sub-consultants. The EIS was compiled by the lead consultant.

KELUKOSKI HYDROPOWER PLANT IN KITINEN, LAPLAND

Development of a hydroelectric power plant in Lapland creating a lake some 6 km in length. Potential impacts on the natural environment included, increased sedimentation during construction affecting water clarity and fish stocks; potential impacts on groundwater; and, flooding the river valley. Impacts on the human environment included destruction of settlements.

The EIA utilised a variety of techniques including checklists, matrices and mathematical modelling which was also employed in the development's application to the Finnish Water Rights Court. Indirect impacts were identified as part of the EIA and reported in the EIS in a specific section. These impacts were primarily associated with archaeology but little assessment of their effects was undertaken apart from to mention that the Finnish Museum's Office can lift the preservation order on the protected site to be affected by the proposed development. However, no specific methodology was employed to assess these impacts.

The EIA was conducted by an assemblage of sub-consultants but the EIS was written by a lead consultant. No fee values or man-hours were indicated by the resposdee.

ENLARGEMENT OF OUTOKUMPU TORINO MILL, LAPLAND

EIA of a large scale smelting mill capable of producing a maximum of 240,000 tonnes of ferro-chromium per year and 54,000 tonnes of steel per year (worst case alternative). Development impacts included impacts to the natural environment such as air due to nitrogen emissions, solid particles and dust; waste water and slag products; and, protected areas and bird nesting habitats. Impacts to the human environment included noise and air pollution impacts on nearby settlements and recreational areas, and associated traffic impacts.

The EIS considers cumulative and indirect impacts as well as impact interactions but not in separate chapters or sections. No specific methodology was identified in the EIS or by the author that was used to assess cumulative or indirect impacts or impact interactions.

The EIA project was slightly below average in terms of fees and time resources in comparison to the average project reviewed as part of this study; it used 160 man-days compared to the average of 192 man-days and the fee value was 33,600 ECUs compared to the average of 39,477 ECUs.

UUSIKAALEPYYY - KIKKOLA POWER LINE

EIA of a proposed development of 50 km of power lines traversing wilderness, agricultural and residential areas. Potential impacts included habitat fragmentation; impacts on agricultural land and waters, bisection of a designated residential area; and, visual intrusion on nearby settlements.

The EIA employed a variety of techniques including checklists, matrices, networks, best practice manuals and consultations. No methodology, however, was reported for the specific assessment of indirect and cumulative impacts as well as impact interactions. Despite this, the EIS reported indirect impacts on land-use and socio-economic effects, such as the impacts of passing a transmission line over agricultural land being used to farm Christmas trees, in a discrete section.

No fee values or man-hours were indicated by the respondent.

CENTRAL SEWAGE TREATMENT PLANT, TURKU

Proposed development to construct a new sewage treatment works to serve the 140,000 inhabitants of Turku. The proposed water treatment works would treat domestic and industrial wastes. The capacity of the plant would be 115,000 m² of waste every 24-hours. Impacts identified in the EIS included, potential impacts on nature such as improved water quality; impacts on the human environment included odour impacts on nearby settlements, visual impacts on the treatment works and reduced recreation opportunities.

The EIA was undertaken completely in-house by the lead consultant with EIS likewise being written by the lead consultant. According to the EIS author, the EIA employed several techniques for impact identification and assessment, such as checklists and matrices. The EIS, however, reported no indirect or cumulative impacts or impact interactions.

The author gave no indication of the financial resources available to the EIA, although the time resource, 90 man-days, was well below the average time taken to undertake an EIA (192 man-days) as defined by this study.

PEAT EXTRACTION, ISTERINSUO, YLI-II

Development of 110 ha of land for peat extraction. Potential impacts identified during the EIA included effects on vegetation, birds and fish; drying effect of the marsh outside the development area; peat dust; loading on rivers and associated eutrophication; impacts on nearby lakes; effects on reindeer pasture and calving areas; and, visual intrusion of the development.

The EIA was undertaken entirely by the lead consultant who also wrote the EIS. The author gave no indication of the financial resources available to the EIA, although the time resource, 60 man-days, was well below the average time taken to undertake an EIA (192 man-days) as defined by this study.

The EIS did not have a specific section dealing with cumulative impacts, indirect impacts or impact interactions. However, some indirect impacts and the interactions with another, nearby, peat

extraction area at Iso-Kinttaissuo were considered qualitatively. No methodology was specified for the assessment of these impacts.

PEAT EXTRACTION, SALOSUO, RANUA

Proposed development of up to 240 ha of land for peat extraction. Potential impacts identified in the EIS included effects on vegetation, birds and fish; drying effect of the marsh outside the development area; peat dust; loading on rivers and associated eutrophication; impacts on nearby lakes; effects on reindeer pasture and calving areas; and, visual intrusion of the development.

The EIA was undertaken entirely by the lead consultant who also wrote the EIS. The author gave no indication of the financial resources available to the EIA, although the time resource, 60 man-days, was well below the average time taken to undertake an EIA (192 man-days) as defined by this study.

The EIS did not have a specific section dealing with cumulative impacts, indirect impacts or impact interactions. However, some indirect impacts and the interactions with another, nearby, peat extraction area at Sääskisuo were considered qualitatively. No methodology was specified for the assessment of these impacts.

Germany

GERMANY		
	Project Title	Project Type
Annex I		
1	B188 Vorsfelde - Bergfiede	Highway
2	A20	Highway
3	Processing Plant for Recyclable Material at Seelze	Hazardous waste
4	B452 Reichensachsen Bypass	Highway
Annex II		
5	MVA Stapelfeld	Domestic waste incinerator
6	Extension of landfill at Dresden	Extension of Annex I Project
7	Securing of North Sea - Baltic Canal	Transport project
8	Velen Bushus Landfill	Waste disposal
9	Rosenow Landfill	Domestic waste disposal
10	Extension of Gravel Extraction, Iffezheim	Extraction project
11	Extension of Gravel Extraction, Monsheim	Extraction project
12	Windfarm at Meerberg	Energy project

EIA FOR PRIMARY ROUTE BYPASS B188 BETWEEN VORSFELDE AND BERGFRIEDE

This EIA was conducted in order to establish the optimal routing of the B188 primary route with the least environmental impact, bypassing four villages and one town to the west of Wolfsburg in Lower Saxony. The EIS was published in April 1994. The study area had a length of 20 km and an average width of 4 km.

The study was conducted in two phases with the first analysing the area for key environmental areas. The second phase included the discussion on alternative routings.

Main direct impacts are land-use, noise, and contamination of air and surface water run-off. A road is also always a barrier dividing territories. A positive impact is expected in diversion of traffic from the villages and town.

The EIS includes detailed sections concerning cumulative and indirect impacts as well as impact interactions. The following sections have taken directly from the EIS:

Secondary and Cumulative Effects and Risks

It is important not to only consider direct impacts on receptors during the interpretation of road projects but to also reflect on:

- The follow on environmental impacts of developments (secondary impacts) and
- The impact interaction between the development with other projects or development with environmental impacts (cumulative effects).

The spatial impacts of a road are difficult to quantify so that a qualitative descriptive assessment needs to be carried out for:

- Secondary positive and negative impacts in the immediate surroundings emanating from the development, and
- Environmentally relevant effects in the spatial development of a region that could evolve from the development.” (3.3h)

Positive secondary impacts

Positive secondary impacts are found mainly in relation to the former B188 road, which now bypasses various population centres. A reduction in the open country will be minimal although the existing impacts will be reduced. Existing impacts such as the accumulation of contaminants in soil and vegetation will continue to represent a risk.

Negative secondary impacts

In this case the impact of the road on the region should be considered as it could create an increase in traffic due to an improved infrastructure or increasing attractiveness for industrial and residential developments.

Cumulative effects

Cumulative effects have to be considered for the whole area of development. This is connected to the high-speed rail link

between Hanover and Berlin. A parallel line for the high speed and standard rail tracks is already being built. The route runs west to east through the area of development. The cumulative environmental effects of the rail links and the planned road especially on the human population will be considerable. This is specifically related to the severing of direct links between areas, which is why the authors of the report suggest a route parallel to the existing rail link". (3.4)

The baseline and impact information is collated independently from one another and then illustrated on a map by means of overlays in order to determine potential areas of conflicts or conflict poor zones. This is the basis on which it is decided what potential routings may be suggested.

No further details on techniques for the assessment of secondary and cumulative effects were detailed in the EIA report but the questionnaire returned by the author suggested the use of checklists, matrix, weighted matrix, network, overlays, best practice, manuals, consultations with the local authorities and the directly involved individuals including farmers, forest wardens etc.

The consideration of minimising cumulative impacts is given in a specific section and suggests the of running the new primary route along existing, planned rail tracks considers sustainability issues even when they are not mentioned by name. Indirect impacts are also discussed in some detail in a specific section (see above).

EIA FOR CONSTRUCTION OF THE FIRST PART THE BAB A20 MOTORWAY AS PART OF THE DETAILED DESIGN PROCESS

The motorway A20 (Ostseeautobahn) was planned and designed in order to revitalise areas along the Baltic coast between Lübeck and Rostock, in the State of Schleswig-Holstein. The EIA is part of the detailed design process assessing the impacts of the detailed design of the motorway and suggesting compensation measures.

The EIA was conducted on a 6.4 km stretch agreed by the planning authorities in the land-use planning process. The EIS was published in September 1995.

Relevant impacts were concentrated in two areas with impacts on humans, flora & fauna, soil, water and landscape. The EIS contained a specific section on impact interactions and used the

Impact Interaction Checklist methodology discussed in detail in Volume 1 (section x.x.x). The interactions were discussed in terms of synergistic and antagonistic effects. The EIS also contained specific sections discussing cumulative impacts and indirect impacts.

Boundaries in the form of impact zones for emissions were determined using guidance issued by the Ministry for Transport. A matrix was used to identify the impact and accumulation effects on sensitive areas. The weighted matrix technique was used in ranking of the results. Mathematical-physical modelling was used to determine the effects on climate and air quality.

The report is a landscape-planning tool that includes direct mitigation measures for impacts on the significant receptors so that a degree of sustainability is ensured. However, no direct assessment of significance was made in the EIS.

The author did not return a questionnaire so no comments can be made concerning the financial and time resources allocated to the project.

EIS FOR THE EXPANSION OF THE INDUSTRIAL SITE OF RIEDEL-DE HAËN IN SEELZE

The facility for material and thermal processing of liquid waste will be installed in an existing building on the industrial site occupied by the company in Seelze, Lower Saxony. The area studied has a radius of 1.65 km. The main impacts described are air emissions, potential contamination of water through water used for cleaning purposes, and some waste arising from the process. The EIS was published in November 1995.

Sensitive receptors include the population in neighbouring residential, as well as recreational and agricultural areas. There are 7 sites designated for environmental protection in the study sector. Additionally, the nearby Leine river was of concern due to elevated heavy metal contamination originating from the local geology of the Harz mountains and the mining activities associated with this region.

The EIS included a specific section on impact interactions and used two of the methodologies discussed in Volume 1: impact interaction pathways (see Volume1, section 5.2.2) and verbal

argumentative techniques (see Volume 1, section 5.2.4). The following data has been translated directly from the EIS:

Impact interactions

Two categories of impact interactions were analysed for the EIA:

- Impact translation to other receptors due to mitigation measures;
- Impact pathways”

Impact translation

No impact translations to other receptors were identified due to the recycling of most of the generated waste, lack of wastewater generated and extensive emissions control. (As defined by German Law)

Impact pathways

“The investigation of impact pathways demonstrates that the concentration of air borne pollutants is significantly lower than the daily impact on human beings and is deemed irrelevant”

Impact interaction and cross media impacts were considered on the basis of German law and their insignificance demonstrated by verbal argumentative techniques.

No reference to the actual techniques could be identified in the text of the EIA but during the interview with the author it was mentioned that overlays, physical modelling, best practice manuals and the verbal argumentative method was used.

The EIA was conducted by a mixture of the lead consultant's in-house expertise and specialist sub-consultants. The EIS was written by a compiling the specialist reports produced by the various consultants. The resources allocated the EIA were below average in terms of time, only 150 man-days as opposed to an average of 192 man-days for EIAs considered for this study. Financial resources allocated were well above average using 92,500 ECUs compared to average value of 39,477 ECUs in this study.

EIA FOR THE B452 BYPASS OF THE TOWN OF REICHENSACHSEN

The volume of road traffic on the primary route through the town of Reichensachsen has increased considerably following Reunification of Germany. Consequently, a bypass was proposed to minimise the impact on the town and its population. The EIA conducted for this proposed project based the assessment on land-use planning criteria to identify the route of least environmental impact for the road. The EIS was published in June 1996.

The area studied was approx. 500 ha. The EIA examined potential effects using three different impact classifications: Construction Impacts, Impacts Generated by Plant and Operational Impacts. The construction phase could include impacts due to temporary land-use, and temporary lowering of groundwater, sealing of areas, noise & dust.

The operational impacts considered included barrier effects of the road, permanent land-use changes, surface and groundwater influences, and the reduction of access between areas divided by the road. The operational phase impacts included noise nuisance, air emissions, usage of salt or other de-icing materials, surface water runoff and visual impacts.

The most critical receptors were considered to be surface and groundwater, landscape, flora/fauna, residential areas and the historical and culturally important settlement of Reichensachsen.

The authors used the Impact Interaction Networks approach developed by Sporbeck *et al.* (See Volume 1, section 5.1.8) by identifying links between landscape components, which are very sensitive to environmental changes and potential impacts. The effect could be described as impact interactions that are confined to a certain landscape element, such as a wetlands.

The following is an extract translated from the EIS:

In the study area it is of importance to consider the complex of impact interaction in the wetlands created by the Wehre stream. Hydrological impact interaction exists within the wetlands between the surface water, the structure of the wetlands themselves and the drainage of the groundwater body. The soil ecology, the habitat structure and the fauna are dependent on the hydrological

conditions. There are further linkages between the habitat structure with climate/air quality, retention conditions and visual elements of the landscape.

A modified ecological risk analysis is used in order to assess the environmental impacts. This follows the relationship between cause-impact-affected enabling the identification of the relevant impact connections. Some of the impacts of the different variants (routes) on to the natural and built environment can be measured in quantitative values (noise levels in dB (A)) Other impacts will need qualitative as well as quantitative assessments by using the concept of risk assessment.

During the final comparative assessment of the proposed routes the qualitative approach - using verbal argumentative methods - is preferred in order to make the results of the study more accessible for the interested population and local authority.

The author's questionnaire indicates that checklists, weighted matrix, networks, overlays, best practise manuals and expert consultations were employed in the EIA. Other methods were described as "verbal-argumentative deductions and descriptions of the impacts". It is suggested that basic scientific methods such as modelling and overlays are used to assess the baseline situation and the sensitivity of the individual receptors. When it comes to forecasting the impacts and impact interactions the main approach used was verbal argumentative methods (see Volume 1).

The EIA was conducted entirely by an in-house team from the lead consultancy. The EIS was then compiled from the individual reports written by the in-house team. The author, however, provided no details of the resources, time and financial, allocated to the EIA.

EIS FOR THE EXTENSION OF THE DOMESTIC WASTE INCINERATOR AT STAPELFELD

The extension of the waste incinerator was proposed due to the future needs predicted for the city of Hamburg. The area of the study varies but averages 64 km² for each environmental receptor with a maximum of 87 km² considered for the assessment of soil. The EIS was published in June 1994.

Air Emissions, Visual Impacts and Transport Effects, were the three main effects impacting on the population and sensitive receptors, such as flora and fauna. The report is focused on the human population as the main receptor.

The EIS discusses various definitions of impact assessments followed by a list of identified impact interactions that are discussed in the chapters describing the individual receptors. The cross-media paths were projected on a map using overlays to demonstrate high levels of air pollution and the effects on nearby moors and natural areas that are also affected by a motorway and a primary route.

The EIS was subdivided into 4 parts, a general section, a technical section, a spatial section and the report conclusions.

The core of the EIS includes a detailed description of the environment and its elements in order to determine the environmental impacts. The potential impacts were assessed in turn by expert analysis. The expert reports included specific issues that characterised existing impacts such as toxicological issues, noise and the distribution of impacts.

The EIA was conducted by a mixture of in-house expertise from the lead consultancy and specialist, external sub-consultants. There is no direct reference in the EIA of what techniques had been used in the study but the author indicates in the questionnaire the use of matrix, best practice guidelines and mathematical-physical modelling. The EIS was compiled from the individual reports made by the various consultants.

EIA TO THE EXTENSION OF THE RADEBURGER STRAÙE LANDRAISE, DRESDEN

The landraise was designed to extend an existing landfill near Dresden. A licence application for a horizontal extension was also under development. The existing landfill was in the void left by a gravel and sand quarry. An EIA was carried out on a voluntary basis in order to find acceptance for the project as residential areas are located at a distance of 120 m from the site. The EIS was published in March 1995.

The study area was around 200 ha with various sensitive receptors including the residential area with two child care units to the south-west of the site. A key issue was the lack of base sealing of the existing landfill and the effects on the underlying hydrogeology. It was estimated that approximately 10% of rainwater entered the aquifer as leachate.

Cumulative impacts are discussed in the EIS, the following example has been translated directly from the EIS:

During the spatial analysis the value of the receptors and their sensitivity towards the existing impact is assessed. This is then considered in relation to the expected added impact to determine the toleration or the conflict. This is followed by the assessment on how conflicts can be solved, minimised or mitigated. The relationships are determined verbally argumentative and the impacts assessed in five phases.

This is followed by a discussion of the relationships between each receptor or receptor complex with the impacts resulting from the project. Each impact is then categorised in one of the following criteria of significance:

- Phase 0: positive impact;
- Phase 1: no impact;
- Phase 2: minimal negative impact, no mitigation measures necessary;
- Phase 3: tolerable significant negative impact, mitigation measures are to be carried out;
- Phase 4: intolerable significant negative impact, Level of unacceptability is reached.

The project sustainability is discussed in the necessity of implementing the suggested mitigation measures in order to continue the operation of the landfill for a further 50 years.

The EIA was conducted with time and financial resources slightly below the average recorded in this study, using approximately 160 man-days as opposed to an average of 192 man-days in this study and utilising 26,000 ECUs in financial resources, compared to the average financial resource of 39,477 ECUs for EIAs in this study.

The EIA was undertaken by a combination of in-house expertise from the lead consultancy and external, specialist sub-consultants.

The main part of the EIS was written by the in-house team with the specialist reports incorporated into the EIS document.

*EIA FOR THE RENOVATION OF THE CANAL CONNECTING THE
NORTH SEA WITH THE BALTIC (RENDSBURG AREA)*

The canal connecting the North Sea with the Baltic was built in the 1920s without envisaging traffic and type of vessels used in recent times. Between 1955 and 1965 traffic doubled and larger vessels began to destroy the banks due to higher back stream velocities. A programme is in place to renovate the canal from km 5.0 to 79.2 so that it is useable by modern shipping. The part of the canal discussed in this study, east of Rendsburg in the State of Schleswig-Holstein, constitutes the last phase of the project.

The EIS was published in August 1995. Significant impacts were identified several environmental components, including soil, flora/fauna, and long term landscape impacts. During the development phase air quality and recreational value were predicted to be significantly affected.

The EIA employed the Impact Interaction Network methodology (see Volume 1, section 5.2.2). The following explanatory paragraph relating to Figure 5.5 (Volume 1) has been translated directly from the EIS:

A rather confusing diagrammatic representation of the impact interactions is created due to the necessary generalisations and due to the lack of existing information. The biological ecosystem elements Fauna and Flora play a most central role. The high number of impact relationships leads to a high number of possible influences that can steer the ecological condition and value. The potential reactivity of the receptors and their secondary impacts increase with the growing number of impact relationships. This means that there is a high chance of significant changes in the entire ecosystem if there are impacts on these central ecosystem elements of Flora and Fauna.

The EIS did not have specific sections on cumulative or indirect impacts, although some cross-media impacts were discussed, such effects of dredging re-mobilising heavy metal contamination into the canal waters, under the relevant receptors.

*EIA FOR THE DETAILED DESIGN OF THE VELEN-BUSHUS
DOMESTIC WASTE LANDFILL SITE*

The waste authority of the district of Borken is presently operating two landfill sites which are expected to run out of capacity by 1997/98. A new landfill planned for any future waste for which there is no alternative to landfilling. The EIS for the proposed landfill was published in May 1995.

The site set out for the landfill was 29.5 ha and the study area was set at 1,010 ha. Relevant receptors were local wildlife habitats, surface water, air emissions including noise, as well as the delineation of the area for recreational purposes.

From the content of the EIS, overlays appear to have been used to assess which of the access roads to the landfill site would have the minimum impact on sensitive receptors. However, the EIS does not have any specific sections discussing indirect and cumulative impacts as well as impact interactions.

*WASTE DISPOSAL PLANT, ROSENOW, EIA ON DETAILED
DESIGN*

Proposed development to construct a landfill in Rosenow, Northwest of Neubrandenburg in the State of Mecklenburg-Vorpommern following a waste management study and land-use planning exercise on site alternatives. The study area varies according to the receptors with a diameter of 4.4 km for air emissions and 1.5 km for local relevant receptors.

The relevant receptors were considered to be humans through noise and odour, flora/fauna, soil and water due to the excavation of 80 ha of soil during the landfill construction.

The baseline survey was conducted by scientific means with most commissioned to individual sub-consultants. The determination of potential impacts was carried out by conflict analysis and discussed by verbal argumentative means. The assessment revealed that noise and air pollutants emanating from a primary route and the waste disposal plant could escalate to a cumulative impact on the study area. The excavation of 80 ha was also considered to have a significant effect on flora and fauna, soil, surface water and groundwater.

It appears that mathematical – physical methods were used to assess the impact from air borne pollutants and overlays were used to determine the cumulative effects from waste disposal plant, the access road and the primary route. The author returned no questionnaire.

EIA FOR EXTENSION OF GRAVEL PIT IN IFFEZHEIM

This study examined the effects on 23 ha of land that were sanctioned for the extension of a gravel pit in the framework of a previously conducted EIA. The development would extend the area covered by water to 76 ha. The quarry is used for the extraction of sand and gravel.

The EIA used boundaries to delineate study areas. The largest area has a 15 km radius which was used to discuss the geology, hydrogeology, and ecology. The most sensitive receptor in this operation was the groundwater. Further receptors are flora and fauna as well as human beings. The impact on these is being classified as minimal.

A factor of sustainability is included in the discussion on habitats and cross media impacts. Due to the project terrestrial habitats are transformed into aquatic habitats. Habitat elimination does not occur as it would if you seal of an area with a road or building. The future use of the lake as a recreational area ensures sustainability for the well being of humans.

EIA FOR THE EXTENSION OF THE GRAVEL EXTRACTION AT MÖNSHEIM

The gravel extraction operations at Mönsheim, east of Pforzheim in the State of Baden-Württemberg, were to be extended and the final resulting void filled with waste earth. The landfilling was subsequently scrapped due to environmental considerations. The operation was located in a forest area with major receptors being land-use, groundwater, noise, dust and vehicle emissions.

The authors stated that the main difficulty with the assessment of impact interaction is the lack of knowledge and is repeatedly mentioned in the chapters on this subject. Cross-media impacts are mentioned as follows and not further discussed:

The extension of the quarry would have a main impact on the hydrological regime of the area. Additionally, the loss of soil and land could impact on nearby forest stock.

Discussions on techniques are not detailed in the EIS but the author questionnaire indicates the use of checklists, matrix, networks, overlays, best practise manuals and consultation. The consultation included an extensive scoping with 25 participants and three separate process scoping meetings. The assessment of potential impacts was carried out using verbal argumentative techniques, without the use of quantitative tools.

The baseline survey was conducted with the support of specific experts, whose input also included the analysis of individual receptors and their potential sensitivity. The final EIS was written by the lead consultant integrating the specialist reports.

*EIS FOR A PROPOSED WIND FARM AT MEERBERG. STUDY
FOR SPATIAL ORDER PLANNING PROCESS*

The Wind Farm in Meerberg, near Hannover, Lower Saxony was designed to include 14 generating units. The study area encompassed 750 ha and main potential impacts were considered to be on fauna (specifically birds), and on visual impact on the landscape. A further significant impact was noise affecting the local population which is already affected by noise and air quality impacts from a nearby motorway.

This EIS was published in August 1995 and makes no reference to the assessment of indirect and cumulative impacts or impact interactions.

Greece

GREECE		
	Project Title	Project Type
Annex I		
1	Egnatia Odos - Environmental Impact Study of the Regina-Strimona section of the Egnatia motorways (1996) Developer: EGNATIA ODOS S.A.	Motorway construction project
2	Environmental Impact Study of the electrification of the Pireaus-Athens-Salonika railway line (1994)* Developer: Hellenic Railway Organisation TRADEMCO	Construction of power lines
3	COLORA Treatment Textile Factory* Developer: Colora A.E.	Manufacturing process
4	Environmental Impact Study of the proposed autofinancing and construction of motorway underpass, Thessaloniki. Developer: Public Power Corporation.	Highway project
Annex II		
5	Environmental Impact Study for Landfill Area at Tagarades in Thessaloniki Cycle (1995) Developer: OTA-MP Thessaloniki	Waste disposal project
6	Environmental Impact Study of a vinification-distillery plant Developer: E. Tsantalos A.E.	Manufacturing process
7	Environmental Impact Study for the sewage treatment plant in Rethimno City (Island of Crete) (1990) Developer: DEYAR	Sewage treatment works
8	Environmental Impact Study for the wider area of the Greek hydrological basin of the Nestos River (1993-94) Developer: Public Power Corporation	Transfer of water resources between river basins
9	Environmental Impact Study of ski centre at Vastlasa (1993) Developer: Local Union Municipality and Community of Prefecture Grahana	Ski-ing development
10	Environmental Impact Study of flood alleviation work to accommodate the Dentrepotamos (1994) Developer: Ministry of Environmental Physical Planning & Public Works	Transfer of water resources between river basins
11	Environmental Impact Study for proposed inert materials quarry, Drimos area. Developer: Cement Industry Titan	Quarry
12	Environmental Impact Study for completion of guest accommodation at Psarades-Prepes (2 floor) (1994) Developer: Region W Macedonian	Hotel complexes

* These project have been introduced to Annex I through the 1997 Amendment to the EIA Directive (85/337/EC)

Although many Greek EIAs investigated indirect and cumulative impacts as well as impact interactions, no documentary evidence could be found in support of these studies and the methodologies used for the assessment of these impact types. Consequently, the

information given below gives only very general information concerning the Greek case study projects.

EGNATIA ODOS - ENVIRONMENTAL IMPACT STUDY OF SECTION OF THE REDINA - STRIMONA OF THE EGNATIA MOTORWAY

An EIA study undertaken in 1995 concerning the Redina to Strimona section of motorway. The section is proposed to 32 km in length and would be a component of the big Igoumenitsa - Thessaloniki, Greek/Turkish crossborder road. The main impacts of the project were considered to be its trans-boundary impacts and its effect on the local and national economy.

In the study, environmental impacts from the construction and operation of the road were examined. Additionally, the existing surroundings were described and the potential effects of the road development investigated. Environmental impacts were evaluated and mitigation measures were suggested to minimise these effects. Indirect and cumulative impacts, as well as impact interactions were assessed, especially those concerning the effects of noise and air pollution.

ENVIRONMENTAL IMPACT STUDY FROM THE ELECTRIFICATION OF THE RAILWAY LINE PIREAUS-ATHENS-SALONIKA

An EIA undertaken in 1994 to investigate the effects of the proposed electrification of the main rail line between Pireaus to Athens to Salonika.

The project investigated the advantages of electrification compared with diesel motion, such as air pollution impacts; the effects of electric and magnetic fields influences; noise and vibration impacts; construction and operation of the line improvements within existing infrastructure; and, the net impacts of the overall development were examined in this study. There were some ecosystems identified along the proposed route with particular significance, which, consequently, had to be protected from development activity.

The results of the EIA reported that electrification of the rail line has mainly positive impacts on the environment. The major effect is the contribution on the improvement of the atmosphere. It was

estimated that the operation of a new, electrified rail line over its lifespan of 30 years would save in the region of 150,000 tonnes of air pollutants generated by using diesel machines.

*ENVIRONMENTAL IMPACT STUDY OF COLORA TREATMENT
TEXTILE FACTORY*

This EIA study was undertaken in 1996 concerning the proposed development and operation of the COLORA treatment textile factory. The proposed plant was intended to produce approximately 20 tonnes of textile products per day. Most of the textile used in the production process is cotton which arrives in rolls and is treated with chemicals (whiteners, colours etc.).

The factory was to be located in an industrial park, near to Thessaloniki. The area surrounding the park was not considered to be environmentally sensitive and was undesignated. At 7 km distance from the factory there are agricultural lands, several rivers and settlements.

The impacts from the factory's development and operation were researched by the study. In particular, the study reports that the treated wastewater from the plant would be discharged into Thermaikos bay and the solid wastes from the plant were to be disposed of into the local sanitary landfill.

*ENVIRONMENTAL IMPACT STUDY OF SUBWAY
THESSALONIKI. STUDY-CONSTRUCTION. AUTOFINANCING-
EXPLOITATION*

The subject of this 1992 EIA study was the construction of an underground metro line, 9.33 Km length, in the town of Thessaloniki, the second biggest city in Greece.

Potential environmental impacts were studied for the construction and operational phases of the project. The effects of, especially, the main pollutants in a city were studied, such as emissions from traffic, industry and accommodation. The level of air pollution for the city was calculated and provisions were made for the additional emission generated during the construction of the project. From the project's operation there were thought to be favourable impacts to the environment, in terms of the reduction in atmospheric pollution.

*ENVIRONMENTAL IMPACT STATEMENT FOR LANDFILL AREA
AT TAGARADES IN THESSALONIKI CITY*

In the area of Thessaloniki the disposal of urban waste disposal is based exclusively on the sanitary landfill at Tagarades, 35 Km south-east of the city. The landfill accepts many types of waste, from domestic to hospital wastes. The operation of the landfill is satisfactory, according to Greek standards, but it is far from optimal when considering the international standards about sanitary landfill.

The object of this 1995 EIA was to assess, predict and suggest measures that can deal with the impacts caused by the disposal of the urban waste at this site. One of the main impacts was considered to be air pollution, in terms of odour and landfill gas emissions. Impacts on the surface and ground-waters of the surrounding area were also assessed. The effects of leachate on the soils in the area were also considered. The EIS made recommendations concerning the mitigation of these impacts and the final restoration of the landfill site.

*ENVIRONMENTAL IMPACT STUDY OF VINIFICATION-
DISTILLERY OF COMPANY E.TSANTALIS A.E. AG.PAVLOS,
CHALKIDIKI*

This 1993 EIA was concerned with the expansion of the wine-factory distillery. The existing plant was 21,065 m² in area. Surrounding the plant there are mixed agricultural farms. The factory produces wine and alcoholic drinks in both bottled and unbottled forms. The plant consists of a) the vinification division b) the distillery division and c) the bottling division.

The proposed extension to the plant would take place in the distillery division and would consist of the installation of stainless steel tanks for the storage and finishing of alcoholic drinks such as ouzo. The study examined the cumulative impacts and impact interactions of the proposed development, with particular regard to the treatment of solid and liquid wastes from the new extension to the plant.

*ENVIRONMENTAL IMPACT STUDY FOR THE SEWAGE
TREATMENT PLANT IN RETHIMNO CITY (ISLAND CRETE)*

This 1993 EIA undertook the assessment of the environmental impacts from the proposed construction and operation of a new sewage treatment plant in the town of Rethimno. The new plant would be capable of treating waste from up to 60,000 people. The purpose of the plant's construction was to cover the needs of rational management of waste water and sludge and to assure environmental improvements in the area.

The EIA investigated the indirect and cumulative impacts, as well as the impact interactions, of the proposed development, especially in terms of the potential environmental improvements to the surface waters and saltwater environment of the nearby bay. Impacts to the nearby resident were also taken into account, such as odour assessment and the socio-economic impacts of the development, such as the improved potential for tourism.

*ENVIRONMENTAL IMPACT STUDY FOR THE WIDEN AREA OF
THE GREEK HYDROLOGICAL BASIN OF THE NESTOS RIVER*

The area studied by this 1993-94 EIA was the hydrological basin of the Nestos river which follows the Greek - Bulgarian borders. At the delta estuary the Public Electricity Organisation (D.E.H.) planned to construct 4 locks as part of a hydroelectric power generation scheme. The Thisauros Hydroelectric Power (Y.H.E.) and Platanobrisis Hydroelectric Power (Y.H.E.) schemes are also being considered for development in this area and had almost reached the construction phase at the time of this study. Additionally, the Temenos Hydroelectric Power and Arkoudorema Hydroelectric Power scheme are still being studied with a view to construction. Simultaneously, the river's water supply would also be used for the irrigation of crops in the area and the 4 dams would regulate the flow of water for power generation, irrigation and water supplies.

In the area studied by the EIA there are many sensitive ecosystems such as the unspoilt forests in the close to Nestos region of Drama. The EIS discussed the indirect and cumulative impacts, as well as impact interactions of the proposed development, especially the cumulative impacts to the natural environment in terms of landscape and morphological impacts; hydrological effects; impacts to the fauna and flora of the region and to the local inhabitants.

*STUDY PREAPPROVAL AREA POSITION AND
ENVIRONMENTAL IMPACT STUDY OF SKI CENTRE OF
VASILITSA*

This 1993 EIA study concerns the proposed creation of a new ski resort with all the necessary facilities, such as lifts, ski-ing pistes, refreshment facilities, electric power sub-station, first-aid station, and an associated road network. The study area and the surrounding region in Vasilitsa, Grevena, Western Macedonia, is a massif with lots of natural beauty and a variety of animal species, plant types and ecosystems.

The impacts of the proposed development, such as noise, physiognomy of the area, transportation, traffic and tourism development of the area were assessed. Two parameters were taken into consideration for the composition of the EIA: 1) the nature of the task performed for the completion of the project as well as 2) the activities that should develop in the area after the project's completion.

*ENVIRONMENTAL IMPACT STUDY OF WORK
ACCOMMODATION OF TORRENT DENTROPOTAMOS*

This 1994 EIA study was focused on the Dentropotamos River, located in the western area of Thessaloniki. The watershed of the river covers an area of 115 km². A further six streams meet with the river in this area. The water of the river is polluted because Dentropotamos is used as a receiver of the area's waste and as a place of litter disposal. River accommodation work was needed to prevent the danger of flooding and to improve the environmental quality of the river.

Additional infrastructure works, including road building, water supply, drainage and electricity supplies were also required as part of the project. Indirect and cumulative impacts, as well as impact interactions, were discussed by the EIS, concentrating particularly on the effects of water pollution and flooding effects on the human environment.

*ENVIRONMENTAL IMPACT STUDY FROM THE EXPLOITATION
QUARRY INERT MATERIALS AT DRIMOS (EFKARPIA) AREA -
CEMENT INDUSTRY TITAN1996*

This 1996 EIA study concerns the operation of the exploitation and quarrying of inert materials at Drimos, Thessaliniki. The quarried material is used for the Cement Industry Titan. The quarry installation is sited 500 m. north-east of the community at Efkarpia and 1,500 m. east from national road between Thessaloniki and Kavala. Additionally, the site is 2.5 km by road from the Cement Industry Titan A.E. The quarry's area is 602,000 m². The quarry would produce 500,000 tonnes per year of inert materials. The production procedure consists of three phases: quarrying, loading and transference.

The study examines the impacts from quarry's operation on the natural and human environment of the study area. The EIS also examines the indirect and cumulative impacts, as well as impact interactions, of the proposed development on these natural and human receptors.

*ENVIRONMENTAL IMPACT STUDY FOR COMPLETION
GUESTS' ROOM PSARADES - PRESPE (2 FLOOR)*

This 1994 EIA concerns the completion of a two-story hotel guest house covering an area 800m² in Psarades, Florina, western Macedonia and the associated development of a wastewater treatment works suitable for up to 50 inhabitants. For the construction of the guest house a series of tasks were needed, in terms of road-construction, earthworks, rock-blasting, building constructions and the foundations for the wastewater processing plant.

The study area is centered on an area in the north-western part of Macedonia, where the borders of Greece, Albania and Yugoslavia meet at the lake of Prespa which is designated as a National Park area. The area is renowned for its aquatic and forest environments. The EIS discussed the indirect and cumulative impacts, as well as impact interactions of the development on the study area. The EIS covers in some detail the cumulative impacts of the project with particular regard to the soil environment, water and the landscape.

Portugal

PORTUGAL		
	Project Title	Project Type
Annex I		
1	A2 - Section Marateca / Alcacer do Sal	30km highway section
2	A2 - Section Aluacer do Sal / Grandola	30km highway section
3	Fuel Storage Park for Lisbon Metropolitan Area	Fuel storage facility
4	CELBI's Industrial Waste Landfill	Paper pulp industry landfill
Annex II		
5	Pig Farm of "Quinta Valverde, Loures"	Piggery upgrade
6	Quarry of "Pedreira do Fumo, Escalao de Foz Coa"	Extraction project
7	Natural Gas project pipeline section Braga / Tuy	Construction of gas pipeline section
8	Dam construction at "Rabadoa"	Dam construction
9	Paper Industry of "Gondezende"	Fluting from recyclable paper process
10	Construction of Lisbon Supplier Market	Infrastructure
11	220 kV power Line between "Chafariz & Ferro I and II"	Electricity transmission lines
12	Urban Development Project at "Quinta das Fores"	Urban infrastructure project

A2 - SECTION MARATECA / ALCACER DO SOL

Proposed construction of a section of Highway South between Marateca and Alcacer do Sol. This section of road would be about 30 km in length and characterised by dual two lanes and central reserve for a total width of 35 m. The EIA considered three alternative routes for the highway.

The EIA considered the different impacts between the three alternatives. The proposed routes pass through areas classified

as Natural Ecological Reserve, other areas designated for their environmental and landscape quality and some sensitive ecological areas such as the Corine Biotope.

One of the main impacts investigated is the generation of effluents with high heavy metal content from the new highway. However, the EIS did not discuss indirect impacts, cumulative impacts or impact interactions in any detail. The author did not return a questionnaire and, therefore, no comments can be made concerning the compilation of the EIS in terms of resources and team composition.

A2 - SECTION ALCACER DO SOL / GRANDOLA

Preliminary EIA relating to the development of a section of highway A2 between Alcacer do Sol and Grandola. Three alternative routings were subjected to study. A comparative assessment of different impacts between the three alternatives was undertaken to identify the preferred route. The section investigated was about 30 km in length. The expected traffic velocity would be 120 km/h and the total width of the road was 35 m.

Sensitive receptors were identified, especially designated species of flora and fauna. The EIS did not discuss indirect impacts, cumulative impacts or impact interactions in any detail. However, selective and qualitative assessments were made of these impact types, such as cumulative impact of noise and air emissions on local receptors and the indirect effects of dust during construction. No specific methodology was identified in the EIS for undertaking these assessments.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

FUEL STORAGE PARK FOR LISBON METROPOLITAN AREA

EIA for a proposed storage park for liquid and gaseous petroleum fuels, and will replace the old storage park integrated in a heavy urban area of Lisbon. The new storage depot will serve the Great Lisbon Region and areas of Santarem, Leiria and most of Portalegre and Castelo Branco.

The existing area is designated to be part of EXPO'98 and, therefore, requires regenerating.

The new storage area will be approximately 60 ha in area. The site infrastructure will consist of several 30m storage tanks and 19 storage spheres. Its estimated lifetime will be 30 years. The types of fuel intended to be stored at the site are butane, propane, gasoline (3 types), diesel (2 types) and jet fuel (jet A1 and JP8).

The main potential direct impacts are morphological changes to the area and the surface water run-off effects of a making 60 ha of soil impermeable. Direct impact on air, water, noise, traffic, landscape and socio-economics. Indirect impacts are expected from groundwater effects and socio-economics. There are no designated sites of heritage interest or designated site of nature conservation interest within the study area.

In terms of indirect impacts and impact interactions selective and qualitative assessments were made of these impact types. No specific methodology was identified in the EIS for undertaking these assessments. No assessment was made of cumulative impacts.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

CELBI'S INDUSTRIAL WASTE LANDFILL

Currently, there is a landfill site that has been operating for 28 years. It accepts 180 tonnes per day but there is an expected increase in waste by up to 55% on current growth. The proposed new landfill would be located in an industrial area. The expected life of the landfill would be 13 years.

The main potential direct impacts of the development are soil and hydrogeological impacts due to changing from an uncontrolled source of pollution to a controlled landfill; negative impacts on vegetation and fauna species in the development area; and, positive impacts in landscape due to improved management of the area. Other impacts were likely to be affects on ground water quality, control of landfill leachates, traffic effects and visual impacts from the landraised waste and its subsequent settlement.

The EIS did not discuss indirect impacts, cumulative impacts or impact interactions in any detail. However, selective and qualitative assessments were made of these impact types, such as the cumulative effects on human health from the potential contamination of the soil, water and air environments and the indirect effects of soil contaminating surface and ground water. No specific methodology was identified in the EIS for undertaking these assessments.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

PIG FARM OF QUINTA DE VALVERDE, LOURES

Proposed project to improve an existing pig farm through increasing the number of animals farmed at the site and including the construction of a waste water treatment plant. The project will increase the farm from 300 to 850 reproducing sows and its main impacts were considered to be the discharge of effluents to the nearby stream and the positive impacts of installing a waste water treatment plant.

In terms of indirect impacts, only selective and qualitative assessments were made of this impact type. No specific methodology, however, was identified in the EIS for undertaking this assessment. No assessment was made of cumulative impacts or impact interactions.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

QUARRY OF PEDREIRA DO FUMO

The proposed exploitation of the quarry aims to support the dam construction of Foz Coa supplying the necessary quantity of inert material for concrete manufacturing. The total area of exploitation was 30 ha, but the area of extraction would only be about 6.1 ha. The extraction period would be 33 months.

The main impacts were considered to be landscape and visual effects, effects of designated avifauna, noise effects and the effects from increased truck traffic. Sensitive receptors were identified, specifically local populations of Golden Eagles, which utilises the area as habitat.

In terms of indirect impacts, only selective and qualitative assessments were made of this impact type. No specific methodology, however, was identified in the EIS for undertaking this assessment. No assessment was made of cumulative impacts or impact interactions.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

NATURAL GAS PIPELINE, BRAGA - TUY

The proposed gas pipeline from Braga - Tuy is part of a plan introducing natural gas to Portugal. This section will allow connection between Portugal and the Spanish gas network. It is planned that approximately 72.2 km of 508 mm diameter pipeline will be laid and buried not less than 80 cm below the surface to create the pipeline. The project would also include the construction of 4 valves, 1 section (block) and derivation station and a boundary section. The construction corridor would be 20 m wide.

There are three alternative routings, one would be selected from the findings of the EIA. The main potential impacts were considered to be construction issues resulting in geomorphological changes, erosion and soil compaction, use of the soil, fauna and flora, and impacts to landscape. There are no designated sites of nature conservation interest within the study area. An important

consideration was the environmental benefits of using natural gas over other, more polluting, fuels.

The EIS did not have any specific sections covering the assessment of cumulative impacts, indirect impacts or impact interactions. However, some selective and qualitative assessments were made for these impact types when the overall, direct impacts are assessed. The author reported using a variety of techniques in the EIA, including checklists, matrices and overlays, although none of these techniques were specifically reported as being used in the assessment of indirect and cumulative impacts as well as impact interactions.

In comparison to other EIAs reviewed as part of this study, this EIA was well resources, financially, using 50,000 ECUs compared to an average of 39,477 ECUs for other projects in this study, and 270 man-days, compared to an average of 192 man-days for other projects in this study.

DAM CONSTRUCTION RABADOA

The proposed dam would have a total storage volume of 1,946,182 m³ and cover an area of 46.9 ha. The water would be used to irrigate an agricultural area of 350 ha. The storage of water occurs in winter time and is intended to be for irrigation of sun flower and winter cereals during spring and summer time.

Main potential impacts are on soils, some with agricultural quality, due to inundation by the new reservoir; vegetation, due to removal of 85 protected trees; impacts on surface water downstream of the dam due to contaminants washed into water courses from the irrigation of agricultural fields; effects to the landscape due to the destruction of vegetation. However, it was thought that the overall effect of the development on the area would be positive since the region is arid and the storage of water will allow the irrigation of local agricultural land, benefiting local communities and assuring existing jobs.

The EIS did not have any specific sections covering the assessment of cumulative impacts, indirect impacts or impact interactions. However, some selective and qualitative assessments were made for indirect impacts and impact interactions when the overall, direct impacts were assessed. No specific methodology

was identified in the EIS for undertaking these assessments. Cumulative impacts were not addressed within the EIS.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

PAPER INDUSTRY OF GONDENSENDE

The project consists in improving and increasing production of an existing unit of industrial paper production, manufacturing, “fluting”, from recyclable paper. The plant will produce cardboard for the national and European market.

The proposed site occupies a total area of 9500 m² and would have an annual total capacity of 16,500 tons/year. The plant is intended to operate 24 hours a day and produce 50 tons of paper material per day.

The EIA considered that the main impacts of the scheme would be on air quality, ecology, agricultural land, groundwater resources, solid waste production, landscape and scenic values. Positive impacts would arise through socio-economic effects in the form of increased jobs.

The EIS did not have any specific sections covering the assessment of cumulative impacts, indirect impacts or impact interactions. However, some selective and qualitative assessments were made for indirect impacts and impact interactions, such as the interaction of increased traffic with the existing roads, when the overall, direct impacts were assessed. No specific methodology was identified in the EIS for undertaking these assessments. Cumulative impacts were not addressed within the EIS.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

LISBON SUPPLIER MARKET

This EIA considered the proposed construction of the Lisbon Supplier Market transferring the current, city-centre market to an area on the out skirts of Lisbon with better accessibility. The proposed development area is about 93 ha. The development's lifespan would be about 50 years.

The EIS considered that the main impacts of such a development would be solid waste production (about 120 tons/day); covering an area of 64 ha, making it impermeable and resulting in changes in the surface water run-off characteristics; air quality effects; noise nuisance; and, visual impacts to the area surrounding the proposed market.

Indirect impacts are considered for several environmental components throughout the EIA. These types of impact were identified for water quality effects; ecology, especially vegetation; impacts to local traffic flows; and for landuse issues. The following sections are translated directly from the EIS:

"Whenever justifiable, the distinction between direct and indirect impacts was established, i.e. between those that are directly defined by the project and those that are induced by its related activities, and those impacts that are cumulative in nature, i.e. impacts defined or induced by the project which will be adding to pre-existing perturbations over any considered environmental components."

With reference to indirect water quality impacts:

"During the operation phase there are potential indirect negative impacts on the quality of water resources, resulting from road traffic induced by the operation of the project."

With reference to impacts to vegetation:

"It is considered that the project under study will induce direct and/or indirect impacts mainly due to damage or destruction of vegetation during the construction phase."

Also;

"During the construction phase the actions from the implementation of the project will cause destruction and alteration of the identified"

vegetation clusters. These impacts will be direct and/or indirect, depending if they are the result of direct destruction from the construction activity."

The following table was reproduced in the EIS showing the identification of direct and indirect impacts on vegetation:

Vegetation Type	Impacts	
	Direct	Indirect
<u>Project Area</u>		
• abandoned agricultural areas	X	
• disperse olive trees with shrubs	X	
• natural fences with dominant olive trees	X	
• natural fences with cypresses	X	
• shrubs	X	
• riparian vegetation with reed plot, ash trees or willows and other species of this natural environment, with dominant blackberry bushes	X	X
• Quercus species in reduced number	X	X
<u>Surrounding Area</u>		
• species of resinous vegetation (pine trees and acacias)		X
• areas of eucalyptus		X
• agricultural areas with vineyard		X
• sparse shrubs		X
• riparian areas with reed plot, ash trees, or willows		X

With reference to impacts on traffic circulation during the operational phase:

"It will be subjected to study and the occurrence of potential negative and indirect impacts over the various environmental compartments - with emphasis given to water quality, air quality and noise components - as a result of the traffic determined by the operation phase of the project, namely the "Via de Cintura da Area Metropolitana de Lisboa" (Lisbon Metropolitan Area Circular), and mainly the closest section to the Lisbon Supplier Market, to where all traffic will converge."

The text of the EIS explains that there is no estimate given of the magnitude of the negative and indirect impacts due to the lack data associated with the expected volume of traffic.

With reference to impacts to the surrounding landscape and municipal planning issues:

"...the implementation of the Lisbon Supplier Market will generate indirect, positive impacts on the proposed development area, even though their effects are dependant on the implementation of PROTAMIL (the Regional Land Planning of the Metropolitan Lisbon Area) and the other plans directly influencing the municipality of Lisbon."

Impact interactions are referred to throughout the EIS and refer to other development proposals in the area, such as new access roads and so forth. Other interactions centre around the interface between the development proposal and the implementation of local plans, such as the urban waste plan and PROTAMIL.

However, as can be seen from the above information, no specific methodology appears to have been used for the assessment of indirect impacts and impact interactions. The author's returned questionnaire states that only two techniques were used in the EIA, employment of best practice manuals (titles not specified) and consultations. Compared to the average EIA examined during this study, this project was above average in terms of time resources, approximately 360 man-days compared to the average of 192 man-days. However, the EIA was well below the average financial resources found in this study, 12,121 ECUs opposed to the average of 39,477 ECUs.

220 KV POWER LINE BETWEEN CHAFARIZ AND FERRO I/II

EIA project for the proposed construction of a 220 kV double power line between the electrical substations of Chafariz and Ferro. The proposals included a connection the railway substation. The power line project would be nearly 19 km in length and the line will have 55 pylons of 3 different heights, 22, 28 and 34 metres above ground level. The maximum pylon arm width would be 12 m.

The main potential impact are on flora due to destruction of plant species on the routing; impact on noise during construction phase; landscape impacts especially in valley area. During operation the

most significant impact would be likely to be problems with birds striking the pylons and electrical cables. The effects to human health from electromagnetic radiation were also considered but only in a qualitative manner due to the lack of available scientific data.

Some selective and qualitative assessments were made for indirect impacts and impact interactions when the overall, direct impacts were assessed. The EIS discusses the following indirect impacts for the project:

- changes to the chemical characteristics of the soil resulting from pollution incidents such as oil spills and fires;
- elevation of soil levels as a result of soil mounding during excavation, such deposition can bury young trees;
- improved accessibility to the area will have a positive impact in relation to fire incidents allowing faster evacuation of local residents and accessibility to the fire; and,
- during the operational phase of the development, the maintenance of the forest to keep a corridor of controlled height surrounding the pylons and cables will cause indirect visual and landscape impacts and, potentially, have an effect on the ecological diversity of the forest.

No specific methodology was identified in the EIS for undertaking these assessments. Cumulative impacts were not addressed within the EIS.

The EIA was undertaken by a mixture of in-house specialists from the lead consultant and external sub-consultants with the final EIS being written entirely by the lead consultant. In comparison with other EIAs reviewed as part of this study, the EIA was below average in terms of time resources, using only 120 man-days in comparison to the average of 192 man-days found in this study. In terms of financial resources, the EIA was above average using approximately 50,000 ECUs in comparison with the average found in this study of 39,477 ECUs.

URBAN PROJECT AT QUINTA DAS FLORES

The proposed housing development would cover 14 ha and involve the construction of a total of 54 2-storey homes and 3 16-storey

buildings (944 homes). The proposed development would be constructed on a mostly green field area of 8.7 ha. Its current landuse consists of an urban part, forested area, public and private gardens.

The main impacts of the project were identified in the EIS as the impermeabilisation of the area, and the subsequent changes in surface water run-off characteristics, and the effects on the catchment area of the Barcarena stream where the proposed project is located. Impact to the surrounding landscape due to the large number of planned buildings and consequent removal of the existing vegetation. The potential for noise impacts from construction and operation and from traffic impacts was also investigated by the EIA.

Some selective and qualitative assessments were made for indirect impacts and impact interactions when the overall, direct impacts were assessed. No specific methodology was identified in the EIS for undertaking these assessments. Cumulative impacts were not addressed within the EIS.

The author did not return a questionnaire and, therefore, no comments can be made concerning the types of EIA technique used in the study or the compilation of the EIS in terms of resources and team composition.

United Kingdom

UNITED KINGDOM		
	Project Title	Project Type
Annex I		
1	Upgrading of 132 kV Transmission Line - Norwich to Great Yarmouth *	Electricity transmission lines
2	M25 Widening Junctions 10-11	Motorway
3	Killingholme Gas Power Station Extension	Energy project
4	Intermediate Agrochemicals Production Plant	Chemical manufacturers
Annex II		
5	A130 Stage 2 Bypass (A132-A127)	5.4 km dual 2-lane road
6	Brine Extraction and Gas Storage Facility	Underground storage of combustible gases
7	Hoodcroft Open Cast Coal Site	Open cast mining >25 ha in area
8	Sherwood Parc Motorway Service Area	Motorway Service Area
9	Cardiff Wastewater Treatment & Outfall	Wastewater treatment works
10	Avondale Quarry	Quarry >25 ha in area
11	Avonglen Landfill	Non-Annex I waste project
12	Strathclyde Crossrail Project	Infrastructure rail link

* These project have been introduced to Annex I through the 1996 Amendment to the EIA Directive (85/337/EC)

UPGRADING OF 132 KV TRANSMISSION LINE NORWICH TO GREAT YARMOUTH

An extensive EIA study, produced in 1996, to assess the impacts of a scheme to upgrade a section of power transmission lines across Norfolk. The proposed scheme has 3 distinct stages, upgrading of lines between Prouse and Durton (including higher towers and

some undergrounding of line), upgrading of lines between Thurlton and Belton, and 2 new parallel lines and some undergrounding between Belton and Garelston.

Numerous sensitive receptors were within the vicinity of the proposed development including 2 designated Sites of Special Scientific Interest (SSSI), over 100 listed buildings, designated for conservation, within 1 km of route, several major roads and the crossing of a river. The major impact of this EIA was considered to be the effects on the surrounding landscape and visual effects in a tourist orientated area.

Some selective and qualitative assessments were made for indirect impacts and impact interactions when the overall, direct impacts were assessed. No specific methodology was identified in the EIS for undertaking these assessments. Cumulative impacts were not addressed within the EIS and were considered by the author to be insignificant.

In terms of resources, the EIA was below average in comparison to other studies reviewed as part of this research project, taking only 25,000 ECUs in fees (compared to an average of 39,477 ECUs) and 100 man-days (compared to an average of 192 man-days) to complete the EIA.

M25 WIDENING JUNCTIONS 10-11

This project was planned as part of the 1990 M25 Action Plan, this part of the Action Plan would widen the M25 between junctions 10 and 11 (a distance of 9 km) from dual 3-lane highways to dual 4-lane. Despite the obvious cumulative effects of widening a major highway around London the other schemes for the M25 Action Plan were subject to individual EIAs, commissioned to cover other aspects of the scheme.

The widening of junctions 10 to 11 would pass through well developed areas of residential, commercial, recreational and agricultural usage. The main impacts are considered to be of negative visual intrusion and beneficial impact on road users and air quality in the long term. A number of sensitive receptors exist including schools and residences, an area designated as a Site of Special Scientific Interest, Tree Preservation Orders, 2 Scheduled Ancient Monuments and numerous other designations for cultural, architectural and archaeological importance.

Some selective and qualitative assessments were made for cumulative impacts, indirect impacts and impact interactions when the overall, direct impacts were assessed, such as the consideration of cumulative air quality improvements due to improvements around the whole M25 and specifically along this section. No specific methodology was identified in the EIS for undertaking these assessments.

The EIA was well resourced in terms of time when compared with the average project reviewed as part of this study, using 225 man-days to complete the EIA. The project was below average in terms of financial resources, with 28,000 ECUs being awarded in fees for the study, compared to an average of 39,477 ECUs for EIAs reviewed as part of this study.

KILLINGHOLME COMBINED CYCLE GAS TURBINE POWER STATION EXTENSION

Assessment of a proposal to extend an existing power station by constructing two 350 MW Combined Cycle Gas Turbine (CCGT) units. The finished development would cover about 7 ha, once complete, close to the banks of the Humber Estuary. The EIS was published in December 1995.

The surrounding area is already heavily developed with 2 oil refineries, the existing CCGT power station and a similar CCGT power station in the immediate vicinity. There are no designated sites within the immediate vicinity, however within a 20 km radius of the development site there are 46 Sites of Special Scientific Interest, Sites of National Conservation Interest, RAMSAR sites and 3 Scheduled Ancient Monuments. The most sensitive receptor was considered to be the Humber Estuary itself and especially by the cooling water intake and discharge. The other major impact would be air quality effects, especially oxides of nitrogen (NO_x), sulphur dioxide (SO₂), ozone (O₃) and carbon dioxide (CO₂) emissions.

Indirect and cumulative impacts, as well as impact interactions, were not discussed within the specific sections of the EIS but some assessment of these impact types, especially for air quality assessments, was made especially using mathematical, or computer, modelling techniques. The author provided no details concerning the resourcing of the EIA.

INTERMEDIATE AGROCHEMICALS PLANT (PMG2 PROJECT)

Proposal to construct a second intermediate agrochemical plant on the existing site at Huddersfield, Humberside, UK. The new plant will cover 1.1 ha of the, approximately, 100 ha site. The main impacts of the development will be on air quality, air emissions and potential aqueous emissions impacting on surrounding surface and groundwater. The site is in a built-up area with numerous residential receptors and cumulative impacts should be a major consideration in the EIA. No protected sites exist nearby, though there are some areas of local biological importance.

The EIS did report on indirect and cumulative impacts as well as impact interactions, but this was not done in any specific sections or chapters. Moreover, where these impacts were assessed no particular methodology was identified for their assessment and the EIS frequently reported a finding of no significant impact for these impact types. Exceptionally, air quality, noise and risk assessments utilised computer modelling techniques as part of the assessment.

The EIA was conducted entirely by a team of in-house consultants from the lead consultancy who also wrote the EIS. The author provided information concerning the time resources of the project: 83 man-days, compared to an average of 192 man-days for other EIA projects reviewed as part of this study.

A130 STAGE 2 BYPASS (A132-A127) ENVIRONMENTAL ASSESSMENT

Assessment of the 2nd stage of the proposed A130 bypass, Essex, UK, involving construction of 5.4 km of dual, 2-lane carriageway with each lane being 7.5m wide. The road will pass through mostly agricultural land in what is termed a "semi-rural buffer zone". The EIS was published in December 1996.

The main potential impacts were considered to be archaeology, architectural heritage, land take, nature conservation, air quality and rights of way. Construction was also be seen as a major impact. Nearby sensitive receptors were mostly local residents and a badger sett only 8m from proposed scheme boundary. A number of designated Sites of Special Scientific Interest are

nearby - 1.5 km distance - and form part of a RAMSAR site though they are not considered to be affected by the scheme.

The EIS did not discuss indirect impacts, cumulative impacts or impact interactions directly in a specific section or chapter. However, some indirect impacts and impact interactions were discussed in sections related to specific environmental criteria, such as landscape and visual impacts. However, no specific techniques was identified by the author for undertaking these assessments.

The EIA was undertaken by a mixture of in-house consultants and external sub-consultants. The EIS was compiled by the lead consultant, including the reports submitted by the external sub-consultants. The EIA was conducted with resources significantly below average for other studies reviewed as part of this study. The study allowed 61 man-days (compared to an average of 192 man-days) and had a fee value of 23,500 ECUs (compared to an average of 39,477 ECUs).

*PROPOSED BRINE EXTRACTION AND GAS STORAGE
FACILITY AT
HOLE HOUSE FARM, WARMINGHAM, CHESHIRE*

Assessment of a proposal to drill 4 boreholes (at least 185m apart) and to a depth of 300m into salt deposits under Rural Cheshire. Salt will then be removed by solution taking nearly 4 years, whereupon the storage of gas will take place within the remaining, impermeable cavity left. The EIS was published in April 1995.

The site is adjacent to an existing brinefield development. Main impacts of the project are visual impact from the 32m drill derrick, noise impacts from drilling operations and 24-hour operation of the site. Nearby sensitive receptors are limited but include residents of nearby homes and village as well as travellers and recreational users of the area. The EIS reported on a limited number of indirect impacts but no methodology for this assessment was identified from the EIS. The author did not return a questionnaire.

HOODCROFT PROPOSED OPENCAST COAL SITE

The proposed project centres on the proposed removal of 900,000 tonnes of coal from a 145 ha site in Derbyshire. The extraction would take place over a period of 5 years and then be restored back to an agricultural use. This site is close to 2 other opencast sites both in the process of being restored. The EIS was published in July 1996.

The development would also involve the building of a new access road and an industrial estate to be constructed on a reclaimed colliery spoil heap. The main impacts were considered to be the landtake and destruction of agricultural land, visual intrusion, wildlife and ecological disturbance. There are no designated sites nearby, though the site borders are designated Ancient Woodland. The area is rural and has few nearby residents. The nearby M1 motorway should also be a factor in the assessment.

The EIS discussed some indirect impacts and impact interactions, particularly dust and noise impacts in a qualitative way. However, no methodology could be discerned from the EIS as to how these assessments were undertaken. The author did not respond to the questionnaire.

SHERWOOD PARK MOTORWAY SERVICE AREA

The project assesses the proposed development of a Motorway Service Area (MSA) on the south-bound side of the M1 Motorway between J28 and 29, Derbyshire, UK. The EIS was published in August 1994.

The development will utilise approximately 21 ha of land adjacent to the motorway. The site is low quality agricultural land and scrub of little ecological value. There are some nearby sites of natural heritage importance. Of primary importance in the EIA are land-use, surface runoff, noise, air quality and ecology and nature conservation. There are few sensitive receptors, a few residential buildings, waterways, and some nearby designated sites.

The EIA was conducted and written entirely by the lead consultant. The EIS discussed some indirect impacts and impact interactions, particularly visual effects and impacts on nearby residents in a qualitative way. However, no methodology could be discerned from the EIS as to how these assessments were undertaken. The author professed that cumulative impacts were not considered to be important during the EIA study.

The EIA was conducted with very limited time and financial resources, allocated only 46 man-days in comparison to the average found in this study of 192 man-days. Additionally, the fee value of the study was only 11,000 ECUs, much lower than the average fee value reported in this study of 39,477 ECUs.

CARDIFF WASTEWATER TREATMENT WORKS AND OUTFALL

Assessment of a proposed project to construct a new Wastewater Treatment Works (WwTW) for the Cardiff area on 20 ha of brownfield site in south-east Cardiff fronting onto Cardiff Bay. The WwTW would serve over 150,000 people. The EIS was published in April 1996.

The project will involve the construction of an outfall pipe 1.9-3.8 km in length and other pipelines from east Cardiff to the WwTW. Main potential impacts are contaminated land issues, water quality and landscape/ecological impacts due to the sensitive location adjacent to the Severn estuary Site of Special Scientific Interest (SSSI), RAMSAR site and Special Protection Area (SPA). The project will also involve some reclamation of land from the sea.

The EIS reported a number of indirect and cumulative impacts as well as impact interactions in a qualitative manner. Exceptionally there was extensive quantitative computer simulation modelling for the assessment of impacts for the discharge of treated sewage. However, these impacts were not addressed in specific sections or chapters discussing indirect and cumulative impact as well as impact interactions. No particular methodology was identified by the author or in the EIS for identifying these types of environmental impact.

The EIA study was well resourced in terms of time and finance; the fee value was approximately 56,000 ECUs, compared to an average fee value reported in this study of 39,477 ECUs. The EIA utilised approximately 500 man-days, substantially more than the average 192 man-days reported in this study.

AVONDALE QUARRY

Proposed development for the extension of an existing quarrying operation, also involving the removal of clay deposits. The void left

by the clay extraction process is intended to be used as a landfill waste disposal site, for the tipping of domestic, commercial and industrial wastes. The quarry and landfill site will then be progressively reclaimed and returned to open countryside. The EIS was published in August 1993.

The study area in Falkirk Scotland, is close to the M9 motorway and is an area with a wide variety of development, from other mineral extraction schemes (see 4.5.11 below) to petro-chemical developments. The assessment did not address cumulative impacts or impact interactions, however, some indirect impacts were discussed qualitatively. No specific methodologies were identified in the EIS or by the author for the assessment of these impacts.

The EIA was relatively average in terms of resources compared to other EIAs reviewed as part of this study. The EIA was allowed approximately 200 man-days and awarded a fee value of 37,000 ECUs, compared to average values of 192 man-days and 39,477 ECUs encountered during this research study. The EIA itself was undertaken by a mixture of in-house specialist from the lead consultancy and external sub-consultants. The EIA was one of the few reviewed as part of this study that was led by an individual with a qualification in EIA. The EIS was written by compiling the separate reports produced by the internal and external consultants.

AVONGLLEN LANDFILL PLANNING APPLICATION

Proposal for a landfill development to accept commercial, industrial and certain special wastes over a 10 year lifespan. The site will cover 7.4 ha just off the A803 main road and approximately 100m from Junction 4 of the M9 motorway in Falkirk, Scotland. The study area contains a wide variety of development, from other mineral extraction schemes (see 4.5.10 above) to petro-chemical developments. The EIS was published in October 1996.

The main impacts of the proposed landfill disposal were considered to be the generation of leachate which may contaminate surface and groundwater and the production of landfill gas which is toxic and potentially explosive. Other impacts include odour nuisance, visual intrusion, land take and vermin. Indirect impacts may include harm to local ecology due to contaminated water. Sensitive receptors in the area include River Avon, Millhill

Reservoir, 5 Scheduled Ancient Monuments (SAMs) and Avonglen Site of Special Scientific Interest (SSSI).

The assessment did not address cumulative impacts, indirect impacts or impact interactions within specific sections of the EIS. Instead, some of these impact types were addressed within sections of the EIS referring to other environmental criteria. Most of these impact types were discussed qualitatively and resulted in a finding of no significant impact. No specific methodologies were identified in the EIS for the assessment of these impacts. The author did not return a questionnaire therefore no comment can be added regarding the resourcing or make-up of the EIA project.

STRATHCLYDE CROSSRAIL: ENVIRONMENTAL STATEMENT

Proposed project to construction new sections and improve other parts of the urban rail network in Glasgow city centre. The development would consist of 2 new rail lines, upgrading of another and the linkage of 2 more lines to improve cross-city links. The EIS was published in March 1995.

As an urban development, there were no designated ecological sites affected by the proposed development. However, the major impacts were considered to include archaeology and cultural heritage, noise impacts, visual intrusion, air quality, access and socio-economic impacts. The EIS did address indirect and cumulative impacts as well as impact interactions in a methodological manner utilising a specially developed method based on three principal elements of the environment. An extended discussion and evaluation of this method is given in Volume 1 of this report (see section 5.2.1).

The EIA was undertaken by a mixture of specialists from the lead consultancy and external sub-consultants. However, the final EIS was written entirely by the lead consultant. The author did not supply any information regarding the resourcing of the EIA project.

Appendix B: Abbreviations and Glossary of Terms

Abbreviations and Glossary of terms

CBA	Cost Benefit Analysis - a technique for evaluating development projects by weighing the financial advantages against its disadvantages.
DGXI	Directorate-General XI of the European Commission whose remit covers nuclear, environmental and civil protection.
EC	European Commission
EHIA	Environmental Health Impact Assessment - procedure for predicting and evaluating the effects of a proposed development specifically pertaining to environmental health issues such as the spread of disease.
EIA	Environmental Impact Assessment - a procedure for predicting and evaluating the effects of a proposed development on its surrounding environment.
EIS	Environmental Impact Statement - report prepared on the completion of an Environmental Impact Assessment often submitted to the Local Planning Authority in support of a development proposal.
EMAS	Eco-Management and Audit Scheme
EPA	Environmental Protection Agency (USA)
EPD	Environmental Protection Department (Hong Kong)
EU	European Union
FONSI	Finding Of No Significant Impact - term used in Environmental Impact Statements to demonstrate that types of environmental impact have been considered but were found not to be of consequence.
GIS	Geographic Information Systems - technique for electronically storing and manipulating geographic and environmental data.
IPC	Integrated Pollution Control - legal process in the UK by which large industrial processes are licensed and regulated.
IPPC	Integrated Pollution Prevention and Control - legal process by which large industrial processes are licensed and regulated, refers specifically to the requirements of the European Commission's IPPC Directive (96/61/EC)

MAUT	Multi-Attribute Utility Theory
NEPA	National Environmental Planning Act - introduced into US law in 1969 and seen as the first official requirement for EIA in the world.
NGO	Non-Governmental Organisation
PER	Public Environment Report - produced under Australian law for development proposals deemed to be of low environmental significance.
SEA	Strategic Environmental Assessment - procedure to predict and evaluate the effect on the environment by the implementation of policies, plans or programmes.
SIA	Social Impact Assessment - procedure to predict and evaluate the effects of a proposed development on its surrounding social environment.
UK	United Kingdom
UNEP	United Nations Environment Programme

Appendix C: Study Questionnaires

Questionnaire 1: Legislative Framework & Official Guidance - Country Overview

Country of Origin	
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1. Under what national/federal legislation and regulations are Environmental Impact Assessments (EIAs) undertaken (name the appropriate laws and regulations and indicate when they were enacted)?

This will be completed by the UK and confirmed by the EIS reviewer from each country.

2. Does the above legislation and regulations fully implement Council Directive 85/337/EC? If not briefly explain the shortcomings and anticipated time of fulfilment of the current requirements?

This will be completed by the UK and confirmed by the EIS reviewer from each country.

3. What is the procedural nature of the above legislation and regulations (e.g. what must be done, how to do it, how to report the results etc.)?

This will be completed by the UK and confirmed by the EIS reviewer from each country.

4. Have official guidelines been produced to assist local authorities/developers etc. in undertaking environmental impact assessments? If yes please provide reference details.

--

5. What is the nature of the guidelines (does it provide advice on scoping/ methodologies/checklists etc.)?

--

6. Do the guidelines refer specifically to cumulative impacts, indirect impacts or impact interactions?

--

If yes describe how.

--

7. Is there a national requirement for official verification/approval of the Environmental Impact Statement (EIS), including its compliance with the Environmental Assessment Directive (85/337/EC)?

--

8. Indicate which organisations (statutory or otherwise) provide verification/approval of EISs.

Do these organisations have documented procedures? Please provide references to their documentation.

9. Is there a national institution statutory or otherwise that accredits authors of EISs?

If yes, please indicate which institution.

10. Is there a requirement for monitoring of actual impacts after project implementation?

If yes, how and by whom is the monitoring carried out (checking forecasts, clarifying cause effect relationships etc.)?

11. If monitoring is undertaken, how and by whom are the results used?

12. Which organisation is responsible for undertaking the EIA; is it a private, public or local planning authority? Please indicate below.

--

13. Are guidelines issued for each individual EIA by the authorities before the EIA is undertaken?

--

If yes please state by whom and how detailed the guidelines are:

--

Questionnaire 2: Questions for the EIA Author

Please complete the following questions to the best of your knowledge concerning the below Environmental Impact Assessment. Continue any question on a separate sheet as necessary.

Project Title	
Country of Origin	

1. Who undertook the EIA?	
Name, Position and Background (e.g. qualifications, profession):	
COMPOSITION OF TEAM	CHECK BOX
In-house team	
Assemblage of sub-consultants	
Mixture of in-house & external sub-consultants	
Other	
Details (e.g. how many individual sub-consultants were used, which areas of interest were assessed in-house and so forth?):	
REPORT STRUCTURE	CHECK BOX
Compilation of separate reports	
Written entirely by lead consultant	
Other	
Details (e.g. was the report a collection of specialist reports?)	

2. Was the EIS subject to any external verification?

If yes state by whom and how.

3. If scoping¹ and screening² of the project was undertaken, did it take into account cumulative impacts, indirect impacts and impact interactions?

¹ Scoping seeks to identify at an early stage of the EIA from all of a project's possible impacts and from all of the alternatives that could be addressed, those that are the key, significant issues (Glasson, Therivel & Chadwick, 1994).

² Screening is carried out as part of the planning process, identifying which projects should be subject to EIA and which should not. In Europe, screening can only be applied to Annex II projects, as Annex I projects carry a mandatory requirement for EIA.

4. What methods or techniques were used for the EIA?	
METHOD OR TECHNIQUE	YES / NO
checklist	
matrix	
weighted matrix	
network ³	
overlays ⁴	
physical modelling	
mathematical modelling	
best practice manuals	
consultations	
other	
Details (if possible attach examples):	

5. What resources were spent on the EIA?
Time allowed (man days)?
Fees awarded (ECUs; as of 9/4/97 1 Ecu = 0.08 FM; 1.95 DM; 0.0015 Dr; 165.0 Es; 0.7 £):
Further comment:

³ Network methods attempt to identify potential impacts by mapping out the complex web of relationships in environmental systems. Impact identification involves following the effects of development through changes in these environmental relationships.

⁴ Overlay maps consist of a series of maps representing different environmental components of the proposed development area that are likely to be affected by the project. By superimposing these maps onto each other the relative intensity of impacts can be assessed.

6. Were any specific problems encountered during the EIA process (e.g. lack of information, uncertainty)?

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7. In your opinion, as author of the EIS, were cumulative impacts, indirect impacts and impact interactions adequately covered?

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If not, why not? What obstacles were encountered, for example, not required by national legislation, lack of knowledge of surrounding developments, confidentiality, not significant, no methodologies or guidance available and so forth?

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2. How was the EIA undertaken (scoping of alternatives, site selection, final design process/main stages)? Was there:

A description of scoping activities?

A discussion of alternatives (e.g. site selection, technology)?

A section on project design, processes or stages of development?

Other details (please specify please specify and attach examples of best practice with an explanation in English):

3. Were cumulative impacts, indirect impacts or impact interactions considered?

	YES / NO	COMMENT
(a) from your knowledge of the project / project type list below the potential indirect impacts arising from other types of induced activity (e.g. ancillary development) and answer yes/no as to whether they were considered?		.

3(Continued). Were cumulative impacts, indirect impacts or impact interactions considered?		
	YES / NO	COMMENT
(b) from your knowledge of the project / project type, list below potential interactions between the project's impacts and between impacts of the proposed projects and other, existing or proposed, projects and answer yes/no as to whether they were considered?		
(c) from your knowledge of the project / project type, list below potential cross-media environmental impacts and answer yes/no as to whether they were considered?		
(d) from your knowledge of the project / project type list below potential impacts from mitigation measures and answer yes/no as to whether they were considered?		

3(Continued). Were cumulative impacts, indirect impacts or impact interactions considered?		
	YES / NO	COMMENT
(e) was the magnitude of impact interactions considered (with reference to indicators used and uncertainty analysis undertaken)?		
(f) was double-counting of impacts avoided?		
(g) from your knowledge of the project / project type list below the potential total impacts (for example the total impact on individual receptors) and answer yes/no as to whether they were considered?		
(h) was the project's level of sustainability tested/evaluated?		
(i) did the EIA process link to any other consent procedures that affect impact interactions? [what should have been considered?]		
(j) Further comments:		

4. Is there a specific section in the EIS where cumulative impacts, indirect impacts and impact interaction are considered?		
SECTION	YES/NO	COMMENT
Cumulative Impacts		
Indirect Impacts		
Impact Interactions		

5. Were provisions for monitoring and follow up actions described?

If yes provide details:

6. Were there any specific problems with the EIA process in terms of its compliance with the informational requirements of the 1985 Directive specifically Article 3 Article 5(2) and Annex III of 85/337?

If so, please briefly describe:

Appendix D: List of Consultees

List of consultees

A.D.K. Engineering Consultants A.E., Greece
AIA Lda. Consultants, Portugal
Cardiff City Council, Cardiff, UK
Cheshire County Council, Chester, UK
City of Glasgow Council, Glasgow, UK
COBA Consultants, Portugal
Derbyshire County Council, Matlock, UK
DEYAR, Crete, Greece
Dr Paris Kokorotsikos, Consultant, Greece
Dr Riki Therivel, Oxford Brookes University Impacts Assessment Unit, Oxford, UK
Egnatia Odos A.E., Greece
Environment Agency, Cardiff, UK
Environment Agency, Ipswich, UK
Environment Agency, Nottingham, UK
Environment Agency, Reading, UK
Environment Agency, Sale, UK
Environmental Agency, Lincoln, UK
Essex County Council, Chelmsford, UK
Falkirk District Council, Grangemouth, UK
Herr Edmund Spindler, Consultant, Germany
HPK Consultants, Portugal
Impacto 2000 Consultants, Portugal
Institute of Environmental Promotion, Ministry of the Environment, Portugal
Ministry of the Environment, Public Works and Place Planning, Thessaloniki, Greece
Norfolk County Council, Norwich, UK
North East Lincolnshire Council, Grimsby, UK
OTAMP, Thessaloniki, Greece
Papachristou Research & Engineering, Greece
Paraskevopoulos-Georgiadis Ltd, Environmental Consultants, Greece
Prefecture of Florina, Greece
Prefecture of Grevena, Local Union of Municipalities and Communities, Greece
Prefecture of Thessaloniki - TEDK, Greece
Prof. Dr. O. Sporbeck, Utrecht, The Netherlands
Professor Christopher Woods, Manchester University EIA Centre, Manchester, UK
Professor Dr E Papachristou, Aristotle University, Greece
Professor Peter Wathern, Aberystwyth University EIA Unit, Aberystwyth, UK
Regional Environment Centre of South-East Finland, Finland
Regional Environment Centre of South-West Finland, Finland
Regional Environment Centre of West Finland, Finland

Regional Environment Centre, North Ostrobothnia, Finland
Regional Environment Centre, South Savo, Finland
Regional Environment Centre, Uusimaa, Finland
SEPA, East Kilbride, UK
SEPA, Edinburgh, UK
Surrey County Council, Kingston upon Thames, UK
Tecnivest Consultants, Portugal
Themeliodomi S.A. - Passavant Werge A.G., Greece
UVP Forderverein, Hamm, Germany