

# AUDITING THE EFFECTIVENESS OF EA WITH RESPECT TO ONGOING ENVIRONMENTAL MANAGEMENT PERFORMANCE

**Angus Morrison-Saunders**

In: M. do Rosario Partidario (Ed.), *IAlA '96 Improving Environmental Assessment Effectiveness: Research, Practice and Training*, 16th Annual Meeting, June 17-23, 1996, Centro Escolar Turístico e Hoteleiro, Estoril, Portugal. Conference Proceedings Volume 1, International Association for Impact Assessment, pp. 317-322.

## INTRODUCTION

There has been considerable interest in understanding how EA processes work in practice, learning from experience and examining the effectiveness of EA (eg. Munro 1987; Ortolano 1993; Lee *et al.* 1994; Sadler 1995). One important consideration, when determining the effectiveness of EA, is the extent to which its goals for environmental protection and management are achieved. The research reported on here examines the environmental management outcomes of development projects that have undergone EA in Western Australia and seeks to determine the role of EA in influencing these outcomes.

### *Background*

A number of previous studies have sought to determine how EA functions in practice. Several studies have focussed on the benefits of EA as an important planning tool for improving environmental decision-making and have suggested that EA largely achieves its objectives through modifying development decision-making (eg. Caldwell *et al.* 1982; Taylor 1984; Ortolano 1993). Other studies have examined the role of EA in post-implementation management and environmental performance (eg. Storey 1986; Hedstrom and Obbagy 1988). Holling (1978) was one of the first practitioners who recognised the need for EA to incorporate an ongoing environmental management role and referred to this process as adaptive environmental assessment and management.

More recently, Culhane (1993) proposed a managerial model of EA in which environmental management objectives are determined from environmental impact statements (EISs) and any conditions established by EA decision-makers on a particular proposal. It is intended that these objectives are then addressed by project managers to ensure that project and environmental requirements are met. This model has been supported by Bailey (1994) who suggested that part of the effectiveness of EA is as a useful tool for ongoing project management. In further work, Bailey (in press) identified a number of linkages that may exist between environmental management and EA as practiced in Western Australia. He suggested that EA has led to improvements in environmental management that accrue after the principal decision to proceed with a particular project has been made.

The purpose of the research reported on here was to determine the extent to which the EA process in Western Australia has influenced environmental management outcomes for a number of development projects. In particular, emphasis has been placed on determining when this influence came about. A model of the EA/environmental management relationship has been developed. In this model, three timeframes or phases of the EA process are identified from which environmental management achievements may originate. This model, which has been derived from the work of Bailey (in press), is now discussed.

### *EA/Environmental Management Model*

The first phase of EA influence originates before the principal decision is made to proceed with a particular project during initial project planning and design. This is the stage in which most, if not all, impact predictions are made and many environmental management actions proposed to mitigate these potential impacts. These management actions may be proposed either by the proponent in EIS documents or by EA decision-makers in setting approval conditions. While the management action may not actually take place until the project is implemented, the resulting environmental benefits actually originate from the pre-decision stage of the EA process.

It is not always possible to predict all project outcomes and to have planned environmental management activities accordingly. Hence, some environmental management activities can be expected to originate after the principal EA decision is made to proceed with a project, particularly during project implementation. Such activities may include the response by a project manager to an unforeseen impact or the adaptation of planned management programmes to accommodate outcomes different to the original impact predictions. Changes to environmental monitoring programmes may also occur as new problems or issues are encountered. This ongoing and adaptive environmental management action by project managers occurs during the post-decision stage of EA.

A third opportunity for EA activities to influence environmental management actions is a transitional one that incorporates both the pre- and post-decision stages of the process. This is where the EA process establishes some important environmental management provisions during the pre-decision stages which require ongoing attention (including modifications to project design if necessary) during the post-decision stages of projects. One example of this involves the imposition of legally binding conditions by EA decision-makers in which an environmental objective is specified (Bailey in press). Here, the proponent is bound to comply with an objective (established during the pre-decision stage) but is not constrained in how to do so during subsequent project implementation. A second example is the requirement for proponent's of major or complex projects in Western Australia, to prepare an environmental management programme (EMP) prior to project implementation. The EMPs consolidate environmental management strategies and objectives identified during the pre-decision stages of EA and put in place a system for both the monitoring of impacts and the necessary response by project managers during subsequent project implementation.

Before presenting some results of the research with respect to the three stages in which the EA process may influence environmental management activities, the methodology of the study is briefly outlined.

## **STUDY METHODOLOGY**

Six case study projects that have undergone EA in Western Australia were selected for detailed analysis. The projects examined were two water supply dams, an offshore oil and gas production facility, an ocean wastewater outfall, a mineral sands processing plant and a chemical manufacturing plant. For each of the case studies, information on four distinct components of EA was collated as follows:

- (i) the identification and prediction of potential impacts in pre-decision EA documents;
- (ii) the occurrence of actual impacts as a result of project implementation;
- (iii) the design and implementation of project environmental management activities to address potential and actual impacts; and
- (iv) the design and implementation of environmental monitoring programmes.

These four aspects are discussed in turn.

Individual impact predictions made during the pre-decision stages of EA for each project were recorded, plus whether or not individual predictions had an associated environmental management action related to them. Predictions that were associated with the occurrence of an actual environmental impact were distinguished from those that were not. For the predictions where no impact was recorded, further examination was undertaken to determine whether this was the result of good project or environmental management, an inaccurate predictive technique or some other reason. By comparing the final environmental quality achieved by a project with the predicted results, it is possible to determine the effectiveness of EA at protecting the environment (Duinker 1989). In this context, it is important to understand how impacts that were predicted to occur were avoided in practice.

The observed environmental impacts associated with the six case studies were recorded and how these impacts were responded to by project managers in terms of any pre-planned action or ongoing adaptive management. The relationship between the occurrence of actual impacts and the content of impact predictions was recorded to enable predictive success to be determined in terms of impact outcomes.

All environmental management activities proposed and/or undertaken for the case studies were recorded. The origin of these were then examined with respect to the EA/environmental management model discussed previously (i.e. to distinguish between individual management commitments and conditions of approval established in the pre-decision planning stages of EA, transitional activities and new environmental management actions originating in the post-decision stage of projects). The relationship between impact prediction and the implementation of appropriate management actions was also examined.

Examination of environmental monitoring reports was necessary in order to identify environmental impacts for the six case studies. The nature and design of individual environmental monitoring programmes were recorded. These were also classified with respect to their origin.

Information on each of the case studies was gained from EA documents including follow up monitoring reports and interviews with staff representing proponents and EA decision-makers. Owing to the complexity of the projects, a large volume of data was generated for each project. Consequently, a computerised database was utilised which enabled the data to be organised and evaluated efficiently. The database provided a useful summary of the status and outcomes of each project examined in terms of the specific EA process experienced by that project. A complete detailed description and explanation of the database is available on request from the author. A separate written account of each case study was also maintained to record additional textual information on the projects.

Some key findings of the research are now presented.

## **PRELIMINARY RESULTS**

A total of 340 impact predictions were recorded for the six case studies. Of these, 40% had some sort of corresponding impact associated with them, 46% did not and for the remaining 14% of impact predictions there was no information available to verify them (i.e. environmental monitoring programmes were not sufficiently comprehensive to provide information on these predicted outcomes). The 155 impact predictions (46%) which did not have a corresponding impact were examined to determine why this was the case. Many of these were simply the result of accurate and inaccurate predictions; i.e. predictions of no impact which were found to be accurate and predictions expecting an

impact to occur which were found to be inaccurate. However, in 47 cases (representing 14% of impact predictions overall) the implementation of an appropriate environmental management action avoided the occurrence of a predicted impact. These management actions were all proposed during the pre-decision stages of EA and provide a measure of the effectiveness of EA in terms of successfully planning and implementing environmental management activities to prevent the occurrence of predicted impacts. Some examples follow.

Numerous examples abound in the six case studies of management actions that avoided project construction impacts or ongoing operational emissions such as:

- watering of cleared areas and unsealed roads to control dust generation during construction activities (relevant to several case studies);
- re-routing of a popular forest tourist trail to avoid a dam construction site; and
- provision of specialised equipment and buildings to control ongoing noise emissions (relevant to several case studies).

A detailed example of the successful implementation of measures to control odour and waste gas emissions from the mineral sands processing plant is provided in Morrison-Saunders (in press). In this example, the experience gained from the early years of plant operation, during which significant adverse odour emissions occurred, was used during the EA of a proposal to double the capacity of the plant and resulted in the installation of upgraded pollution control equipment which has subsequently avoided the occurrence of this impact.

A total of 75 environmental impacts were recorded for the six case studies. It was found that 57% of these were accurately predicted, 29% were inaccurately predicted and the remaining 14% were new or unexpected impacts. In addition to predictive accuracy, the management response to the impacts was recorded. A management response was not required for 58% of the observed impacts (i.e. inevitable and/or accepted adverse project outcomes which could not be avoided and beneficial outcomes of projects). Several impacts did not receive a management response for other reasons (4%) while the remaining 38% were responded to. Management responses varied from actions taken to minimise the extent of the impact in the first place, to post-impact rectification and compensation measures. Of the impacts that had a management response, some 24% (overall) were either inaccurately predicted to occur or were unexpected. The management responses to inaccurately predicted impacts were mostly identified during the pre-decision stages of the EA process. This finding indicates that the environmental management benefits of EA planning can be realised even when impact predictions are proven to be unreliable. The unexpected impacts were responded to with new (post-decision) management actions. This result indicates that ongoing and adaptive environmental management did occur. Before presenting some examples of this, the nature of environmental management activities will be examined in more detail.

A total of 284 environmental management actions were recorded for the six case studies. It was found that 91% of these were related to an impact prediction in some way. This implies that a strong relationship existed between the identification of potential impacts and the establishment of management actions to address identified concerns (or vice versa) during the EA process for the case studies. The majority of environmental management actions (80%) were proposed in their entirety during the pre-decision planning stage of the projects. It is clear from this that the pre-decision stages of the EA process made the greatest contribution to project management. A further 15% were transitional activities (eg. where a management objective only was established during the pre-decision stage) and the remaining 5% were new management actions initiated during the post-decision stage of the projects (i.e. often in response to an unexpected impact). Hence, despite the utility of the pre-decision EA planning stages in environmental

management, there was a considerable role for adaptive and ongoing environmental management.

A different trend was apparent in the 113 environmental monitoring programmes identified for the six case studies. Here only 25% of monitoring programmes were proposed outright in pre-decision EA documents, 46% were transitional and the remaining 29% were initiated during the post-decision stages of projects. Hence monitoring programmes were much more likely to be modified or extended during project implementation than their environmental management counterparts. This result could be anticipated given the intrinsic ongoing nature of environmental monitoring and the opportunity for learning from experience that it provides.

Some examples of adaptive environmental management and monitoring activities are now presented. All six case studies experienced some sort of transitional management and monitoring activities based upon the establishment of environmental objectives which proponents were expected to meet. For several projects, this entailed the preparation of a comprehensive EMP document prior to project commencement. In other cases one or two particular issues were singled out for particular attention. Examples include:

- preparation of an EMP for one of the water supply dams which would investigate and report on the effect of the dam on downstream riverine ecology;
- preparation of an oil spill contingency plan including mapping of sensitive marine habitats for the offshore oil production project. This information was then used to determine equipment needs and safety procedures; and
- preparation of a construction stage management plan to determine how noise and dust emissions and rainwater runoff were to be managed at the chemical manufacturing plant.

In each case, the requirement for management or monitoring of particular aspects of the projects enabled flexibility in how this could occur in practice, and thereby provided for ongoing adaptive management activities. A more detailed example follows.

With respect to a water supply dam on a seasonal brook, an important consideration was the potential barrier effect on upstream lamprey migration as they travel from the sea to the upper reaches of brook to spawn. It was predicted that lampreys would migrate overland around the proposed dam and a smaller downstream gauging weir if they could not climb over these structures. An environmental management commitment was made to maintain suitable vegetation adjacent to these structures to facilitate overland migration and the EA decision-makers requested the proponent to monitor and report on the effectiveness of these measures. During subsequent monitoring, it was found that the dam wall design, including adjacent earthworks and landscaping treatment was not conducive to lamprey movement, and that migration upstream was not successful. The proponent's responded to this by making appropriate cosmetic changes to the base of the dam wall and surrounds (filling expansion cracks and smoothing sharp corners) and installed a guided movement mesh to direct overland migration. At the time of this research the project managers were waiting for a major lamprey migration event to occur to determine the effectiveness of these measures. A number of additional management options had also been identified which could be implemented if found necessary. This example demonstrates ongoing adaptive management accompanied by monitoring in response to an observed impact (where the impact was inaccurately predicted in the first place).

Adaptive management was also found to originate during the post-decision stages of projects, usually in response to new or unexpected impacts. In brief, some examples of this include:

- ongoing provision of safeguards at the chemical manufacturing plant in order to reduce risk levels and enable the capacity of the plant to be expanded with no additional environmental impacts occurring;
- changes to the start-up procedures utilised at the chemical manufacturing plant to minimise the impact of temporary gaseous emissions on adjacent industry workers;
- change of wastewater disposal methods for the offshore oil and gas production project from ocean discharge to deep well injection. The environmental monitoring evidence was inconclusive with respect to the potential occurrence of marine pollution. In spite of this the proponent opted for a more expensive but environmentally acceptable disposal option; and
- ongoing modification of marine monitoring programmes for the wastewater outfall project to correct observed problems with temporal and spatial limitations in the monitoring which meant that the environmental consequences of the project could not be ascertained precisely.

## CONCLUSIONS AND RECOMMENDATIONS

An important measure of the effectiveness of EA is the extent to which it achieves its environmental protection goals and ongoing management of the environment for individual development projects. Research has been undertaken to examine the extent to which EA extends beyond the decision to proceed with a development proposal to influence subsequent project management and environmental performance.

Six case studies from Western Australia have been examined in terms of their environmental management outcomes. The planning stages of EA were found to have contributed the greatest amount of environmental management activities and to have avoided the occurrence of numerous predicted impacts. However, environmental benefits have also accrued from ongoing adaptive management and monitoring programmes. This has largely occurred in response to observed impacts including those inaccurately predicted or unexpected. The occurrence of adaptive environmental management and monitoring appears to have arisen largely from the practice by EA decision-makers in Western Australia of setting environmental objectives for proponents to meet rather than prescriptive undertakings. In extrapolating the results of this research to the wider practice of EA, it is therefore recommended that:

- environmental management and monitoring programmes should be tailored to environmental objectives and subject to regular review to enable ongoing refinements and improvements to be made; and
- EA practitioners should allow for secondary stage benefits to accrue by encouraging ongoing management and avoiding a prescriptive approach to environmental management activities.

## ACKNOWLEDGMENTS

*The research was funded by a Murdoch University Research Studentship. I would like to acknowledge the valuable input of Dr John Bailey to an earlier draft of this paper and the contribution of participants interviewed during the research.*

## REFERENCES

Bailey, J. 1994 "EIA, Management and Policy Reform: The Tyranny of Small Decisions Working Well," Presented at: *Looking Back and Projecting the Future, The 14th Annual meeting of the International Association for Impact Assessment.* 14th-18th June 1994, Radisson Gouverneurs Hotel, Quebec City.

Bailey, J. (in press) "Environmental Impact Assessment and Management: An Under-Explored Relationship", *The Environmental Professional*.

Caldwell, L.K., D.E. Bartlett, D.E. Parker and D.L. Keys 1982. *A Study of Ways to Improve the Scientific Content and Methodology of Environmental Impact Analysis*, Bloomington: Advanced Studies in Science, Technology and Public Affairs, School of Public and Environmental Affairs, Indiana University.

Culhane, P.J. 1993 "Post-EIS Environmental Auditing: A First Step to making Rational Environmental Assessment a Reality", *The Environmental Professional*, 15: 66-75.

Duinker, P.N. 1989 "Ecological Effects Monitoring in Environmental Impact Assessment: What Can It Accomplish?" *Environmental Management* 13: 797-805.

Hedstrom, G.S. and J.E. Obbagy 1988 "Environmental Auditing: A Global Perspective - Transition to the 1990's", *UNEP Industry and Environment*, 11: 11-13.

Holling, C.S. (ed.) (1978), *Adaptive Environmental Assessment and Management*, John Wiley, Chichester, UK.

Lee, N., F. Walsh and G. Reeder 1994 "Assessing the Performance of the EA Process. *Project Appraisal*", 9(3): 161-172.

Morrison-Saunders, A. (in press July 1996), "EIA Auditing to Determine Environmental Management Performance", *Eco-Management and Auditing*, 3(2).

Munro, D.A. 1987. "Learning From Experience: Auditing Environmental Impact Assessments", In: *Audit and Evaluation in Environmental Assessment and Management. Canadian and International Experience Volume I Commissioned Research.*, edited by B. Sadler, 5-31, Beauregard Press Ltd, Canada.

Ortolano, L. 1993 "Controls on Project Proponents and Environmental Impact Assessment Effectiveness", *The Environmental Professional* 15: 352-363.

Sadler, B. 1995 *Environmental Assessment: Toward Improved Effectiveness, International Study of the Effectiveness of Environmental Assessment, Interim Report and Discussion Paper*. Canadian Environmental Assessment Agency.

Storey, K. 1986 "From Prediction to Management: Increasing the Effectiveness of SIA", In *Impact Assessment Today Volume III*, edited by H. A. Becker and A. L. Porter, 539-551, Uitgeverij Jan van Arkel, Utrecht.

Taylor, S. 1984. *Making Bureaucracies Think*, Stanford: Stanford University Press.