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3

Post-project analysis in environmental impact assessment

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Post-project analysis in environmental impact assessment

Report prepared by the task force on environmental impact assessment auditing with Canada as lead country

UNITED NATIONS
New York, 1990

NOTE

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PREFACE

In March 1988 the Senior Advisors to ECE Governments on Environmental and Water Problems decided to undertake a project on the use of environmental impact assessment auditing. This project has been carried out by a task force with Canada as lead country. The task force set out to determine the approaches used by those who have already undertaken successful post-project analyses (PPAs) so that others might avail themselves of viable ways to improve the practice of environmental impact assessment (EIA).

Because PPAs appear to offer the promise of substantially strengthening EIA, and because the need for more PPAs is now clearly seen, it was considered timely to develop and document suitable approaches to undertaking PPAs. In order to meet this goal, a comparative case study analysis has been carried out. Task force participants provided 11 cases for analysts.

The case studies involved both management-oriented PPAs and EIA process development oriented PPAs. They included PPAs that addressed single issues and those which covered an entire project. Some of the PPAs were scientific and technical, while others dealt with procedural and administrative issues. Both biophysical and socio-economic impacts were addressed. The PPAs selected from eight different countries illustrate a variety of ways of employing the principles of EIA to all phases of projects. The aspects explored as a result of the analysis were the following: (a) the role of PPAs in EIA; (b) the content of PPAs; (c) the development and design of PPAs; and (d) the management of PPAs.

The study begins with a summary including conclusions and recommendations. Chapter I discusses classification of PPAs; it also includes definitions of PPA, EIA processes, and various types of monitoring. Chapter II provides a summary description of the case studies. The final chapter presents the results of the analysis. Annex I contains information provided by ECE member countries in response to a request for reports on PPA practices. Annex II gives of a more detailed description of the approach taken by the task force in its study of PPAs. A glossary of terms is provided in Annex III.

The work of the task force was completed during 1988 and the resulting report together with all relevant background material was approved in March 1989 by the Senior Advisers to ECE Governments on Environmental and Water Problems.

The present publication represents the state of knowledge and experience around the end of 1988. Participating in the task force were: Canada; Finland; Germany, Federal Republic of; Hungary; Netherlands; Norway; Poland; Sweden; Union of Soviet Socialist Republics; and United States of America. Denmark, German Democratic Republic, Switzerland and Yugoslavia provided information on legal and administrative policies regarding PPA. The Senior Advisers wished to put on record their appreciation for the efforts of the Government of Canada in leading the task force on Environmental Impact Assessment Auditing. In accordance with established practice, this report is published under the sole responsibility of the secretariat.

SUMMARY WITH CONCLUSION AND RECOMMENDATIONS TO ECE GOVERNMENTS

The importance of environmental concerns and their relationship to economic development is recognized by Governments. One significant response to this realization is reliance on assessment of environmental impacts. Environmental impact assessment (EIA) is a procedure used in order to evaluate the effects of economic activity before a development takes place. This instrument is thus an aid in interpreting and communicating information about eventual impacts. Environmental impact assessment allows possible effects to be investigated and consequently a means for their management to be identified. By providing the decision-maker with a composite picture of the environmental consequences of a proposed activity along with alternative developments, environmental impact assessment contributes to good environmental management.

The increasing use of EIA and its value in dealing with the economy-environment linkage has stimulated attempts to improve this practice. Two functions are in need of improvement. They are: (a) EIA's ability to predict project impacts accurately and convincingly; and (b) EIA's capacity to allow project decisions to be made in the absence of certainty about environmental impacts. Concern has been expressed, for example, that EIA analysts lean too heavily on expert opinion when they are making predictions and do not rely enough on empirical evidence from actual projects. In other words, it is felt that there is too great an inclination to "re-invent the wheel", to start each time at the beginning as it were, with too little study of actual project impacts.

Making decisions in the absence of certainty is of course a problem that manifests itself in a variety of ways. The very high cost of "react and cure" strategies (compared with "anticipate and prevent" strategies) should preclude approving any project with significant unmitigated impacts. It goes without saying, prior assessment of predicted effects can likely save money in the long run. Insisting on mitigation measures for every possible impact could be inordinately expensive, however.

One of the most cost-effective tools for improving assessments of environmental impact is post-project analysis (PPA). PPAs are environmental studies undertaken during the implementation phase (prior to construction, during construction or operation and at the time of abandonment) of a given activity - after the decision to proceed has been made. PPAs may be undertaken to ensure or facilitate the implementation of the activity in accordance with the terms imposed by the environmental assessment process, or to learn from the particular activity being studied.

The findings of the task force were derived from a comparative analysis of 11 case studies. The case studies have made significant contributions to addressing the two problematic aspects of EIA discussed above. Examining projects as they are implemented (that is, in the phases of preconstruction, construction, operation and abandonment) and documenting and analysing the observed impacts and the effectiveness of mitigation measures elicits precisely the sort of factual evidence needed for future environmental reviews. This observation also applies to procedural and administrative aspects of project management. That is, the case studies cover not only scientific and technical aspects of the projects but also deal with the

effectiveness of the environmental management systems employed. In this way authorities responsible for future projects of the same type or projects with parameters similar to those studied will reap the benefit of the better understanding gained of likely impacts and effective mitigation measures possible.

The difficulty of making decisions in the absence of certainty will always be a part of any environmental review: after all, the projects examined are inevitably those which are relatively new or expected to have significant impacts or risks. For some of these impacts, case-study PPAs indicate that final decisions regarding mitigation measures may be postponed until more is learned about their efficacity. Conversely, the prevention of many types of impacts depends on mitigation measures being incorporated from the very beginning of the project in order to be effective. In the latter instance, deferral of decisions on mitigation measures is definitely not appropriate. The role of PPAs in these circumstances is to monitor project consequences, evaluate the results, and employ such mitigation measures as are actually required. In this way, resources devoted to environmental management can have a much more efficient yield while mitigation measures may be applied where they are needed but not where they are unnecessary. In addition, public confidence in a project can be legitimately enhanced by the use of suitable PPAs. This "monitor, evaluate and manage" strategy was found to be very effective in the case study PPAs.

The case studies have led the task force to appreciate the value of PPAs in managing environmental consequences of development projects. Moreover, they illustrate how the EIA process can be improved through reiterative feedback during the project implementation phase. Not only can PPAs contribute to assuring that the benefits anticipated as a result of the environmental review are effectively put in place when the project proceeds, but they can also improve the environmental impact assessment process itself by providing feedback about how environmental impact assessment has worked.

CONCLUSION AND RECOMMENDATIONS TO ECE GOVERNMENTS 1/

as endorsed by the Senior Advisers to ECE Governments on Environmental and Water Problems at their second session 2/

The task force concluded that post-project analyses are a very effective and necessary means of continuing the EIA process into the implementation phase because of their uses for the following purposes:

(a) To monitor compliance with the agreed conditions set out in construction permits and operating licences;

(b) To review predicted environmental impacts for proper management of risks and uncertainties;

(c) To modify the activity or develop mitigation measures in case of unpredicted harmful effects on the environment;

(d) To determine the accuracy of past impact predictions and the effectiveness of mitigation measures in order to transfer this experience to future activities of the same type; and

(e) To review the effectiveness of environmental management for the activity.

With a view to promoting the use of effective and efficient PPAs as well as to strengthening EIA processes in the project implementation phase, it is recommended that:

1. Post-project analysis should be used to complete the environmental impact assessment process by providing the necessary feedback in the project implementation phase both for proper and cost-effective management and for EIA process development.

2. ECE Governments should apply the specific recommendations set out hereafter to suitable projects and should report back to the Senior Advisers in three years' time on the results of those PPAs and experience gained in their implementation.

Relationships between environmental impact assessment and post-project analysis

3. A preliminary plan for the PPA should be prepared during the environmental review of a project; the PPA framework should be fully developed when the EIA decision on the project is made.

4. The PPA should focus on important impacts about which there is insufficient information; identification of these impacts and their priorities is undertaken during the environmental review process.

5. The authority to undertake a PPA should be linked to the EIA process so that the concerns identified for inclusion in the PPA during the environmental review can be properly addressed.

6. The conditions of approval for a project should be such that the environmental management for that project will take into account the findings of the PPA.

7. PPAs should be done for all major projects with potentially significant impacts. In addition, for other projects, focused PPAs may be suitable either for environmental management of the project or to learn from the project.

Content of PPA

8. The development of hypotheses to test should be a part of PPAs. The hypotheses will depend greatly on the nature of the PPA and may involve comparisons of impacts with predictions or with standards or they may relate to how well the environmental management system worked.

9. In order to undertake PPAs effectively, baseline data relevant to the hypotheses should be collected and be as complete as possible.

10. Monitoring and evaluation of the data collected in the monitoring process should be an essential part of PPA. These steps are needed in order to test the hypotheses.

11. Documentation of the project and its impacts should be encouraged in order to improve PPAs.

PPA development and design

12. The first and most crucial step in developing a PPA should be to define its purpose. This would include the development of a specific purpose and focus for each component of the PPA.

13. Once the purpose of the PPA is known and its conceptual content identified (from the environmental review), it is essential to define the roles and responsibilities of the various participants in the PPA - the proponent, the various government agencies, scientific and technical advisers, and the public.

14. Management and participant responses required in the light of PPA findings should be, as far as possible, specifically addressed.

15. The need to deal with environmental surprises must be built into PPAs. Monitoring should be done in such a way that unexpected results have a good chance of being detected and those responsible for the PPA should have the power to respond appropriately to unexpected results.

16. The use of independent experts to help design the PPA should be encouraged as it leads to a better and more credible PPA.

17. The detailed development of the PPA should consider features such as the different phases of the project (preconstruction, construction, operation and abandonment), the need for integration of different aspects being studied, and the need to relate the effects being monitored to the project (separating out confounding effects of other activities).

PPA management

18. As a tool for managing PPAs, advisory boards consisting of industry, government, contractors, independent experts and public representatives, should be used. Such boards with well-defined terms of reference increase the credibility and quality of the PPA.

19. Public participation in the PPA should be encouraged.

20. PPA reports should be made public.

21. The use should be encouraged of independent researchers to do those parts of a PPA that are particularly sensitive and for which work done by the proponent (or possibly even by a government agency) may not be regarded as credible.

22. PPAs should be managed adaptively with opportunities to refine them depending on the results obtained. More effort should be put into examining those effects that are observed and important, and less effort should be expended on those effects which the PPA indicates are not resulting in significant impacts.

Notes

1/ An analysis of the information which led to the conclusion and recommendations is contained in Chapter III B.

2/ The United Kingdom fully concurs with the principle that the actual effects of a development project on the environment should be evaluated, after development consent has been given, both during the construction phase and subsequently during the project's operation. Such evaluation needs to be continuous and to be accompanied by powers to enforce environmental standards and conditions of operation, to require action to remedy adverse environmental effects and to secure improvements, for example by continually upgrading plant to the standard of the best available technology not entailing excessive cost, or by the tightening of pollution controls in the light of new evidence of risk. The United Kingdom has long-standing provisions of this kind, applying to all relevant installations, not only those which have been subject to environmental impact assessment. These provisions will be refined and expanded by planned new legislation on the introduction of an integrated system of pollution control for industry. In the United Kingdom's view the elaborate post-project procedures recommended by the task force would not improve on these arrangements. (In accordance with document ECE/ENVWA/9, paragraph 42).

I. DESCRIPTION AND CLASSIFICATION OF POST-PROJECT ANALYSIS (PPA)

In this section the term post-project analysis (PPA) is defined in greater detail and its role in the EIA process is identified. Related terms such as "monitoring" and its many variations are also defined. Two different classifications of PPAs are introduced then subsequently used to describe the case studies.

A. PPA in the environmental impact assessment process

Environmental impact assessment (EIA) is a process that attempts to identify and predict the impacts of proposed activities on the environment and on human health and well-being. EIA also interprets and communicates information about those impacts, and investigates and proposes means for their management. In an EIA process, proposed activities undergo an environmental review followed by a decision on whether or not to proceed with the activity (and, if so, under what conditions). This process is illustrated in Figure 1.

The details of how this environmental review takes place vary, depending on the activity proposed and on the EIA process employed in the relevant jurisdiction. Most environmental reviews include significant involvement of the public.

Some would argue that the decision on whether or not to proceed with a project ends the EIA process, but most EIA analysts today would agree that the process continues into the implementation phase when the proposed activities are under way. The implementation phase (including preconstruction, construction, operation and abandonment of the activities) begins with the decision to proceed with the project. It should be recognized that, in principle, EIA deals not only with projects but also with programmes, policies and plans. However, the case studies presented deal only with projects and most EIA processes have been applied mainly to projects. Accordingly, for simplicity, it has been assumed that a project is involved.

Post-project analyses encompass environmental studies undertaken during the implementation phase of a project; that is, PPAs are the set of environmental studies undertaken following the decision to proceed with the project. These studies are generally undertaken either to ensure or facilitate the implementation of the project in accordance with the terms imposed by the environmental assessment process (management-oriented studies). They may also be done to learn from the particular project (EIA process development studies). Compliance monitoring studies required by regulatory agencies are considered to be PPAs.

B. Classifications of post-project analyses

There are two different ways of classifying PPAs. The first groups them according to the use or purpose to which they are put (project management or EIA process development); the second identifies them by the type of study undertaken (scientific and technical, or procedural and administrative).

Classification by purpose of PPA

As mentioned above, there are two major kinds of PPAs. The project management PPA involves studies undertaken for the purpose of controlling the environmental impacts of a project. These may involve monitoring and analysing selected aspects of the environment or of the project and applying the findings to manage the project appropriately (e.g., in accordance with the terms imposed as a result of the environmental assessment process).

The project management PPA may involve compliance monitoring directed at ensuring that regulations are observed and that standards are met. Effects monitoring may also take place; this involves looking at environmental variables in order to determine those changes attributable to the construction and operation of the project. Base-line monitoring - the measurement of relevant environmental variables during a representative period of pre-project conditions - is a valuable component of PPA because it is crucial to relate the findings of the PPA to the project. Any of these types of monitoring may in turn involve target monitoring or factor monitoring.

Examples of how monitoring can lead to better environmental management of the project are numerous. If construction techniques observed during compliance monitoring are found to be less than satisfactory, then the timing or nature of the construction practices may be adjusted. In extreme situations, it may be necessary to stop work in order to resolve problems that the project has created. Environmental effects monitoring may lead to the conclusion that certain impacts are greater than was expected and hence that mitigation measures are called for. If measured noise levels are higher than those found acceptable during the environmental review, for example, additional steps may be taken to achieve the lower levels specified in the permits granted at the time of project approval. Conversely, if monitoring indicates that certain predicted effects are not occurring, it may be wise not to spend resources on any mitigation efforts but rather to reallocate resources to areas where the benefits will be worthwhile.

A final example is the use of monitoring results in order to determine the compensation required to be paid to local citizens affected by a project. If the local employment levels are too low, or if wear on local roads is too great, the project proponent (or perhaps the government) may agree to provide compensation to affected communities. The magnitude of that compensation, or indeed the need for it, may depend on the outcome of effects monitoring.

PPAs may also be relevant for EIA process development. There are, of course, process development benefits other than those which accrue to the field of EIA. Improvements in science, engineering, and management may also result but, for the sake of simplicity, attention here is focused on the process development benefits for EIA. The EIA process development PPA involves learning the lessons to be learned from the particular project (and process) so that this knowledge can be applied productively and lead to discovery of ways to improve EIA. The predicted impacts may be compared with actual impacts, in an effort to improve predictions of environmental impacts; or the means of managing projects may be examined from an environmental point of view. For EIA process development PPAs, the purpose is to learn by doing. Thereby society can take advantage of successful methods and avoid in future those which have proven inadequate.

Classification by type of study

The second classification of PPAs characterizes them according to their typology: scientific and technical or procedural and administrative. Scientific and technical studies generally deal with the scientific accuracy of impact predictions and the technical suitability of mitigation measures. Such studies compare predictions made in the environmental assessment review with facts observed when the project proceeds.

Procedural and administrative studies deal with EIA process-effectiveness (hence they are often evaluation-type studies). They may deal with environmental management systems and practices, public participation roles, or the relations between environmental assessment processes and other government procedures. These environmental managements systems will generally involve the proponent and relevant government agencies (including the agency responsible for environment matters, i.e., the agency with responsibility for the affected environment; the competent authority, i.e., the agency with responsibility for regulating the project; and such other agencies as appropriate). It may also include outside technical experts, contractors, and members of the affected public. It should be noted that, for project management orientated PPAs, the environmental management system is likely to be responsible for the PPA.

It may be useful to subdivide procedural and administrative PPAs into those which are project related and those which are process-related. The former deal with environmental management of the project when it proceeds while the latter address the environmental assessment process. Anyone concerned with the environmental assessment process might question its effectiveness or its efficiency. Did the EIA identify the right concerns? Were all stakeholders (public, proponent, government agencies, technical experts) involved appropriately? Are there more efficient means of getting the same information? Was the process fair to all participants? What was the relationship between the environmental review and other government planning processes? These process-related studies, it should be noted, still involve specific projects, but the focus of the study is the review process and not the project itself. (C.f. Figure 2 for a succinct view of this system.)

Procedural and administrative PPAs that are project-related look at how the recommendations arising from the environmental review were acted on during the implementation phase of the project. These reviews may well be coupled with a scientific and technical assessment of the project and can address a variety of techniques used to ensure that the good environmental-management plans developed during the environmental review are practised when the project proceeds. These techniques may include the use of an environmental co-ordinator for on-site supervision, an environmental committee charged with responsibility for implementing suitable environmental-protection measures, or a binding agreement between the proponent and the environmentally responsible agency. Questions asked might deal with the successes and failures of the environmental management system. Was it effective in seeing that the mitigation measures were applied properly? How did it respond to the inevitable environmental surprises not predicted during the review? How was the final project design reviewed for environmental concerns? How did the environmental management system respond to the results of monitoring

programmes? Did the system work well for the participants? Was it able to function when key project actors were promoted or replaced by others? The key to such studies, as with all PPAs, is to identify what works well so that it can be emulated, and to avoid repeating problems.

For the purpose of this study, PPAs include not only those focused on scientific and technical issues but also those dealing with procedural and administrative matters. Both types of analyses have much to offer for the improvement of EIA.

Other classifications of PPAs may also be mentioned. One common classification, similar to that of study type, involves defining audits and evaluations. 1/ Audits are PPAs that compare the measured impacts of the project with the pre-project conditions and the predicted effects of the project. Evaluations are PPAs that examine the effectiveness of the processes used to manage environmental impacts.

1/ See, for example, "Environmental Monitoring and Audit: Guidelines for Post-project Analysis of Development Impacts and Assessment Methodology", October 1988, Environment Canada and Transport Canada (Environmental Impact Systems Division, Environment Canada, Manuscript Series), Ottawa, Canada.

Figure 1. Environmental Impact Assessment Process

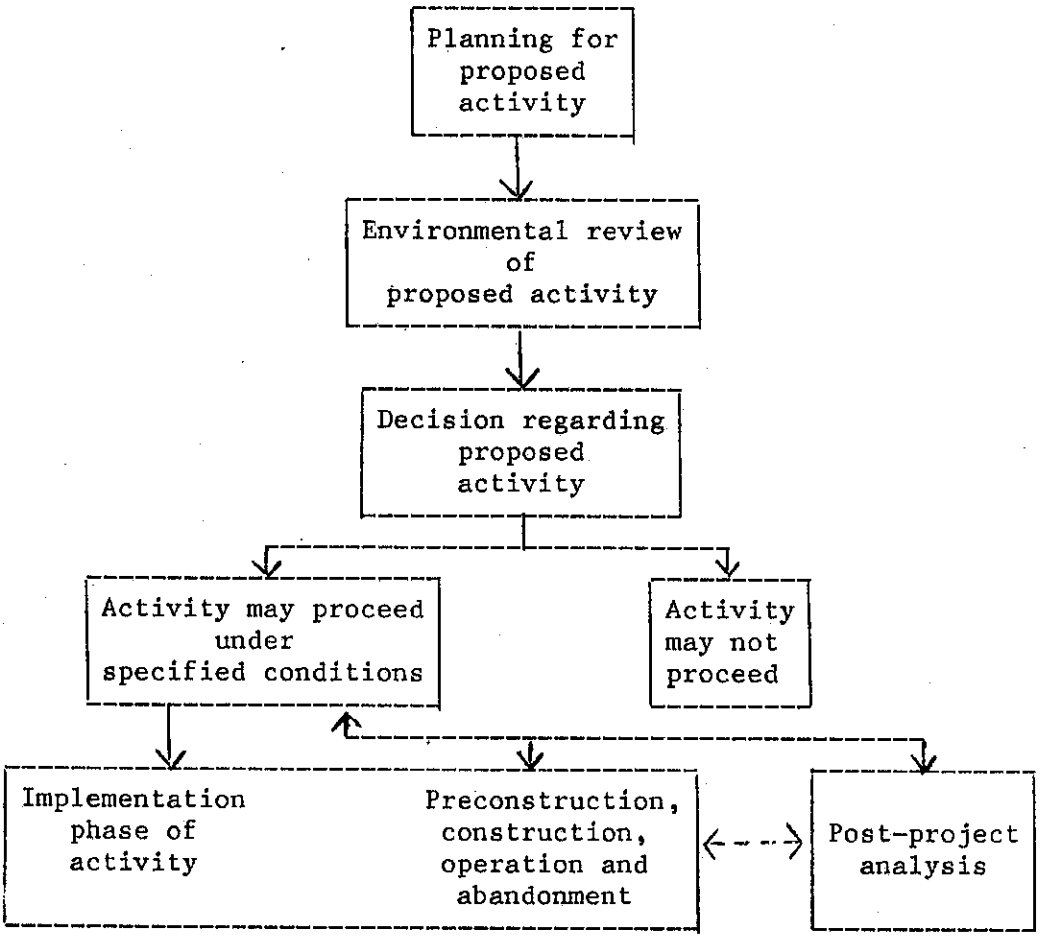

Figure 2. Summary of Classifications for Post-project Analyses (PPA)

CLASSIFICATION BY USE OF PPA

Project Management PPA	Undertaken for the purpose of managing the environmental impacts of the activity.
Process Development PPA	Undertaken to learn the lessons to be learned from the activity so that future reviews of similar projects can benefit.

CLASSIFICATION BY TYPE OF PPA STUDY

Scientific and technical PPA	Deals with the scientific accuracy of impact predictions or the technical suitability of mitigation measures.
Procedural and administrative PPA	Deals with EIA process effectiveness. May deal with the project as implemented or with the EIA process.

II. SUMMARIES OF CASE STUDIES

This section provides a description of each of the case studies selected by the task force according to a methodology specified in Annex II.

Case 1: Norman Wells Oilfield development and pipeline project in the Northwest Territories (Canada)

The project consisted of the expansion of an oilfield at Norman Wells, Northwest Territories (increasing oil production from 600 cubic metres per day to 4,000 cubic metres per day) and the construction of an 860-kilometre pipeline for shipping the oil to markets in southern Canada. The project was reviewed under the Canadian federal environmental assessment review process in 1981 and 1982. The project was approved with a two-year delay before construction started in 1983; operation commenced in 1985. Since 1982, several PPA studies have been conducted for the Norman Wells project; these could be described as biophysical studies, socio-economic studies, and government effectiveness studies.

The biophysical studies included compliance monitoring; this is normally required by the pipeline regulatory body, but it can also address other issues arising during the environmental review. These studies were undertaken for both environmental management and process development. The biophysical studies were scientific and technical.

The socio-economic studies were scientific and technical but included environmental-effects monitoring. They were intended primarily to document the socio-economic effects of the project for the benefit of future environmental reviews; that is, the socio-economic studies were a procedural and administrative PPA.

The biophysical studies involved both compliance monitoring and environmental-effects monitoring and were largely based on a legal agreement between the federal Government and the pipeline proponent. Co-ordination of these studies has been done by the Norman Wells Research and Monitoring Working Group, which is composed of representatives of the federal Government, the Northwest Territorial government, the proponents, academics, representatives of research institutes, and the affected local people. The priority areas for biophysical research include raptors, wildlife, snow geese, thermal régime and ground stability (in the discontinuous permafrost zone), air quality, revegetation and site restoration. For each of these (and other) concerns, monitoring studies have been done and are documented in the annual reports of the working group.

The socio-economic studies were conducted by the federal Department of Indian and Northern Affairs, independently of the biophysical studies. The socio-economic studies, conducted by an academic seconded to the department, began in 1982, prior to the start of construction and continued until just after completion of the project in 1985. The study focused on the four communities most directly affected. The main interest of the research programme was employment and spending in these communities - the extent of local hire, demographic impacts, economic leakage, and local perceptions of project impacts.

This PPA case study also deals with compliance monitoring for project management. It has yielded considerable information for predicting impacts of future northern projects.

Case 2: CP Rail* Rogers Pass development in British Columbia (Canada)

The project entailed construction of a 34-kilometre second main railway line in Glacier National Park, British Columbia. This comprised two tunnels (one 15 kilometres in length and a second 2 kilometres long), a ventilation shaft for the long tunnel, six bridges, two work camps, and other associated facilities. The project was reviewed under the Canadian federal environmental assessment review process in 1982 and 1983. Construction began in 1982 and was completed in 1988.

As a result of the environmental review, several monitoring and evaluation studies were required of the proponent and of the agency responsible for environmental management purposes. In addition, a separate study of the project was undertaken for Environment Canada so as to improve environmental impact assessment by learning what happened during construction of the project. This EIA process-development study was undertaken by independent consultants who, although familiar with the project, had not been involved at earlier stages, either on behalf of the proponent or the environmentally responsible agency.

The management-oriented component of the PPA involved both compliance monitoring and environmental-effects monitoring. It was largely a scientific and technical audit undertaken by those involved in the environmental management system for the project. The EIA process development component of the PPA included both environmental-effects monitoring and a detailed assessment of how the environmental management system worked for the project. Some scientific and technical auditing of specific impacts was carried out, but the PPA concentrated primarily on procedural and administrative questions.

The major biophysical issues addressed by both PPAs were the design and siting of the ventilation shaft, the visual impact of the surface route along a river valley across from the Trans-Canada Highway, the revegetation and reclamation measures, terrain impacts and erosion control, stream crossing techniques, and the operation of work camps within Glacier National Park.

This PPA case study has made a major contribution to knowledge about effective environmental management and a better understanding of impact prediction and mitigation.

Case 3: National hazardous-waste treatment plant in Riihimaki (Finland)

The national hazardous-waste treatment plant consists of an incineration plant, a physical-chemical treatment plant, a special landfill, a receiving station (including pretreatment facilities for oily wastes) and a waste-water treatment plant. The facility, which has an annual capacity of 114,000 tonnes of waste, is located in Riihimaki in southern Finland, about 60 kilometres north of the capital city of Helsinki.

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*/ CP Rail stands as an abbreviation for the Canadian Pacific Railway Company.

While there was no formal EIA process in Finland at the time this project was proposed, an environmental review was carried out in order to obtain permission to process hazardous waste, and for approval according to the air pollution control notification procedure. The review took place between 1981 and 1983, at which time preliminary permission was granted to proceed with the project. After four years of pilot operation and monitoring, final permission for the facility was granted in 1987.

A substantial sophisticated monitoring and evaluation programme was developed as required for the project. The pilot-phase monitoring focused on measuring plant emissions and their effects on the environment (environmental-effects monitoring - both target monitoring and factor monitoring). The conditions for according final permission were set by the competent authorities and required monitoring of the emissions and plant operation, monitoring of air quality, monitoring of the state of the environment, additional studies, and environmental research and reports to the authorities. The actual work done to date has been undertaken by the proponent, research institutes, universities and individuals.

An extensive baseline data gathering programme was undertaken. It dealt with: ground water and surface water; air; tree stands, vegetation and soil; animals; foodstuff and cattle feed; as well as human beings. The same type of data continues to be collected but attention and resources allocated to the monitoring are adjusted depending on the results observed.

This was essentially a scientific and technical PPA used for project management, although there was also a significant EIA process development component for improving impact predictions concerning future facilities of this kind. The major contributions of this PPA case study are the knowledge gained about the impacts of such a facility and the adaptive management strategies involved in the PPA. Public involvement in this PPA should also be noted.

Case 4: Ground-water extraction in the Lueneburger Heide (Federal Republic of Germany)

The project involved a permanent ground-water extraction scheme for the supply of drinking water to the city of Hamburg. The facility is located in the Lueneburger Heide, the oldest ecological reserve in the Federal Republic of Germany about 30 kilometres south of Hamburg. It consists of 30 deep wells (between 90 and 350 metres in depth) and is licensed for the extraction of 25 million cubic metres of water annually.

The project was not subjected to an environmental review under a formal EIA process, although it did go through 60 single reviews dealing with specific types of environmental impacts. These were completed between 1967 and 1974 and the administrative permit was granted by the water authorities in 1974.

The PPA for this case consists of many different studies undertaken by various agencies. These studies by experts, academics, members of the public, environmental groups, the Federal Environmental Agency all drew attention to and addressed the environmental risks of the project. In addition, an

evidence gathering procedure (Beweissicherungsverfahren) was used during the licensing procedure. It was extended by the water authorities as a result of further questions about the project. This procedure resulted in many of the PPA studies being undertaken.

The PPA involved agricultural studies (land-use patterns, agricultural yields, soil nutrients), forestry studies (tree-growth measurement, forestry mapping, tree-quality measurements), soil investigations (especially of the relationships between soils and ground water), wetland investigations, plant sociology studies (plant communities in hundreds of grassland, arable land, and forest sites), hydrological studies (movement of surface waters, precipitation, and ground-water levels) and fish ecology investigations. The nature of these studies could best be described as environmental effects monitoring.

This case study has been used for project management as a result of public pressure in response to the PPA findings. The public was also involved in undertaking some of the PPA studies. The PPA could also be classed as scientific and technical since its main purpose was to document the project impacts. PPA studies have also been used to provide evidence for the legal permit process used for water extractions.

Case 5: A secure landfill for middle class hazardous waste on the North Sea coastline (Netherlands)

The project consists of the creation of a storage site for non-treatable middle class chemical wastes. (Middle class waste consists of inorganic wastes such as pigment sludges, metal sludges, spent catalysts, enamel sludges, metallurgical slag, blasting sludges, fluoride sludges, and gas scrubber sludge from incineration of chemical waste.) The landfill is located at the Maasvlakte on the North Sea near the port of Rotterdam. The hazardous waste will be stored in a reinforced concrete tank with a capacity of 230,000 cubic metres.

For this project, the Dutch EIA process was followed to aid decision-making on the following: (a) dispensation to deposit chemical wastes in or on the soil - Chemical Waste Act; (b) the Nuisance Act licence required for the storage of waste and for general operation of the facility; and (c) a licence for discharge of waste water into surface water - Pollution of Surface Waters Act. The EIA procedure started in November 1984 and the final decision to approve the facility was taken in April 1987. Construction began in January 1988 with operation expected to begin in late 1989.

Under the Dutch EIA process, a PPA is required; the first concept of the PPA was developed initially as part of the environmental review. This was altered somewhat as a result of the review and a framework for the PPA was included in the licences for the facility. This framework was subsequently expanded upon and gradually detailed execution plans were developed before and during construction. The PPA includes both compliance monitoring and environmental-effects monitoring. The competent authorities are responsible for the PPA in accordance with EIA regulations in the Netherlands. Detailed plans for the PPA were developed mostly by the proponent and were presented to the competent authorities, who approved them.

The PPA for the construction phase of the project consists mostly of compliance monitoring in the expectation that the most important measures taken to make the project environmentally acceptable in the long run would involve controls at the time of construction. In this phase the competent authorities relied somewhat on outside expertise. During operation, attention will be devoted to matters such as soil protection provisions, composition of the drain water, measurements of ground-water levels, determining leachate composition, noise, dust and odour concerns, and the development of nature and the landscape surrounding the landfill. After closure of the landfill, the PPA will shift its concern primarily to possible leakage of the cover system, ground-water composition, and the development of nature and the landscape surrounding the landfill.

This PPA is essentially scientific and technical, designed both for environmental management and to document the impacts of the hazardous waste facility. It involved compliance monitoring as required by the competent authority. It demonstrates how a PPA evolves from a preliminary plan to a solid outline for the studies actually undertaken.

Case 6: Disposal site for contaminated silt dredged from Rotterdam Harbour (Netherlands)

The project consists of a disposal site for contaminated silt from dredging operations in and around the port of Rotterdam. The site is located on the North Sea near the port, adjacent to the secure landfill for middle class hazardous waste (discussed under case 5 above). The facility consists of a 46-metre-deep excavation extending from 23 metres above sea level to 23 metres below sea level and having a surface area of 240 hectares. It has a storage capacity of 100 to 150 million cubic metres.

The environmental review was conducted before the adoption of legislation on EIA, on a voluntary basis, in accordance with the Dutch EIA process as it was being developed between 1982 and 1985. The project and the PPA began in April 1986 and the disposal site was opened in September 1987. The PPA development was based substantially on the environmental review. This led to a rough outline of the PPA being included in the licences for the project. Adjustments to this outline were made, resulting in a proposal to monitor both temporary and permanent effects. Subsequently, it was decided that the PPA should monitor and evaluate only permanent effects and, since 1987, this has been the focus of the work. Other criteria used to select the elements to be addressed by the PPA were: (a) impacts that can be diminished or eliminated by mitigation measures; (b) impacts that played a substantial role in the decision making during the environmental review; and (c) impacts that may play a role in future reviews of comparable projects.

Environmental-effects monitoring was the main tool employed in this PPA. Effects monitored included silt deposition on the beaches, changes in the morphology of the study area (erosion and sedimentation), soil studies, wave heights, and sea levels. In addition, the permanent effects monitored have included vegetation, birds, salt spray, and soil fauna.

This case study deals with a scientific and technical PPA which had as its main purpose EIA process development. Environmental management was also

an important concern. This case study like the one which precedes it (case 5) demonstrates the gradual development and refinement of PPAs from the environmental review through to project implementation.

Case 7: Terminal facility for gas from the North Sea Statfjord Field (Norway)

This project consisted of a facility to receive natural gas from the offshore Statfjord Field in the North Sea. The plant, located in Karsto in western Norway, receives, refines and ships gas to European customers. The project was reviewed through an ad hoc impact assessment carried out as part of the process of establishing input in the application for a licence. The decision to locate the facility in Karsto was taken in 1981; construction was completed and the plant opened in 1985.

The licence to develop a gas terminal was given on the condition that a major research programme on social and economic effects would be carried out. This programme emphasized local and regional effects and was financed equally by the proponent and the Norwegian Government. The PPA was required partly because of concern raised during the environmental review and partly because, during the review, the subject was not treated with the depth required. The principal reason for the PPA, however, was that construction of several gas terminals of the same type had been anticipated and the detailed knowledge to be gained of socio-economic impacts would be of great value in future environmental reviews.

Three independent research institutes were engaged to do the work. Some of the Government's share of the cost was transferred through the Royal Council for Applied Social Science as part of a broader research programme ("Oil and Society"). A co-ordinating and advisory board was established, composed of representatives of the financing ministries, the proponent, the research institutes involved, the county of Rogaland, and the municipality of Tysvaer (where the facility is located). This board has generally dealt with the broad questions of research strategy and not with the more detailed questions of research design and methodology. It has been a useful channel of feedback to the users of the information gathered through the PPA.

The issues that have been addressed are: labour market conditions and industrial life; social and cultural aspects of life in the community; and municipal-level finances and expenditures. The studies have been socio-economic in nature: a combination of environmental-effects monitoring and compliance monitoring. Compliance monitoring in this case deals with ensuring that the proponent's obligations negotiated with the community of Tysvaer are met. In order to do this, an assessment was also undertaken of the socio-economic environmental management system.

This PPA case study was scientific and technical (although evaluating socio-economic impacts inherently involves procedural and administrative work as well) and was mainly designed as an EIA process development PPA. Considerable information has been made available about impacts of such projects through this PPA.

Case 8: The Rudna copper mine and the Zelazny Most tailings pond in the Legnica-Glogow Copper District (Poland)

This project concerns the Rudna copper mine and the related Zelazny Most tailings pond. The mine is in the Legnica-Glogow copper district in south-western Poland. There are three copper mines (including the Rudna mine), a copper ore processing complex, and the Zelazny Most tailings pond. A fourth copper mine was under construction in the area.

The Rudna mine extracts copper ore from depths of between 90 and 1,100 metres. The total ore mined yearly at Rudna Mine amounts to 15 million tonnes of sandstone copper ore containing an average of 1.8% copper. (This represents one half of the output from the three-mine complex.) The Rudna mine opened in 1974.

The tailings pond was constructed in 1977. It consists of a 1,500 hectare pond with a capacity of 350 million cubic metres. The tailings pond receives the flotation waste as a slurry from the three mines. This slurry contains mainly quartz and dolomite, but also copper and trace amounts of heavy metals. Also of concern is the excess found in the tailings pond of flotation reagents left after separation of copper from the ore (in particular, carbon disulphide).

The environmental review of the project was based on land-use planning laws, mining laws and environmental protection laws. The mining laws were most important in the review. They consist of a set of regulations for planning, designing, constructing and operating mines. These mining regulations are intended primarily to prevent subsidence of the land and to assure reasonable mining practices. The environmental review was not integrated but fragmented, as was the practice in the 1960s.

As a result of the environmental review, requirements were imposed for monitoring the identified significant environmental impacts. Monitoring networks were put in place in the area in order to measure and assess the following: (a) mining damage; (b) dust fall and fine particles; (c) sulphur dioxide, nitrogen oxides and carbon disulphide concentrations in the air; (d) surface and underground water quality; and (e) heavy metal concentrations in soil and vegetation. A separate complementary network was established around the Zelazny Most tailings pond for monitoring air, surface-water and ground-water pollution.

In addition, an area-wide environmental assessment of regional development in the Legnica-Glogow copper district was undertaken in 1979 with the co-operation of the United Nations Development Programme (UNDP) and the World Health Organization (WHO). This work involved comparing the impacts observed as a result of the Rudna mine project with those predicted. As such, it was also a PPA.

The PPA was primarily a scientific and technical review. It involved compliance monitoring and environmental-effects monitoring. Base-line monitoring for the area had begun before the mine started operation. The PPA results were used, in part, to suggest modifications to mine operations if unacceptable impacts were observed and to adjust, at five-year intervals, the "programme of environmental protection". However, the main purpose of the PPA

was to verify and improve the methods used for predicting impacts so that future mines (and similar projects) could benefit from the results and be subjected to more meaningful environmental reviews.

The PPA has led to a better understanding of the impacts that accrue from the mining technologies used. Several suggestions also came forth regarding ways to overcome the most unacceptable of these effects. These improvements include better techniques for back-filling the mines, different construction techniques for the tailings pond, and a more environmentally sensitive ore-treatment technology. Several means of improving the environmental review process were also developed through this PPA.

Case 9: Baikal pulp and paper mill (Union of Soviet Socialist Republics)

The project described is the Baikal pulp and paper mill located at the south end of Lake Baikal in Siberia. The pulp and paper mill was constructed in 1966 to produce high-quality cellulose pulp. It was built with an expensive, three-stage waste treatment capability (mechanical, chemical, and microbiological treatment) but, despite those precautions, the negative effects of the mill on the environment and on the Lake Baikal ecosystem have been considerable.

The project was the subject of an environmental review process that took place during and after its construction in the mid-1960s. The environmental review process was co-ordinated by the State interagency commission, which organized regular scientific and public meetings in the town of Baikal'sk (where the pulp and paper mill is located).

As a result of this environmental review, several monitoring and analysis programmes were developed in order to get regular information on the state of the environment in the Lake Baikal region. These programmes were undertaken primarily by the USSR State Committee for Hydrometeorology and by the Academy of Sciences. The agency currently responsible for the PPAs is the USSR State Committee for Environmental Conservation. The purpose of the studies was to obtain and evaluate environmental data and to predict future changes in the biotic and abiotic components of the ecosystems in and surrounding Lake Baikal.

The monitoring programmes, while paying considerable attention to the Baikal pulp and paper mill, did not focus solely on that project. Regional, national, and even global environmental concerns all manifest themselves in the Lake Baikal region; hence one important task of the PPA was to determine how much responsibility the pulp and paper mill should bear for the environmental problems identified through the monitoring programmes. With this goal in mind, the main task of the PPA was to obtain full information on major sources of pollution. Particular attention was paid to water quality, air quality, soils and ground-water pollution. The integrated regional monitoring system developed for the purpose made extensive use of mathematical models in order to describe and predict how the pollutants (from several sources) were being distributed. The verification of these models with field data was an important component of this PPA. The PPA was also expected to predict future environmental changes and formulate measures to improve the ecological situation in the region.

Hydrochemical base-line data on the waters in the area were gathered beginning in 1965, one year before the Baikal mill opened. The PPA itself is clearly of a scientific and technical type, with environmental-effects monitoring (mainly factor monitoring but also some target monitoring). The PPA has been used both for managing the project and for EIA process development.

The information gained about the functioning of the regional ecosystem has considerable value for future proposals in the region. In addition, the 1987 decision of the Soviet Government to close the Baikal pulp and paper mill and to transform it into a non-polluting industry during the period of the five-year plan 1991 to 1995 was influenced strongly by the PPA, which found that the environmental impacts of the mill were too great. This decision followed many years of reporting by the State Committee for Hydrometeorology, the agency responsible for the control of the state of Lake Baikal, which documented the impacts of the mill. It is also worth noting that public concern about these impacts - essentially public reaction to the PPA results - also influenced the government decision to close the mill and to convert it into an industry with zero-pollutant emissions.

Case 10: Relocation of Highway route 1A, in Harrington, Maine (United States of America)

The project involved the construction or relocation of a five-kilometre section of highway around Harrington, Maine, across the Harrington River, an estuary of the Gulf of Maine. This was the first highway project in the State of Maine to be evaluated through the environmental review process of the federal National Environmental Policy Act of 1969. The review was undertaken between 1970 and 1972. Construction of the highway took place in 1975.

One of the major concerns with the project was the displacement of a segment (approximately 0.6 hectares) of the Harrington River salt marsh. The Maine Department of Environmental Protection has a regulation that requires construction projects which eliminate or degrade existing salt marshes to compensate for these losses by creating salt marsh habitat equivalent to that destroyed. For that reason, a marsh creation project was made part of the highway construction project funded by the State and federal governments. As experience with reconstructing salt marshes as far north as Maine was essentially non-existent, a programme to monitor and evaluate the salt marsh reconstruction was also implemented. This PPA was a scientific monitoring programme that dealt only with this issue. It began with the construction of the highway (and of the marsh) in 1975 and continued through 1986. A scientist at the University of Maine, funded by the proponent (State and federal governments), carried out the work. The purpose of this PPA was to learn from the marsh reconstruction for future projects of this kind; it was a process development PPA which was strictly research-oriented. Compliance monitoring of the marsh reconstruction was also involved.

The PPA began in the preconstruction phase of the project with the gathering of base-line data on marsh vegetation species for comparison with later development stages of the relocated marsh. Construction and transplanting methods were documented and evaluated. Subsequently, measurements were made of hydrographic conditions, species composition and

distribution, growth rates, and plant biomass. The PPA consisted of an ecological study of salt marsh development. As such it would certainly be classified as a scientific and technical PPA.

Case 11: "Four Pepper Two" timber sale in Siskiyou National Forest in the State of Oregan (United States of America)

This case study concerned a timber sale consisting of eight clear-cut regeneration units totalling 56.5 hectares and one commercial thin unit of 11.8 hectares. The timber sale was situated in the Grayback Creek Watershed in Siskiyou National Forest in the State of Oregon (United States of America). The sale of timber was undertaken in order to harvest over-mature stands of timber and to convert the stands to a manageable condition. The project was originally reviewed under the United States National Environmental Policy Act of 1973. The proposed sale and alternatives were examined and a finding of "no significant impact" was handed down. As a result of that review, several management requirements and constraints were imposed on the project. The sale proceeded as "Four Pepper" but was later defaulted. A number of changes to the environmental assessment report were made in 1980 and the detailed design for the cutting was updated. A sale was then made under the name "Four Pepper Two".

In 1985 most of the forestry operations were completed. At that time, representatives of the National Forest Service (which, in this case, was both the environmentally responsible agency and the competent authority) undertook a PPA covering the sale contract, sale inspection reports, and on-ground results, in order to compare them with the original environmental assessment. The intent of this PPA was to learn how to undertake such projects better in the future; that is, it was an EIA process-development PPA. The PPA played a minor role as a management-oriented PPA. Most of the work for this project was completed at the time of the field review, hence the lessons learned were of more use for future projects.

This PPA investigated the effectiveness of local management of the EIA process as manifested in the Four Pepper Two sale, the extent to which the sale was carried out in accordance with the requirements imposed as a result of the environmental review, and the extent to which the project complied with requirements of the Forest Service generally. The major contribution of this PPA case study is improved understanding of impacts and their management for future forestry operations.

III. ANALYSIS OF THE CASE STUDIES

A. The five roles played by PPAs

Many references were made in the conclusions to the roles played by PPAs; hence their usefulness in fulfilling these roles merits consideration. For this reason, the roles are identified first then the ways in which the case studies contribute thereto are discussed. As was noted earlier, the two main reasons for undertaking post-project analyses (PPAs) are environmental management of the project and development of the EIA process. One of the recommendations of the Seminar on Environmental Impact Assessment held in Poland in 1987 is particularly relevant for its identification of the various stages of the EIA process as well as the overall purpose as follows:

> "Depending on the nature and degree of assessed impacts, EIA should continue during the construction, operational and decommissioning phases of activities in order to:
>
> "(a) monitor compliance with the agreed conditions set out in construction permits and operating licences;
>
> "(b) review environmental impacts for proper management of risks and uncertainties;
>
> "(c) modify the activity or develop mitigation measures in case of unpredicted harmful effects on the environment; and
>
> "(d) verify past predictions in order to transfer this experience to future activities of the same type."

The four aims listed clearly constitute subsets of the management and process-development objectives. Compliance monitoring, review of impacts for management, and activity modification in response to surprises are examples of environmental management. Verification of predictions is an example of EIA process development.

The case studies themselves also indicate another type of process-development PPA. Not only does post-project analysis help verify predictions regarding impacts or the effectiveness of mitigation measures, but PPAs also allow for scrutiny of procedural and administrative aspects of the project and of the EIA process. The task force, therefore, observed that the fifth purpose of post-project analysis was to review the effectiveness of environmental management for the activity. The five roles are summarized in table 1.

Table 1. Roles of Post-project Analyses

ENVIRONMENTAL MANAGEMENT OF THE ACTIVITY

1. Monitoring of compliance with the agreed conditions specified in construction permits and operating licences;

2. Review of predicted environmental impacts for proper management of risks and uncertainties;

3. Modification of the activity or development of mitigation measures in case of unpredicted harmful effects on the environment.

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS DEVELOPMENT

4. Verification of the accuracy of past predictions of impacts and the effectiveness of mitigation measures, in order to transfer this experience to future activities of the same type;

5. Reviews of the effectiveness of environmental management for the activity in question.

In order to see how the case studies contributed to these aims, table 2 was created. In it the major reasons for undertaking each of the PPAs are indicated. As may be seen, the case studies clearly respond to many of the demands of post-project analysis. The ways in which case studies do this will be discussed.

Table 2. Major Reasons for Undertaking Post-project Analyses

Case Study	Compliance monitoring	Review of predicted impacts for risk management	Modification in the light of unprecedented effects	Verification of predictions	Review of environmental management effectiveness
1	*	*		*	*
2	*	*	*	*	*
3	*	*	*	*	
4	*	*	*	*	
5	*	*	*	*	
6	*	*	*	*	
7	*	*		*	*
8		*	*	*	
9		*	*	*	
10	*			*	
11	*	*		*	*

1. Compliance monitoring

Regulatory compliance monitoring was a significant component of several of the PPAs studied. The examples cited are of course not unique. Other case studies could have been selected to make the same points. The Dutch (case 5) and Finnish (case 3) hazardous waste studies and the Canadian oil development study (case 1) all incorporate the regulatory compliance monitoring required by competent authorities as part of the post-project analysis. If PPAs are to be cost-effective, it is important to avoid duplication with other monitoring requirements. This has been successfully averted in the studies analysed. The ground-water extraction example (case 4), from the Federal Republic of Germany, involved the collection of data for use in the evidence-gathering procedure, a feature similar to compliance monitoring in other PPAs.

2. Review of predicted impacts for risk management

Reviews of actual project impacts for environmental risk management were undertaken as shown in many of the cases. For the Polish copper mine (case 8) and the Soviet pulp and paper mill (case 9), the results of the PPAs were quite often applied to adjust project-management plans. For the Dutch contaminated silt study (case 6), the PPA was designed specifically to address issues amenable to management. The Canadian railway PPA (case 2) involved several adjustments being made to project construction details as a result of the PPA findings.

Review is an aspect of PPAs which must be well-handled because the link between PPA findings and environmental-management of projects is the key to deriving many benefits from PPAs. Some of the PPA findings will point to the need for extra effort to deal with environmental impacts that are more serious than anticipated. The outcome of other PPAs will justify less diligence in certain areas as the impacts predicted do not materialize or prove to be less serious than expected. Both situations are described in the case studies.

3. Modification in the light of unpredicted effects

Coping with environmental surprises is an essential component of PPAs although it is one of the most difficult tasks to do well. The Dutch hazardous waste study (case 5) showed that specific requirements had been set for the proponent to respond to environmental surprises as reflected in the PPA findings. The Canadian railway PPA (case 2) also involved a legal agreement requiring the proponent to meet specified performance criteria. Adjustments were made to the project when it was found that a particular construction technique was bringing about needless visual impacts, a result not expected according to the environmental review. The water extraction example (case 4) illustrates a different means of responding to (perceived) environmental surprises. Public pressure on the proponent following PPA findings resulted in a downward adjustment in the rate of water extraction; this is an instance of a response to unexpected PPA findings. The Soviet pulp and paper mill study (case 9) represents, perhaps, the most dramatic response to an unexpected environmental finding; when the PPA findings demonstrated that the Lake Baikal ecosystem was being damaged significantly by the mill, a decision was taken to close the mill and convert it to a non-polluting industry.

4. Verification of predictions

All PPAs studies involved verification of impact predictions; PPAs must make some initial determination of impacts in order to contribute to environmental management and process development. The Norwegian gas development case study dealt in detail with determining socio-economic impacts in an area where this knowledge will be needed for future developments (case 7). The Polish copper mine case study (case 8) involves a determination of impacts in an ecologically endangered area where future copper mines are under development. The United States highway study (case 10) involved a detailed ecological analysis of an ecosystem (a salt marsh) that was not previously well understood. Moreover, the legislation calling for salt marsh restoration implies that understanding such an ecosystem is of critical importance. Clearly, all these PPAs offer a modus operandi and insight that will help when assessing future projects.

5. Review of environmental management effectiveness

Some of the case studies put particular emphasis on environmental management. The United States forestry PPA (examined in case 11, the "Four Pepper Two" timber sale project) deals with the environmental management of national forest resources, the effectiveness of the federal EIA review process in contributing to the management goals, and the means by which the EIA process was being locally implemented. The Canadian railway PPA (case 2) examined the detailed environmental management system employed for the project. This study also analysed the effectiveness of a legal agreement in achieving good environmental management of the project.

B. Further analysis of the case studies which led to a conclusion and recommendations

Because the five purposes defined above (table 1) are so well served by the PPA case studies, the task force concluded that PPAs yield the hard evidence needed for future environmental reviews. Thus they allow good decisions to be made in the absence of certainty about project impacts. The task force also concluded that PPAs can meet the objectives set for them as identified in table 1.

The case studies examined by the task force have led to renewed appreciation of the value of PPAs in managing environmental consequences of development projects. These case studies illustrate the usefulness of completing the EIA process through the introduction of post-project analysis. Not only can post-project analyses contribute to assuring that the benefits anticipated as a result of the environmental review are effectively achieved as a project proceeds, but PPAs can improve the EIA process itself by providing essential feedback about how well the EIA process has worked in a given instance.

In developing the conclusions and recommendations, the task force has relied primarily on the findings drawn from the case studies. However, the experiences and opinions of the individual participants, as well as the results of interviews conducted during information gathering have all had an influence on the formulation of conclusions and recommendations of the task force.

The task force also realized the value of undertaking a model post-project analysis to which the many recommendations derived from the case studies and presented here would be fully applied. It was decided, however, that such an effort would demand more time than was available and thus unduly delay the release of this report. Accordingly, the task force decided not to undertake such a demonstration but rather to suggest that the lessons presented here might be applied by each ECE member country to a suitable project which could be studied as soon as the opportunity arose. Subsequent to such an exercise, further discussion should take place on the best way to go about exchanging knowledge concerning the usefulness of PPAs. Through further testing of the ideas presented here, a better understanding of PPAs may be gained and member countries will be able to improve not only post-project analysis but also environmental impact assessment and identification of environment-economy linkages.

In addition to the overall recommendations, the task force developed a number of specific recommendations. These specific recommendations are broken down into four categories: the relationships between EIA and PPA; the content of PPAs; the development and design of PPAs; and the management of PPAs. For each category, the analysis and conclusions derived from the case studies are presented. The recommendations, as endorsed by the Senior Advisers to ECE Governments on Environmental and Water Problems, are set out in the Summary at the beginning of this report.

Relationships between EIA and PPA

Several lessons were learned about the relationship between environmental impact assessment and the PPA done during the implementation phase. Analysis showed that the content of the PPA should be based substantially on the results of the environmental review process conducted for the project. The power to require a PPA is also related to the review process, although several other means were also shown to be successful. The relation between the PPA and the regulation of the project as indicated in conditions for approval of permits and other instruments should also be spelled out fully as part of the decision taken in the environmental review process. Finally, the question of which projects require PPAs was addressed.

(i) PPA development based on EIA results

The PPAs studied were generally based on the results of the corresponding environmental reviews. The PPAs were designed for management of the project or to learn from the project. In either case, they were expected to deal with the most important and least understood impacts. Fortunately, these are the very issues identified during the environmental review. It therefore follows that better integration of preliminary plan development for the project PPA with assessment of project impacts will lead to better environmental management and better decision-making. This is a crucial feature that has not been as widely recognized as it should be. A preliminary plan of the PPA for a project undergoing an environmental review should be reviewed during the EIA process. Moreover, this preliminary plan for the PPA should be refined during the environmental review so that when the decision is made to proceed with the project, a complete design for the PPA can be developed. This PPA design should be based on important issues, and especially on those identified during the environmental review as requiring further analysis. All the case studies analysed had this attribute. That is, the content of the PPAs was based closely on the environmental reviews.

This was clearly so for the case dealing with hazardous waste in Finland, Norwegian gas development, contaminated silt and hazardous waste in the Netherlands, Canadian oil development, United States highway construction, and United States forestry management (cases numbered 3, 7, 6, 5, 1, 10 and 11 respectively). The Canadian railway case study, the Soviet pulp and paper mill case study, the Polish copper mine case study, and the water extraction case study from the Federal Republic of Germany (cases respectively numbered 2, 9, 8 and 4) - although founded substantially on their environmental reviews - were done more independently.

The way in which the content of a PPA develops from the environmental review can vary greatly. Public concern about an impact can result in the issue taking on great importance with monitoring, evaluation and management required as a consequence (as, for example, the extensive base-line and monitoring studies required for the Finnish hazardous waste plant). Lack of knowledge about an impact can lead to benefits from monitoring and evaluation of that impact (e.g., heat flows in the permafrost for the Canadian oil development case study); it may also happen that studies undertaken for the environmental review may not address a topic adequately and thus necessitate consideration of the topic during operation so as to make up for the lack of information (for instance, the socio-economic information provided for the Norwegian gas development case study).

(ii) Authority to undertake a PPA

Why and under what authority was a PPA undertaken? Was it a condition of licensing or project approval? These questions concerning authority are important, in part because of the need to co-ordinate the different components of the PPA. The Netherlands has a PPA requirement as part of its EIA legislation whereby projects which go through the environmental review phase of the Dutch EIA process must include a PPA. An outline of the PPA programme must be presented jointly with the written decision regarding the project following the environmental review.

All countries have sectoral legislation (e.g., clean air or clean water acts or acts governing specific activities such as pipelines, railways or highways) under which monitoring and evaluation requirements may be imposed. The differences between the two types of authority are worth exploring for examining the situation in the Netherlands where some form of PPA is required almost every time an environmental permit is issued. If an environmental review is required, however, the PPA may address a wider variety of issues. For example, if a permit is issued under the water pollution act, then the PPA scope is restricted to the monitoring of water pollution. Where an environmental review is required, the PPA covers a wider range and may deal with other relevant matters such as the effects of water pollution on fish, other sectoral interests such as air and soil pollution, nature and landscape, or even traffic patterns, if appropriate.

For some of the case studies, the PPA was required as a result of the environmental review leading to approval of the project. For others, the PPA was developed later in order to learn from the project experience. The two Dutch case studies, the Finnish case study, and the Norwegian case study were all undertaken as a result of an environmental review. In the Federal Republic of Germany, the PPAs were developed in part because of the competent authority's concerns at the time of granting the permit, in part because of

legal challenges to the permit, and in part because of subsequent public concerns. The two Canadian case studies had components that were required following environmental reviews, as well as components included specifically to learn from project experience. The Soviet and Polish case studies also developed from the environmental reviews but over time evolved significantly to reflect regional environmental concerns. The authority for the early monitoring and evaluation undertaken for the Polish case study rests in the mining laws which required monitoring data to be collected for the mine in order to revise regularly a programme of environmental protection. The United States highway PPA (case study 10) was required as a result of a state law which calls for an environmental review whenever marsh land is involved. The United States forestry case study incorporated a subsequent management investigation designed to learn from the project.

(iii) Conditions of approval must reflect PPA outcome

Licensing authorities and permit-granting agencies should have some flexibility to adjust conditions of approval depending on the outcome of the PPA. This need is best illustrated in the water-extraction case study from the Federal Republic of Germany. In this case inability to make an adjustment has left the proponent free to extract water at the rate originally specified in the permit, which might have a substantial impact. Fortunately, at present no major impact has appeared, perhaps because water has been extracted at less than the full rate permitted. It is not a satisfactory situation if a permit cannot be adjusted for good reason.

For more recent projects, PPAs generally show that environmentally responsible agencies have been vested with appropriate powers. These powers can include the authority to stop construction in the face of unacceptable practices (e.g., Canadian railway case study), to require changes in the process or even to shut down operation (e.g., Finnish hazardous waste facility), or indeed to require specific responses to identified failures (e.g., Dutch hazardous waste case study, where a more stringent standard could be imposed for organic solvent content in accepted wastes if the amount of organic solvents in the leachate was higher than that predicted in the environmental review). The PPA can also specify performance criteria that must be met, albeit by whatever means the proponent chooses. Performance criteria have been used for a number of issues including control of noise levels and attention to revegetation in the Canadian railway project.

(iv) Which projects require PPAs?

Almost all the case studies presented involved major projects. Major projects obliged to undergo an environmental review because of the significance of their impacts are obvious candidates for PPA studies. This requirement is formally imposed on all projects subject to an environmental review in the Netherlands in accordance with the EIA legislation in that country. The United States forestry case study is a project that did not go through a major environmental review but for which a PPA was done. While this specific project did not undergo a major environmental review, the management plan for the area was subjected to such a review. The United States Forest Service undertakes such reviews even for smaller projects in order to assure good environmental management and to determine the effectiveness of measures developed in the preliminary screening phase of the American EIA process.

No one claims that a PPA should be undertaken for all projects. Projects for which well-known, effective mitigation measures have been put in place and for which no major public concerns have been identified can normally proceed with modest attention being paid to monitoring and evaluation. As complexity or uncertainty rises, the attention that must be given to PPA increases rapidly. Enough monitoring and evaluation should be done as is required for management purposes for any project.

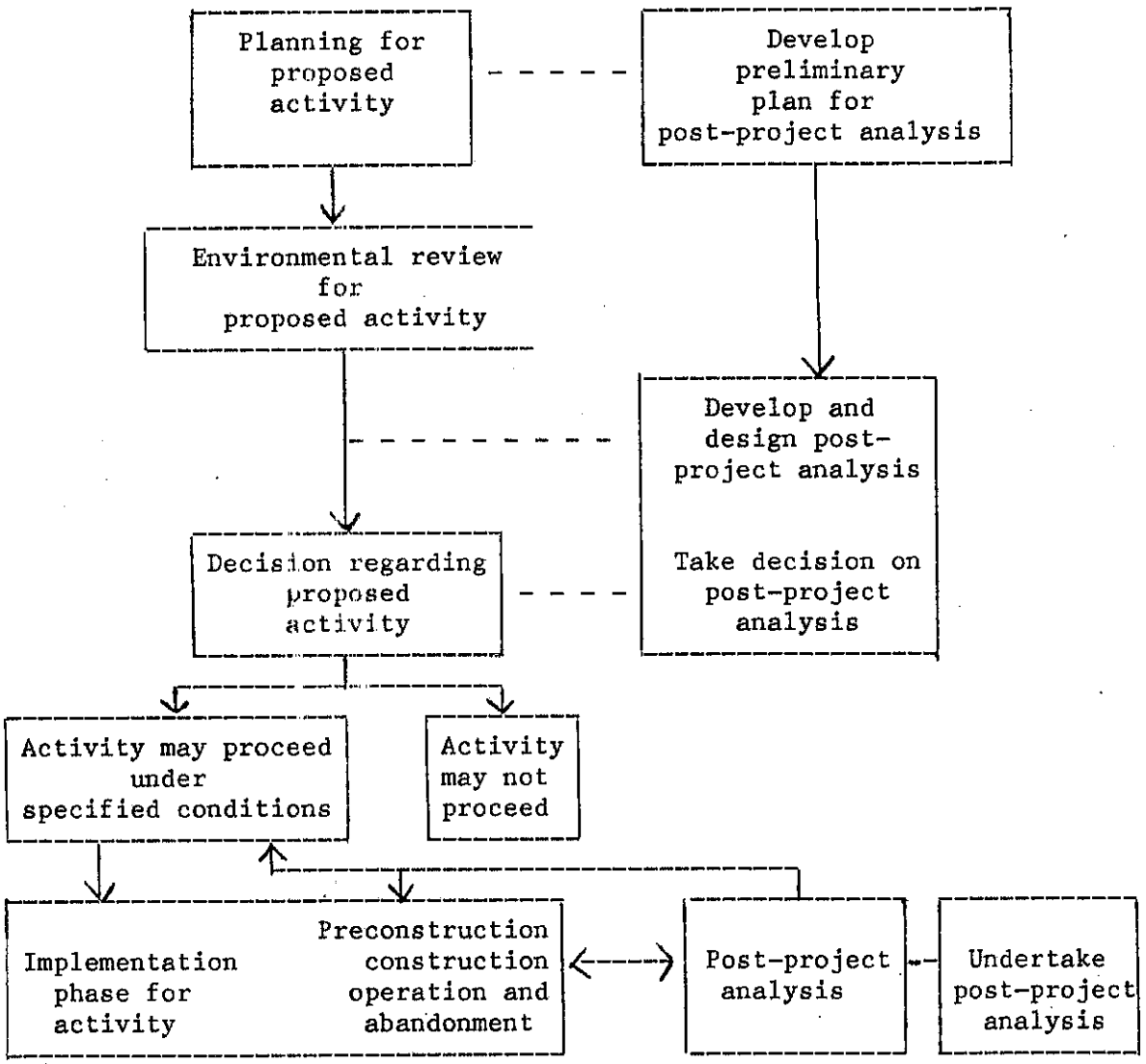
In addition, whenever new information can be gained from studying the project, the PPA should attempt to collect and distribute that information with a view to improving future environmental reviews. The new information input that can be applied will come from examining such features as impact prediction, mitigation measures and environmental management systems. The benefits of learning-by-doing are clear to those involved in undertaking environmental reviews: PPAs allow knowledge to be gained and impacts to be better predicted as well as the most viable mitigation procedures to be identified. However, there are also considerable advantages to Governments too, for example, in the knowledge of what environmental management systems will do or not do. For the Canadian oil development project, for instance (case 1), one government study was undertaken specifically to investigate ways in which the government agency could improve the effectiveness of the department's involvement in future EIA processes. PPAs represent one of the most cost-effective means of improving EIA. The following treatment was recommended in the report of the Canadian railway PPA:

> "For all projects which are subject to environmental reviews (including initial assessment reviews as well as formal public reviews) careful documentation of the day-to-day activities should be kept. If, in the views of the environmentally responsible agencies, no interesting impacts or new features are observed, this will be sufficient. However, where interesting features are uncovered, more detailed evaluation and documentation should be prepared and made available to others. This higher level of documentation may consist of an annual report by those involved or an equivalent paper available to those who need to learn from it. For larger projects, where one expects to learn a great deal, an independent post-project analysis should be undertaken."

(v) Concluding remarks on the relationships between EIA and PPA

A preliminary plan for the PPA should be prepared when the proposed activity is conceived. PPA planning should continue through the environmental review stage of the project; the PPA should be designed, in principle, at the time the decision is made about implementation of the project (i.e. should the project proceed or not?). During the environmental review, the need for a PPA should be examined and consideration of PPA content and design should be included in the reports prepared for the environmental review. The PPA should address important impacts about which there is insufficient information. The environmental review is expected to elicit the information needed to develop the PPA so that, by the time a decision is taken about the project, the PPA requirements are known. A decision on the PPA framework should be taken at the time the decision is made regarding the project. The approach recommended is illustrated in Figure 3.

Figure 3



While several different authorities might be cited as requiring a PPA, it is better to involve the one linked to the EIA process. In this way, the PPA can be fully integrated (when appropriate) and can address the issues as they develop from the environmental review. This also allows the different components of the PPA to be co-ordinated. Failing this approach, the various authorities must be able to require collectively that the PPA be completed.

The conditions of approval for the project must take into account the findings of the PPA. For example, licences can specify what is required of the proponent in the light of certain findings. The permits for the project may be granted for fixed periods of time after which renewal is conditional upon compliance with standards set on the basis of PPA results. This sets in motion reiterative steps. Performance bonds, or their equivalent, can also be used to ensure suitable responses to the findings of the PPA.

PPAs should be done for all major projects, including those for which an environmental review is required because of the significance of their impacts. In addition, for other projects, focused PPAs may be suitable, either for environmental management of the project or to learn from the project. For smaller projects, the decision to require a PPA will be based on the specific features of the project.

Content of PPA

It would be impossible to identify all of the different types of material included in the case studies analysed. Instead, it seems useful to describe four generic features observed in the selected case studies as these are likely to be important for most PPAs. First, base-line data are required in order to interpret properly the results of subsequent monitoring. Second, verifiable hypotheses must be developed for the PPA to test. Third, good documentation is important throughout the project, especially in cases of personnel turnover. Fourth, in all the case studies, monitoring has been an essential component and environmental-effects monitoring was particularly important.

(i) Importance of Base-line Data

The collection of base-line data is important, some would say essential, for PPAs. The purpose of base-line data is to provide a description of conditions before development; when this background data set is compared to the description derived from subsequent monitoring it can be used to detect change. In the Finnish hazardous-waste case study, extensive base-line samples were collected; some were analysed and others were kept for possible future use. In the Dutch contaminated-silt case study, good base-line data was highly valued. The water-extraction case study from the Federal Republic of Germany seems to have had very good base-line data. Base-line data were collected for the Soviet pulp mill case study beginning in 1965, one year before the mill was completed. In addition, data from a nature reserve on north shore of Lake Baikal were used as a control for comparisons with data from the pulp mill area on the south shore. For the United States highway case study base-line data were collected regarding ecological characteristics of the existing salt marsh which were compared with data on the marsh being created. Presumably some base-line data do come from the environmental review of the project. This was certainly the case for the two Canadian case studies and the United States forestry case study.

The collection or updating of base-line data can be facilitated by taking advantage of any time period between completion of the environmental review and the commencement of construction of the project. This time gap can allow the proponent (or Government) to collect further base-line data or to update existing base-line data for which, the need has been identified during the environmental review. This use of time gaps to collect base-line data was observed in the Canadian oil development case study; the environmental review resulted in a decision to delay the project for two years so as to enable preparations by Government, local organizations, and the public. This interval was used both to develop the PPA studies and to assemble needed base-line data.

(ii) The need for testable hypotheses

Testable hypotheses should be developed as part of the PPA. Verifiable hypotheses may be based on predicted impacts as identified in the environmental review, but they do not need to be. Compliance with accepted performance standards, whether set in legislation or part of a project agreement can serve as test of success also. PPAs that are primarily for management purposes will tend to rely more on meeting standards; PPAs for which the primary purpose is EIA process development will tend to concentrate on testable hypotheses based on predicted impacts. In the Dutch contaminated-silt case study the need for verifiable results was noted; this is clearly one way of developing testable hypotheses. The United States highway case study did not involve prior testable hypotheses but rather these were developed as part of PPA research. For the United States forestry case study, the questions posed were directly related to whether the environmental requirements imposed on the sale were met or not. That is, one hypothesis tested was how well the environmental-management system worked. In the Norwegian gas development case study, the predictions made during the environmental review were not well developed and so during the first phase of the PPA alternative predictions were formulated that could subsequently be tested.

In all case studies, testable hypotheses were developed although only rarely, if ever, based solely on the environmental review. Even if the material for the environmental review was exceedingly well prepared, the very review of the project itself often led to changes to the detailed project design and thus to changes in the expected impacts. This can make "predicted" impacts no longer applicable to the revised project. The environmental review for the Dutch hazardous waste landfill case consequently resulted in a change in project design: a more sophisticated containment structure was adopted following the review than had been initially planned at the time an analysis was made for the environmental review. This meant that the impacts on soil, predicted for the environmental review, were outdated and the PPA hypotheses had to be adjusted accordingly.

The need to base the PPA hypotheses on the most up-to-date information available is a common feature which must not be overlooked. Generally, the step of developing testable hypotheses forms part of the PPA. It should also be noted that not all impacts are detected through test hypotheses. Some are observed randomly; the environmental surprises.

(iii) Documentation

The importance of documentation for PPAs was observed specifically in the Canadian railway case study. The researchers were able to rely extensively on excellent notes, memos, minutes and other monitoring reports prepared by the environmental managers of the project. The United States forestry case study also paid tribute to the value of good documentation of this kind. Personnel continuity is an especially important element with regard to PPAs: new staff will not have the same knowledge of the history of a project as more experienced staff.

(iv) Monitoring: an essential part of PPAs

Monitoring and environmental-effects monitoring, in particular, was an essential component of all the case studies examined. This should not be surprising, as the collection of specific categories of data was clearly essential to analysing the effects studied in the PPA. The detailed means of monitoring and the concerns monitored varied greatly within and among case studies. It is not the purpose here to describe how the monitoring took place but only to note that monitoring is a crucial component of a PPA.

(v) Concluding remarks on the content of PPAs

In terms of basic content of the PPA, the key to effectiveness is monitoring those matters of relevance and analysing the results of that monitoring. The development of hypotheses is, of course, a primary task of the PPA. The nature of the hypotheses to be tested can vary greatly. One obvious hypothesis is to see if an impact predicted in the environmental review actually appears or if mitigation measures worked as predicted. Likewise, one may treat as a hypothesis the claim that a certain threshold standard will be met. The hypothesis may be of a quantitative nature (e.g. that pollutants of a certain type will be found in the atmosphere at a specified concentration) or it may be amenable only to more qualitative testing (e.g. the extent of satisfaction of park visitors concerning visual impacts). An hypothesis may relate to how well the environmental management system worked, as another example. It is important to identify the hypotheses to be examined; the collection of data should then address these hypotheses. Generally, base-line data will be required; they should be collected as soon as possible. The monitoring programme then becomes responsible for assembling the data needed to test the hypotheses. It is also important to maintain complete documentation for the project as this can make PPAs much easier to do.

Development and design of PPA

Most of the recommendations of the task force relate to the development and design of PPAs. They covered: defining the purpose of the PPA, defining the roles and responsibilities of the participants in the PPA, defining the environmental management links to PPA, the treatment of environmental surprises, the use of independent expert advice on PPAs, the relation of the PPA to the different project phases (preconstruction, construction, operation, and abandonment), the need for integration of the various components of the PPA, the importance of linking the effects measured to the project, and the need for good planning of PPAs.

(i) Purpose of the PPA

It is crucial to define carefully the purpose of the PPA. The main distinction to be made in defining the purpose of the PPA is the importance given to its role in environmental management of the project compared to its role as a tool for EIA process development. Environmental management PPAs are those for which results will be used primarily to improve the actual project being assessed. Process development PPAs are those for which results would be expected to apply more to future projects. The hazardous-waste case studies (Finland; Germany, Federal Republic of; Netherlands) are primarily management oriented. The contaminated silt case (Netherlands), the Polish case and

both of the American studies as well as the Norwegian one are primarily process-development oriented while the Soviet study and the two Canadian studies reveal aspects of both roles.

It must be noted that the dichotomy between management-oriented and process-development-oriented PPAs is not as sharp as suggested here. While this representation of the case studies is essentially justified, all case studies feature aspects of both management and process development. Some PPA design issues are clearly linked substantially to the uses anticipated for the PPA results. For example, if the PPA results must withstand judicial review, the research design must be much more carefully developed than when the purpose is simply to give an indication of a certain impact. This was an important feature for the water-extraction case study from the Federal Republic of Germany. Litigation took place following project approval and many of the post-project studies were developed and undertaken in response to the litigation.

Public concerns can often be addressed by a programme of monitoring and evaluation. In the Finnish hazardous-waste case study, local people were concerned about the possible adverse effects of the plant in question. As a result, extensive base-line study programmes were developed, in part by working groups that included local representatives. It should be emphasized that monitoring and evaluation programmes developed in response to public concerns must be credible; a suitable management response must be ready to respond even to unacceptable results. Under such conditions, PPAs may make projects much more acceptable to the affected public.

(ii) Definition of roles and responsibilities of PPA participants

As part of the PPA design, the roles and responsibilities of the proponent, of government agencies, of scientific and technical advisers, and of the public must be defined. The allocation of costs, research roles, analysis roles, and management decision roles must all be a part of this process. Participants should be aware of the financial and other resource implications of participation.

One excellent way of doing this is to require those involved in the implementation of the PPA to develop collectively certain detailed implementation plans. This approach is only viable, however, if certain basic decisions about the PPA have already been taken. The conceptual content of the PPA (although not necessarily the operational content) must be specified. The financial and resource requirements to be imposed on the various participants must be clearly identified. There must be enough detail about the PPA to provide guidance to participants without unduly limiting choices. A mechanism must be created that will be responsible for the PPA. (For management-oriented PPAs, this will likely be a part of the environmental management system for the project.) Those responsible for carrying out the PPA must then proceed to develop the specifics of the PPA from this rough outline. These requirements for allocating roles and responsibilities to PPA participants are particularly important for management-oriented PPAs yet, while still important, they are generally of less concern for process development-oriented PPAs.

Confusion can arise over whose responsibility it is to provide financial and other resources. This problem apparently manifested itself in both Canadian case studies and in the two Dutch case studies. The EIA act of the Netherlands requires a PPA and makes the competent authority responsible for it. When there are two or more competent authorities, normally the authority responsible for the environmental review co-ordinates the PPA. For the hazardous-waste case study of the Netherlands, decisions during the PPA were taken by a government working group comprising all competent authorities. This group also developed the framework for the PPA as required in the project licences. The working group will continue to exist with its chairperson functioning as co-ordinator of the PPA. This informal structure seems to have worked so far but it is too early to know whether the arrangement will prove satisfactory in the long term.

For the contaminated silt case study of the Netherlands, the need for funding of the PPA was not considered in the PPA documentation; hence a substantial delay resulted. This points to the need to consider the basic roles and responsibilities of participants and of having a mechanism for deciding who is responsible for providing resources should the need not be identified early enough to be treated routinely or incorporated into the process.

Similarly, in the Canadian railway case study, there was resistance from the proponent to the spending of money for PPA research; the financial commitment therefore had to be established fairly early in the project. This led to more successful working relations later on among those involved in the environmental management team (as well as the PPA process). The socio-economic studies for the Canadian oil development case study were terminated earlier than had been originally planned because of a lack of government funding to complete the work.

(iii) Definition of management links to PPA

The task force found it important to determine management links to the PPA at an early stage. This aspect was especially critical for management-oriented PPAs although of lesser concern for process-development-oriented PPAs. It is especially important in drawing up conditions of approval for the project to define the proponent's and government's responsibility to respond to various possible outcomes. These domains of responsibility should be spelled out as clearly as possible, although no one should entertain the illusion that there might not be surprises.

The inclusion of management responses to PPA results was quite effective in some of the case studies analysed. In particular, the two hazardous-waste facility case studies (Finland and Netherlands) have involved action plans to be implemented in the case of exceptional or catastrophic situations. The Dutch licence, for example, indicates that if the ground-water level rises in the future (above a specified level, such that it contacts and draws out the bottom of the waste) then supplementary control measures are required. In the Finnish case study, conditions were imposed for reporting exceptional situations (such as a fire or explosion) and the proponent was required to submit to the competent authority a plan for environmental studies to be undertaken during and after possible catastrophes. Similar attention to action plans was also paid to the contaminated silt project, in the case study from the Netherlands.

The Canadian railway case study involved a number of controls being decided at the beginning of the project. The same sort of controls were available for the biophysical studies related to the Canadian oil development case study. For the socio-economic and government studies of the Canadian oil development PPA, no direct management link was involved, as those components were oriented towards process development and not towards management. The same was true for the Norwegian study and both American case studies.

In the Soviet Union and in Poland, the management link to the PPA case studies was through the relevant government agencies. For both case studies, the PPA results were used by the Governments to adjust operations of the projects. Indeed, for the Soviet pulp mill case study, the decision was taken to close the mill and convert it into a non-polluting industry because the PPA results indicated that the environmental impacts were very serious and not acceptable.

(iv) Treatment of environmental surprises

It is important to ask, for management-oriented PPAs, how environmental surprises can be handled. Environmental surprises, that is unanticipated project impacts, can result from poor impact prediction, mitigation measures that do not work properly, poor project management, or complete failure to consider certain impacts. This is of significance because one of the features claimed for management-oriented PPAs is their ability to respond to unanticipated impacts.

Answer to this question must be qualified. The shortcomings generally involve the powers given to the environmental management system (which usually includes the regulators) for the project. For example, a reserve fund for long-term maintenance of the landfill was required of the proponent in the Dutch hazardous-waste case study. In other case studies, legislation identified in the conditions of approval empowers government agencies to take action in the case of major unanticipated impacts. In the water-extraction case study of the Federal Republic of Germany, public pressure was believed to have resulted in corrective steps being taken by the proponent. Adjustments were made to the construction of the Canadian railway project when unexpected and undesirable visual impacts were observed. For the Polish copper mine case study, the carbon disulphide emissions (from the ore treatment process) were an unexpected impact. Techniques of limiting this problem have been developed (although not yet effectively implemented) by those involved in the PPA. In general, environmental surprises can best be handled by ensuring the ability to detect them and a commitment to respond to them.

(v) Independent expert advice on PPAs

Independent expert advice on PPA design can be very helpful. This is essentially the peer review concept. This approach has been applied for all of the case studies. Academic advice may be provided for a government-designed PPA; or a pilot project may be undertaken in order to help refine the research details. Use of independent advice not only improves the quality of the PPA, it can also add to its credibility.

One common means of obtaining an independent review of the PPA is to include a preliminary plan for it in the environmental review of the project. In the case of the Dutch contaminated-silt case study, several academics

provided criticism of the proposed monitoring programme. As a result, any appropriate adjustments needed were possible even after implementation of the PPA. In this case, funding was provided to the academics to do further research on how to design a PPA for the particular case study (contaminated silt).

In the Canadian oil development case study, a working group was established to develop and implement the PPA. This group included several government departments (including the environmentally responsible agencies and the competent authority) as well as the proponent and university and research organizations.

(vi) Relation of PPAs to different project phases

In undertaking the PPA, it is important to distinguish between the phases of the project - preconstruction, construction, operation, and abandonment. This was noted explicitly in two case studies. The Dutch hazardous-waste case study distinguished among the construction, operation, and post-closure phases. The construction phase was viewed as being crucial to the long-term integrity of the project. For the project, it was believed that long-term environmental impacts could best be reduced by careful attention during the construction phase. Accordingly, great effort was expended on monitoring and evaluating the construction phase. A detailed quality assurance plan was developed for the project. It describes how the licensing requirements will be implemented in practice, contains detailed instructions for the contractor, describes areas of responsibility and lines of authority for execution of the plan, and suggests how problems will be solved. It also contains a list of inspection and control activities (observations and tests, sampling requirements) and budget specifications. Once the project goes into operation, the PPA becomes more focused on maintenance and monitoring of anticipated and possible impacts. The case study also addressed the uncertainties of the project (such as, for instance, the variations in quantity and quality of leachate over time). During the post-closure phase of the project, the emphasis of the PPA shifts to the decommissioning of a landfill site, for instance, its use after closure, ground-water quality, water-tightness of the cover system, and the general landscape surrounding the facility.

The same observations could be made for the Norwegian gas development case study. There, too, the need to separate the preconstruction, construction, and operation phases was noted. This feature is important for both biophysical and socio-economic PPAs. For the Norwegian case study, the work undertaken during the preconstruction phase consisted of developing a broad description of the region, the target population, and the industrial and social life of the community and region. Two major features unique to this phase of the PPA were the gathering of base-line data (in part through a sample survey of living conditions, and cultural and social affairs) and the formulation of testable hypotheses regarding the expected impacts of the project.

During the construction phase, the same kinds of features were studied but the techniques used differed somewhat. Base-line data gathering and hypothesis development were replaced by statistical analysis of data made available by the company and the local authorities, and by a number of in-depth interviews with a selected group of families in the community.

Reports are made of the operation phase based on follow-up studies of the features examined in the preconstruction phase. Among other methods, a panel study of living conditions has been carried out.

Similarly, some projects create impacts that are predominantly associated with one particular phase, and so the PPA is designed primarily for that phase. For example, the United States highway case study examined only a particular impact created during construction of the highway. Likewise, for the Canadian railway case study the bulk of concern was also related only to the construction phase and the PPA was designed to reflect that feature. In the water-extraction project of the Federal Republic of Germany the potential impacts were associated with the operation phase and the PPA has focused on that phase. The same is true of the Soviet pulp mill and Polish copper mine case studies: the important impacts of those projects were related to the operation phase; therefore that phase was the primary object of study for the PPAs.

(vii) Integration of PPA components

As is true for EIA generally, many diverse, independent studies do not replace a comprehensive study. Especially for environmental management purposes, it is important to have an integrated picture of all consequences of a project. Some studies examine systemic links, e.g. socio-economic studies, or studies of the environmental management system and how it functions. These are illustrated by the Norwegian gas development case study, the socio-economic component of the Canadian oil development case study, the United States forestry case study, and the Canadian railway case study. Conversely, certain studies can readily be undertaken as stand-alone research tasks. Examples of these include the United States highway case study and some components of the Canadian oil development case study. The stand-alone PPAs are generally research oriented.

Many of the studies associated with routine management-oriented monitoring and evaluation can be done without significant integration into other parts of the PPA. For example, measurements of heavy metals content in lichens, made for the Finnish hazardous-waste case study, or the examination of air quality, beach morphology, and soil chemistry, undertaken for the Dutch contaminated silt case study, could all be done independently of other studies.

(viii) Confounding effects of other projects

The effects of projects are important and can be a serious confounding "variable" in PPA research design. Measuring effects is one thing; being certain that they are caused by the project is quite another. It is important to understand, before starting to monitor specific aspects of the environment, the extent to which a statistically sound relationship can be established between the project and the measured changes in the environment. Such concerns were raised specifically regarding the two Dutch case studies where the projects were situated near one another in a heavily developed part of Europe and where effects from other industrial developments could conceivably be confused with those of the projects in question.

Another good example of the need to distinguish between the effects of a particular project and other possible factors was found in the Soviet pulp mill case study. The effects on Lake Baikal stem from many sources in the

region; hence determining the contribution of the pulp mill proved to be one of the most difficult aspects of the PPA. Extensive use was made of mathematical models in order to make that determination. The Norwegian case study demonstrates the same feature. In that situation, the question arising was whether the socio-economic changes detected were due to the project or were caused by other factors.

(ix) Need for good planning of PPAs

Undertaking PPAs should be done in a financially responsible manner so that the PPA is economically efficient and cost-effective. Changes to a PPA programme can be essentially based on results obtained, but changes also cost money and they slow down the implementation of the PPA; accordingly, good planning should prevail in PPA design. There were problems observed in the Dutch contaminated-silt disposal case study: adjustments to the PPA after it had started slowed down the process. This result could have been avoided with careful planning of the PPA.

(x) Concluding remarks on the development and design of PPAs

In developing the content of a PPA, the first critical step is to define the purpose of the PPA, including the development of a specific purpose and focus for each of its components. The use to which the PPA results will be put determines significantly the PPA content and how it should be undertaken. The major distinction to be made is between PPAs intended primarily for environmental management of the project, and those for learning from the project for EIA process development.

Once the purpose of the PPA is known and the basic conceptual content is identified (from the environmental review), it is then essential to define the roles of the various participants in the PPA - the proponent, the various government agencies, scientific and technical advisers, and the public. The financial and resource requirements must be identified for each participant at the time of starting the PPA. In addition, responsibility for the conduct of the PPA (and for reporting on its results) must be clearly assigned. This responsibility must include the power to respond appropriately to environmental surprises, and the authority to adjust the project and the PPA in response to the PPA results. The participants' roles will likely be developed in phases, with their basic responsibilities defined at the outset and the details defined and adjusted subsequently.

Management of PPAs

Four recommendations were elaborated regarding the management of PPAs. These deal with the value of advisory boards to guide the PPA, public participation in PPAs, adaptive approaches to PPA, and the use of independent researchers for sensitive parts of a PPA.

(i) Value of advisory bodies to guide PPAs

Joint boards or advisory bodies involving industry (or the proponent), government, technical experts and the public can be very helpful in managing PPAs. Their value is distinct from the usefulness of seeking independent advice during the design of the PPA. The role of these boards must be defined clearly. Their terms of reference may include advising on suitable research

and research programmes; helping to select researchers, interpret results, and review reports; helping to revise PPAs and mitigation programmes; guiding compensation programmes; or explaining results to communities. Management boards may also be helpful in obtaining funding for the research programmes needed. The members of such boards, either by virtue of their positions or their good counsel, can influence industry or government officials to allocate funds for necessary investigations. These joint industry-government/ academic-public boards have been widely predominant in many of the case studies.

Sometimes, for example the Canadian and Norwegian natural resource development case studies, such boards played major roles in directing the PPAs. In the Norwegian case study, there was a co-ordinating and advisory board. For the most part, it concerned itself with broad questions of research strategy and not with detailed questions of design and methodology. The board was also a useful means of feeding the results of the PPA to the users of the research information. For the Canadian oil development case study, the Norman Wells Research and Monitoring Working Group was created. It consisted of industry, government (seven different government agencies), academics, researchers and public representatives. This working group co-ordinates the research and monitoring conducted; it establishes research priorities and meets annually to evaluate how satisfactorily the project is proceeding. Its annual reports are public.

In the Finnish hazardous-waste facility case study, the proponent relies on an information committee; this committee meets twice a year to exchange information and discuss current subjects concerning the treatment plant.

(ii) Public participation in PPAs

Public participation in EIA processes properly extends into the implementation phase. The public can play a role, for example in monitoring, participating on an advisory body, supporting better environmental management, or in disseminating information. This is, in part, a continuation of public participation prior to the EIA review; it can lead to better environmental management, as was the case for the water-extraction case study of the Federal Republic of Germany. Equivalently, public pressure on the Government can bring about an effect desired. This was the case for the Soviet case study; public pressure on the Government as a result of the PPA findings contributed substantially to the decision to close the pulp mill and to replace it with a non-polluting industry.

In the Finnish hazardous-waste case study, public participation was quite influential. Some of the monitoring and evaluation was done largely to reassure local inhabitants. Local people formed an association ("Environmental Follow-up") to advocate their interests. The proponent also established an information committee representing various aspects of local interests. The purpose of this committee was to provide credible information to the interested public.

For the Dutch contaminated-silt case study, there was extensive public input into the environmental review although the PPA plan was not ready at that time. As the PPA was based on the environmental review, the PPA was focused on issues that played a major role in decision-making, that is, on those issues important to the people. In particular, the PPA dealt with the

nearby dune nature reserve, a major concern arising from public participation in the review. Despite this response to public concerns during the environmental review, there has been scant public participation in the PPA itself.

(iii) Adaptive approaches to PPA

Some PPAs were designed in phases with opportunities to refine them in the light of the results obtained. Greatest effort has been put into those project effects deemed important and less effort into the effect which monitoring has indicated were not resulting in significant impacts. Thus not only the project, but also the PPA must be changed in response to the PPA findings.

The Finnish hazardous-waste case study was very successful in using the adaptive, reiterative approach suggested here. After a few years of operation, it became clear that monitoring all the variables measured during the base-line study was unnecessary and much data-gathering was reduced in frequency in response to those results. Conversely, the importance of organo-chloride compounds in emissions from hazardous-waste treatment plants was realized and the emissions monitoring programme adjusted accordingly. The proponent was also required to make a separate study of concentrations of certain organo-chloride compounds in the needles of coniferous trees and lichens surrounding the plant.

Generally, the Finnish approach to the PPA was highly regarded by the task force. Data was collected and some of it was analysed. If the results did not indicate a problem, the rest of the data was stored for possible future use. If the results did show that certain limits were being exceeded, then further analysis was undertaken in accordance with the magnitude of concerns indicated by the results. This phased approach ensures that data are collected and analysed as needed. The entire analysis is only undertaken if the results indicate that the expense of doing so is justified.

Regular reviews of the PPA for the Dutch case studies were built in to accommodate the needed flexibility (although it was still too early to expect reports of concrete examples of any consequent changes in the monitoring programme). The water-extraction case study from the Federal Republic of Germany consisted of many smaller components. Its structure gives it exactly the sort of flexibility advocated here. The Canadian oil development biophysical case study incorporated constant review and adjustment by an overseeing committee which examines the results and the PPA annually. The Canadian oil development socio-economic case study also had the flexibility to respond to observations; changes made to the PPA were deemed to be more in response to data access than to unexpected impacts. The Canadian railway case study also involved adjustments to monitoring requirements (and indeed to mitigation measures) as a result of the PPA observations. For example, less attention was paid to measuring water quality for work-camp sewage effluent when it became clear that the sewage systems were working; more effort could then be devoted to monitoring compliance of construction efforts where problems had occurred.

(iv) Use of independent researchers for sensitive parts of PPAs

Independent researchers were generally employed to do the PPA, or at least the most sensitive components of the PPA. This finding is echoed in recommendation 21 which deals with execution. With an emphasis on design, recommendation 16 also calls for independent advice. The two recommendations are primarily intended to reinforce the credibility of the PPA. The researchers should be agents independent of the proponent or of any affected party whose objectivity might be questioned. The latter could include any government body or locally affected community, depending on circumstances. Independent agents could be research institutes or universities chosen for their expertise, impartiality and credibility.

The practice of using independent researchers is reported in most of the case studies investigated. In the Finnish hazardous-waste case study, for example, some of the monitoring and evaluation is undertaken by consultant firms, universities and research institutes. The proponent also undertakes some of the work. The Norwegian gas-development case study was done solely by research institutes. The Dutch hazardous-waste case study involved contracting a government agency not otherwise involved in the project for its expertise regarding sensitive components of the PPA. The water-extraction case study from the Federal Republic of Germany was done by many researchers from several different government agencies as well as by university researchers. The United States highway PPA was done by independent academic researchers. The Canadian railway case study involved independent reviewers along with academic and consultant expertise on the environmental assessment review panel. The reviewers did not play any role in the implementation of the project. The Canadian oil-development case study equally made extensive use of independent researchers. The socio-economic component, for example, was done by an academic on secondment to a government agency. The Soviet pulp mill case study involved researchers from the USSR State Committee for Hydrometeorology, from the Academy of Sciences, and from the nearby Irkutsk University, all credible by virtue of their independence from the pulp mill. For the Polish copper mine case study, some of the studies were carried out independently by United Nations organizations (the United Nations Development Programme and the World Health Organization).

C. Concluding comments

This comparative study attempts to demonstrate that post-project analysis has a great deal to offer in terms of gaining greater environmental protection through environmental impact assessment. PPA can contribute substantially to achieving the goals of EIA in an efficient manner.

Efficiency is a key word in this regard. Project proponents may become more supportive of EIA processes when PPAs help to focus mitigation measures on impacts that are real problems rather than on those which are unlikely to materialize. The use of PPAs partly for environmental management of projects and partly for EIA process development gives a double-edged advantage. With regard to project management, some mitigation measures can be dismissed in the face of more certain information about project impacts; such information is obtained through PPA. As for process-development aspects, a better understanding of likely impacts, gained through the study of PPAs done on previous projects, will save a lot of unnecessary trial and error.

Governments likewise benefit from the application of PPAs. Because PPAs can often forecast environmental surprises these can be identified and dealt with before any damage is done. Hence, PPAs inspire confidence that approved projects will operate in an environmentally satisfactory manner. This factor, combined with the environmental management role of PPAs, allows decision-makers to operate even in the face of some uncertainty about environmental consequences of particular projects. (As noted earlier, there are limits to postponement of decisions and these limits must be respected. Rarely can all decisions affecting environmental protection be deferred until the implementation phase.) Through learning from project implementation (the EIA process-development aspect of PPAs), everyone concerned gains a better understanding of the issues and how best to deal with them.

The public also benefits from PPA in that useful information about project impacts can be applied to achieve the environmental protection needed and people can see that the impacts are dealt with appropriately. In addition, public involvement during the EIA process review is extended through PPA into the implementation phase of the project. These benefits yield legitimately increased satisfaction with and acceptability of projects.

Post project analysis offers considerable advantages. More gains are certainly possible and may be achieved following the measures recommended in this report. Further experience with PPA is needed. The members of the task force would like the lessons learned through the analysis of the 11 PPA case studies discussed here to be of benefit to everyone undertaking PPAs.

ANNEX I

LEGAL AND ADMINISTRATIVE POLICIES REGARDING PPA

The information given here concerns the national legal/administrative policies for PPA systems of countries which provided case studies. In order properly to understand the case study material, it was necessary to review the legal/administrative setting. Some other countries which did not provide such material, nevertheless, informed the task force of their legal/administrative system for PPA or their plans to establish such a system. That information also appears below.

Canada

Environmental impact assessment in Canada is implemented through a Guidelines Order-in-Council issued under the authority of the Government Organization Act. The Order-in-Council addresses post-project analysis in that the competent authority (initiating department) is required, along with other bodies concerned with the proposed activity, to implement measures decided upon following the environmental review and to see that suitable implementation, inspection, and environmental monitoring programmes are established. The proponent, similarly, must ensure that appropriate post-assessment monitoring, surveillance and reporting are carried out. These requirements apply formally only to those proposed activities which, because of their potentially significant impacts, are referred for a public review. Thus, for those projects, PPAs are required as determined in the environmental review.

The environmental assessment process in Canada is currently under review and PPA has been identified as one element of the process that needs strengthening. It is likely then that more attention will be paid to PPA in the revised federal Canadian EIA process expected in the near future.

Two other means of undertaking PPAs in Canada should also be mentioned. First, the usual powers to require monitoring rest with sectoral regulatory agencies and these can be important for specific projects. Second, Environment Canada has commissioned several PPA studies a/ and has been quite active in promoting PPA methodology.

Denmark

In Denmark, the EIA process works through requirements to license projects that may cause impacts on the environment and through contingency planning, which must be approved by the environmental authorities (generally local and regional councils). The Environmental Protection Act stipulates that a "heavily polluting enterprise" must obtain a permit that sets out the conditions under which the enterprise may carry out its activities.

According to Danish administrative practice, an authority may, when granting a permit, set up any relevant terms and conditions calling for compliance. Failure to adhere to the terms can result in sanctions, usually in the form of fines. Since the beginning of 1987, the authorities may, under the Environmental Protection Act, require a "heavily polluting enterprise" to have the conditions of its permit reconsidered at least once every eight years.

In short, PPAs are taken care of through the licensing procedures in Denmark; the licences (and hence PPA requirements) can be reviewed periodically.

Finland

Environmental impact assessment in Finland is not yet fully integrated into Finnish legislation. There are, however, situations in which such reviews are required based on either statutory obligation or a practice established by an authority. Examples include projects concerning roads, railways, water use, and waste management. Environmental assessment and PPA are therefore covered under the various sectoral acts. The assessment of environmental impacts as part of a planning process is, in the main, only done for questions of land and water use and in individual projects. Practice varies from sector to sector and various public authorities may issue their own instructions on such assessments.

In many cases an application for a permit must be accompanied by an assessment of environmental impacts. The conditions attached to the permit may include obligations on the applicant to monitor the effects of the activities. For example, any conditions considered necessary may be attached to the issuing of a hazardous waste processing permit for a period of predetermined length.

The problem identified with this approach to EIA and to PPA is the following:

> "The disintegrated nature of the provisions for EIA results in a division of the decision-making processes between a host of authorities and courts of law, with each authority and court assessing the implications of its own field. This creates problems not only for those subject to environmental hazards but also for those responsible for carrying out the projects concerned. b/"

German Democratic Republic

The environmental assessment process in the German Democratic Republic involves the Governmental Environmental Inspectorates in the 15 counties. Before the approval of any activity, these inspectorates give an expert opinion that provides a practical basis for environmental requirements to be attached to the decisions on the activity made by local councils and assemblies.

After approval of the activity, control is exercised on several levels. The most important of these for environmental purposes is compliance monitoring during construction and environmental monitoring during operation. The Governmental Building Inspectorate controls both the technical and the construction aspects of project implementation.

The Governmental Environmental Inspectorates and the District Hygiene Inspectorates are obliged to monitor the completed project continuously. These boards are entitled to impose adequate restrictions in order to maintain environmental standards. The control by the Governmental Environmental Inspectorates is realized on the basis of a guideline on evaluation of environmental protection investments, that is now being tested in practice.

Germany, Federal Republic of

Legislation governing EIA in the Federal Republic of Germany does not yet exist. However, there are legal instruments enabling environmental reviews to be undertaken as well as some PPAs. These allow for monitoring of projects and measures to prevent or reduce impacts to be introduced when appropriate. These instruments include, inter alia, laws such as the Federal Pollution Control Act, the Waste Avoidance and Waste Management Act, federal acts governing forest management, railways and highways, and the Federal Water Act.

According to the Federal Pollution Control Act, for example, the competent authority is able to monitor compliance with limit values and other basic obligations during project operation. If harmful effects on the environment are found, further remedial measures can be taken through the issuance of subsequent directives. This may even lead to the revocation of the licence.

The Waste Avoidance and Waste Management Act contains similar provisions. It generally prescribes that waste management facilities be supervised, thus allowing for post-project control. Furthermore, specific conditions may be imposed on an operating facility. As is the case with the other legal instruments, the criterion for such imposing control is the "protection of the public interest". Thus, only when the harmful nature of a waste management facility has been recognized can these subsequent conditions be imposed. This is also the case for installations subject to licensing under the Pollution Control Act.

Under water law, a permit or a licence may be granted subject to such conditions as ordering the "institution of measures for the observation or ascertainment of the condition of the water before use and of the extent of any damage done or harmful effects caused by their use" (the Beweissicherungsverfahren). Based on the results of the observations prescribed, additional measures can be imposed to reduce or offset any harmful effects on the environment.

If no specific act is applicable, the laws governing public safety and order (police laws) take effect. The post-project review under these laws may be initiated if "danger to public safety and order" may be presumed. In such a case, the competent authority is empowered to investigate possible dangers and to apply further directives likely to ward off further damage. These laws set the minimum requirements for post-project control.

In the case of the procedure for granting a permit for the extraction of ground water in the Lueneburger Heide (Case 4), the competent authority called for an evidence-gathering procedure (Beweissicherungsverfahren) on the basis of the Lower Saxony water law. This procedure was linked to the granting of the permit. Consequently, it was not possible to use the results as a basis for the decision; the finding could eventually be used for subsequent directives and measures that may become necessary. In order to require compliance with subsequent directives after the permit has been granted, it will be necessary to furnish proof of the harmful effects of the ground-water extraction. It may be difficult to establish a cause-effect link between the specific project and environmental harm.

The Netherlands

Post-project analysis is required as a formal component of the environmental impact assessment process in the Netherlands. EIA legislation in the Netherlands explicitly requires subsequent investigation of the environmental consequences of any activity reviewed under the EIA act. These investigations must be carried out during or after the undertaking of the activity. Responsibility for the PPA is assigned to the competent authority for the activity and the proponent is obliged to co-operate and to provide information required for the PPA. This requirement under the EIA act is set in addition to sectoral legislation under which environmental permits are needed and for which monitoring may be required. The EIA legislation has broadened the range of impacts that may be monitored.

PPA results are published periodically, thus providing public access to the information so obtained. The competent authority is obliged to act when the PPA indicates that the result of the activity is more harmful to the environment than was expected when the initial decision was taken to proceed with the activity. Under these conditions, the competent authority must take such measures at its disposal as it deems fit, in order to restrict the harmful results or to undo them altogether.

Experience with PPAs as defined in the EIA legislation is modest, as the Act was passed only in 1986. The contaminated silt case study examined by the task force was the first experience with PPA under the Act.

Norway

A general requirement for EIA was suggested in 1977 as part of the recommendations for complete revision of building and planning legislation. In general, the EIA system is being directed towards certain major projects with significant impacts on the environment and the community in general.

The Norwegian parliament advocated general EIA requirements when revising the Planning and Building Act in 1985-1986. It nevertheless left out the specific EIA requirements, while observing the need for more detailed clarification compared to existing sectoral regulations and licensing procedures.

Since then a revised and more detailed concept of EIA procedures has been developed. This concept is based on the main features of good practice developed in countries with significant experience in the field of EIA. The concept specifies 11 main qualities forming part of EIA. One of these qualities is that the process should contain an explicit evaluation of the need for post-project monitoring and audit programmes.

In an investigation of the existing (sectoral legislation) requirements, the writers Lerstang and Medalen (Environmental Impact Assessment in Norway, 1987) found that the PPA requirement did not appear in any of the eight sectoral acts. In three acts (Pollution Act, Regulation of Watercourses Act and Water Resources Act), however, an evaluation of the need for a PPA may be imposed under the existing regulations (for instance, as a requirement for licensing).

Poland

The legal basis for environmental impact assessment generally in Poland is found in the Environment Act, the Planning Act, and in legislation governing mining. Both the Environment Act and the Planning Act allow for the competent Minister to require an environmental review in appropriate circumstances. While neither act explicitly mentions post-project analysis, follow-up studies may be required if serious environmental damage has occurred or public concern has been expressed about environmental impacts. If so required, suitable expertise would be used and the expense would be borne by the proponent. Mining law requires specific environmental analysis and periodic audits of project-related environmental impacts after the mining activity has commenced.

Currently the Polish EIA process is undergoing study, with a view to improving it. In the EIA guidelines, in draft form at the time of writing, PPA is considered an integral part of the process. According to the draft, the power to require a PPA would be given to the licensing and permit-granting agencies. The Polish Commission on EIA would also review the PPA in collaboration with the licensing and permit agencies; other parties concerned, such as the public, would be included or not, depending on the specific case.

Sweden

While Sweden lacks a formal environmental impact assessment process, it does manage to have a review of proposals in a manner that is directly linked to the planning and decision-making processes in that country. In particular, EIA is done through an elaborate physical-planning process and in connection with licensing procedures covering specified projects or activities with possible adverse effects on the environment. Industries identified in this way are the following: iron and steel works, pulp and paper mills, oil refineries, chemical plants, nuclear power facilities, large fossil fuel combustion facilities, and mines in the mountain region.

For every polluting activity (including all of the above list of industries and others such as sewage treatment plants) granted a permit according to Swedish environmental protection law, a PPA is required. This PPA includes a requirement to monitor effluents and, sometimes, effects. The PPA essentially consists of compliance monitoring. The PPA is carried out according to a special programme with reporting to the appropriate regional environmental-protection authority.

Switzerland

Environmental impact assessment in Switzerland is currently undergoing significant change. The federal law on the protection of the environment requires that projects with the potential for significant environmental impacts must be subjected to an environmental assessment. This takes place before the competent authorities make decisions regarding them. This principle is manifest in a directive that is currently in the final stages of development.

The concept of post-project analysis is not covered in the directive, thus there is no explisit provision for PPA in the Swiss EIA process. Responsibility for implementation rests on the competent authorities (with collaboration of such natural resource agencies as fisheries, forestry, water, and nature and landscape). Thus, the sectoral regulatory powers of the competent authorities can be applied to implement PPAs.

Union of Soviet Socialist Republics

The legal basis for the development and implementation of PPAs is found in the USSR fundamental law (the constitution) and in specific legislation (laws dealing with conservation, air, water, soil and wildlife). In 1985, a special decision of the USSR Council of Ministers was made. According to this decision, all projects with potentially significant environmental effects must be reviewed by the USSR State Ecological Expertise Commission before a decision is taken to approve the project.

In 1988, further measures were taken in this field. In April, the new act, "Perestroika in the Field of Environment Conservation", was passed. By this Act, the "All Union State Committee on Environment Conservation" was established. Within the structure of this government committee there exists a special body for the development and implementation of PPAs - the PPA Department of the State Committee on Environment Conservation.

This State Committee is also responsible for the development and implementation of EIA. (In the structure of the Committee, there is a special body for the development and implementation of ecological and environmental expertise.) The PPA activity is based on the USSR national monitoring system, the All Union Service to Control Pollution of the Environment and its Consequences. This service operates on the basis of the local and regional monitoring stations under the USSR State Committee for Hydrometeorology.

United States of America

The United States has no overall requirement for undertaking PPAs at the federal level. However, it is worth noting that under the specific statute and implementing regulations for hazardous waste storage, treatment, and disposal, there is a very thorough system for monitoring during the activity and following closure of facilities. This system includes provision both for monitoring and for financial assurances to ensure that any adverse impacts can be suitably addressed.

During 1988, a number of discussions were held concerning possible amendments to the National Environmental Policy Act. Post-project audit was discussed, primarily with regard to reviews of completed projects, in order to ensure that mitigation measures agreed upon during the environmental impact statement (EIS) process had been implemented and were successful. Federal agencies were expected to review a percentage of the activities for which EISs had been prepared and to report the results to the Council on Environmental Quality. According to the information available the legislative session ended, however, without amendments to the Act.

While there is no overall PPA requirement, there are, however, several means used to undertake PPAs by individual agencies. A brief examination made by the General Accounting Office has determined that selected agencies had mechanisms to allow them to undertake PPAs.

Two examples will illustrate how PPAs are done. In the Federal Highway Administration, there are no separate regulations or directives covering PPAs. Such audits occur on an ad hoc basis as part of a more general programme management review. The Washington headquarters office reviews the activities of the regional offices, which in turn oversee the state offices. The Forest Service similarly has no separate regulations or directives covering PPA. Such reviews occur on an ad hoc basis during the normal management review cycle. The Forest Service has a management system comprised of several levels of review: the general management review, the programme review, the activity review, and the functional assistance trip.

The general management review is a formal review with written results to which the unit reviewed must respond in writing. The functional assistance trip would normally be the form in which specific project reviews would occur. They are seen as constructive reviews and are generally designed: (a) to assist a unit in implementing direction, (b) to solve technical or operational problems, (c) to exchange information or (d) to survey for review needs. The results of these reviews are used in the performance evaluations of units and employees involved.

United States Forest Service manuals and handbooks offer direction and provide checklists on how to do environmental assessments but there are no specific directives regarding post-project analyses.

Yugoslavia

Environmental policies, laws and practice in Yugoslavia do not include any explicit mention of post-project analysis. Environmental monitoring is, however, an explicit component of these policies. Monitoring of the state of the environment in Yugoslavia has a dual purpose: environmental protection and promotion; and the development of an appropriate environmental information system. For example, water-quality monitoring involves surveillance on the part of inspection services coupled with new forms of organizational control and responsibility which makes it clearly compliance monitoring.

Notes

a/ See, for example, Audit and Evaluation in Environmental Assessment and Management; Canadian and International Experience; 1987; Proceedings of the Conference on Follow-up/Audit of EIA Results; Environment Canada; editor, Barry Sadler.

b/ Environmental Protection in Finland: National Report 1987, prepared by the Minister of the Environment, Environmental Protection Department, page 129.

ANNEX II

WORKING METHOD OF THE TASK FORCE

Recognizing the need for further study of the use of post-project analysis in assessing environmental impacts, the Senior Advisers to ECE Governments on Environmental and Water Problems at their first session established a task force on environmental impact assessment auditing, with Canada as lead country (ECE/ENVWA/3, Annex I, project element 05.2.1 (b)). The task force worked in close co-operation with the Experts on Environmental Impact Assessment, a group established by the Senior Advisers in 1981. Their achievement rests on the foundation laid by a previous task force on application of EIA, with the Netherlands as lead country. This task force was active between the years 1983 and 1985 when it elaborated the first volume of this series entitled Application of Environmental Impact Assessment: Highways and Dams (United Nations publication, Sales No. E.87.II.E.14). Significantly, one of the earlier conclusions was that "provisions for, and implementation of, monitoring programmes appears to be one of the most neglected areas in EIA".

The proposal which launched the present task force described the benefits of post-project analysis (PPA) for rendering environmental impact assessment more effective and set out a preliminary typology of PPAs, along with an outline of the proposed study to be conducted. It was decided to focus on case studies. This approach was intended to throw light on the methods and deliberations of those who had undertaken successful PPAs, in order to profit from practical experience. To this end, a set of criteria was developed for the selection of case studies. These were circulated to member countries of the Economic Commission for Europe with an invitation to participate in the study.

The criteria for selection of case studies were as follows:

(a) The project reported must have been subjected to a prior environmental review;

(b) The project must have been implemented following the environmental review - at least to a stage where the major consequences (impacts) of the project could be reasonably determined;

(c) A subsequent analysis of the project must have been undertaken with certain results reviewed carefully; such a study is known as post-project analysis (PPA); and

(d) The post-project analysis should have been designed to yield useful information so that subsequent environmental impact assessment could benefit from the information gained.

Based on these draft criteria and on discussions that had taken place at the meetings of Experts on Environmental Impact Assessment and those of the Senior Advisors, case studies were submitted by several participating countries.

A meeting of the task force took place in Warsaw (Poland) in September 1987. It coincided with the Seminar on Environmental Impact Assessment conducted by the Senior Advisors to ECE Governments on Environmental and Water Problems (ENV/SEM.17/3). The task force defined its objective as the study of existing practices and procedures in the participating countries based on an analysis of case studies, the purpose being to learn from the collective experience. Conclusions and recommendations on how to undertake post-project analysis would be formulated to this end. It was agreed to concentrate on administrative methods and approaches rather than on scientific methodology.

Participants discussed the criteria for the selection of case studies and agreed with the principles outlined. However, the criteria were treated as guidelines: not all cases had to meet all criteria. For instance, case studies designed for management of a project could be considered good case studies even if the project itself had not been substantially completed. Discussion also took place regarding the classification of proposed post-project analyses.

Case studies were presented at the Warsaw meeting and the participants elaborated a method of work. The lead country was invited to compile sufficient information about each of the case studies needed so as to draw some preliminary lessons about post-project analyses for consideration at a future meeting. For this purpose, materials describing the case studies were collected at the meeting or shortly afterwards. In addition, contacts were identified for each case study so that more information could be obtained as necessary. Such information was subsequently elicited by letter or phone calls. On the basis of the information thus obtained, the lead country drafted a list of lessons learned. These were classified as relating to the role of PPAs in environmental impact assessment, the content of PPAs, the development and design of PPAs, as well as their management.

Among the significant conclusions formulated by the Seminar on Environmental Impact Assessment the following was recorded: "Various functions of post-project analysis were considered important, such as verifying predictions, monitoring compliance, managing risk and uncertainty, etc. However, there is a need for clear definitions in this area." (ENV/SEM.17/3, annex I, paragraph 14).

The Seminar also drew up a set of recommendations to ECE Governments. With regard to the timing and objectives of environmental impact assessment, the Seminar recommended that: inter alia,

> "Depending on the nature and degree of assessed impacts, EIA should continue during the construction, operational and decommissioning phases of activities in order to:
>
> (a) monitor compliance with the agreed conditions set out in construction permits and operating licences;
>
> (b) review environmental impacts for proper management of risks and uncertainties;

(c) modify the activity or develop mitigation measures in case of unpredicted harmful effects on the environment; and

(d) verify past predictions in order to transfer this experience to future activities of the same type."

(ENV/SEM.17/3, Annex II, Recommendation 9).

The second meeting of the task force took place in Geneva (Switzerland) in January 1988 when case studies were discussed, updated and possible additions identified. A preliminary selection was then made of cases which would be retained in the study. Discussion at the meeting focused on a draft document outlining preliminary conclusions from the case studies. Participants made a number of revisions to the draft document in order to reflect their direct experience with the case studies. ECE member countries would be invited to provide information on policies, laws, and experiences including incentives relating to post-project analyses. The information so obtained appears above in Annex I.

The next meeting of the task force took place in Banff (Canada) in June 1988. At that meeting two new case studies were presented, bringing the number to eleven with eight different countries contributing. Task force members agreed to continue with the eleven case studies identified. The eleven case studies have been summarized elsewhere in this report (Section II). The main purpose of the Banff meeting was to review and discuss the report of the study which eventually became this volume. In addition to the content, the format was also discussed and a site visit was made to the Canadian railway case study (see Case 2).

Following the Banff meeting, a substantially revised draft report was prepared for review by the task force at a meeting in Geneva in October 1988. The review included detailed consideration of the conclusions and recommendations of the task force, a discussion of how best to present the material both to the Senior Advisors and to ECE member Governments generally. Direction to the lead country regarding changes to be made to the report was also discussed. Following that final meeting of the task force, revisions were made to the report as directed.

ANNEX III

GLOSSARY

Environmental Impact Assessment or Environmental Review: An examination of the consequences of a proposed activity and its reasonable alternatives in which the environmental impacts are assessed; the EIA also interprets and communicates information about those impacts and investigates and proposes means for their management. This review may be conducted under a formal environmental assessment and review process, as part of a planning process, as part of a regulatory permit process, or by some other mechanism used for environmental reviews. It should be noted that environmental effects are generally understood to include both biophysical and socio-economic effects.

Post-project Analysis: Environmental studies undertaken following the decision to proceed with a given activity. They are done in order to ensure or to facilitate the implementation of the activity in accordance with the terms imposed by the environmental assessment process or they may be aimed at learning from the particular activity studied. PPAs are also known as follow-up studies or environmental audits.

Project Management PPAs: Post-project analyses undertaken for the purpose of managing the environmental impacts of the activity.

Process Development PPAs: Post-project analyses used to learn from the particular activity so that future reviews of similar projects can benefit.

Scientific and Technical PPAs: Post-project analyses that deal with the scientific accuracy of impact predictions, or the technical suitability of mitigation measures.

Procedural and Administrative PPAs: Post-project analyses that deal with EIA process effectiveness. They may examine the project as it is implemented following the environmental review or deal with the review process as it worked for the particular project.

Audits: Post-project analyses that compare the measured impacts of the project with the pre-project conditions and with the predicted effects of the project.

Evaluations: Post-project analyses that examine the effectiveness of the processes used to manage environmental impacts.

Environmental Management System: The mechanism put in place to see that the good environmental management plans developed during the environmental review are properly implemented as the project proceeds.

Monitoring: Checking or scrutinizing systematically with a view to collecting specified categories of data.

Compliance Monitoring: Monitoring directed at ensuring regulations are observed and standards met.

Environmental Effects Monitoring: Watching environmental variables to determine any changes attributable to the construction and operation of the activity.

Base-line Monitoring: Measurement of relevant environmental variables during a representative period of pre-project conditions in order to obtain control parameters.

Target Monitoring: Monitoring of targets such as organisms that are likely to undergo change as a result of the project.

Factor Monitoring: Monitoring of factors such as emissions from the project that may cause environmental changes. These factors may be measured at the source, in the environment, at the point of exposure, or on a target.

Environmentally Responsible Agency: Government agency with responsibility for the affected environment.

Competent Authority: Government agency with responsibility for regulating the project.

Environmental surprises: Project impacts that were not anticipated. They can result from poor impact predictions, from mitigation measures that do not work properly, poor project management, or failure to consider all the impacts.
