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Thai's Monitoring Mechanism as a Tool for Pollution Control

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Abstract: The research report in this paper focusses on environmental monitoring through a comparison of project for which Environmental Impact Assessment (EIA) is mandatory (paper production) and those for which EIA is not required (fish processing). The content of an EIS was found to be a key determinant in defining the monitoring procedures for projects requiring EIA. Generally, more comprehensive, an EIS results in extensive requirements for project monitoring. For non-EIS projects, monitoring provisions are more uniform and determined by other provisions, such as pollution control regulations. For both types of project, agencies are responsible for ensuring the performance of both projects that require EIA and those that do not. The results of study confirm that monitoring procedures for projects requiring EIA are more satisfactory since EIS can supply the basic prescription of the project performance.

Key words: Environmental impact assessment, industrial sector project, impact monitoring, post-EIS appraisal.

Introduction

Environmental Impact Assessment (EIA) is widely acknowledged to be an effective tool in environmental management and its benefits are well known. The key elements of the EIA process (Wathern, 1988) have been incorporated in many legal systems around the world. As a formal process, project EIA deals with development proposals from their entry into the decision making process through to the post Environmental Impact Statement (EIS) during which projects are built and operated. During the initial phase of EIA research, researchers tended to focus on the early—such as screening and scoping—stages of the EIA process. Of late, however, the comprehensive are intended increasing by the crucial stage of project implementation, for it is the construction and operation of projects that actually cause impacts.

In this study, post-EIS performance is highlighted. Post-EIS operations incorporate monitoring which can be used to evaluate the effectiveness of the EIA process (Sadler, 1988). However, not all development projects pass through a formal EIA, many are excluded from lists of projects for which EIA is mandatory, while others are too small in scale or located in non-sensitive environments. The fact that in some countries particular projects may require EIA while comparable developments may be excluded, provides a valuable opportunity to study the influence of EISs as the design in implementation of monitoring programmes. This paper reports such a study of industrial projects in Thailand.

Project screening is the initial stage of the EIA process that gauges the EIA requirements for particular projects (Biswas, 1987; Canter and Canty, 1993; Leu, Williams and Bark, 1997). With respect to Thailand, project screening is controlled by the Office of Natural Resource and Environmental Policy and Planning (ONEP), through the Environmental Impact Evaluation Division (EIED). The EIED is responsible for managing the EIA system in Thailand. The Thai EIA screening process is a compulsory system under the National Environmental Quality Act (NEQA), 1992. The types and sizes of projects, as well as locations for certain types of development, which require EIA, are listed in the

Government Gazette. Thus, EIA is required if any proposed project is categorized as a "prescribed activity". The ONEP identifies such projects based on threshold levels. In practice, project screening under the ONEP still involves some uncertainty, especially in defining appropriate types of project and, especially, thresholds.

The prescription of project requiring EIA produces the EIS as one of the basic tools in project performance. Mitigation and monitoring programmes in EIS are the circumstances which are included in the license of project under section 50 of the NEQA, 1992.

However, procedures and monitoring mechanisms concerning post-EIS processes are major criticisms of EIA practice, particularly in developing countries (Munn, 1979; Biswas, 1987; Kakonge, 1994; Said, 1997). Indeed, post-EIS evaluation has been identified as a crucial tool for improving the practice of EIA (Sadler, 1988; UNECE, 1990; Leu et al., 1996; Wood, 1996). It is the only means of providing feedback on the effectiveness of EIA as projects are undertaken. Consequently, it should be regarded as a basic tool for the environmental management of projects.

In this study, the main objective is to examine whether EIA is used as an effective planning tool, especially with respect to post-EIS strategies. This is achieved through an analysis of the monitoring procedures for selected projects requiring EIA and for those projects that do not.

Methods of Study

The industrial sector was taken as a case study in this research as both types of project are found within it. Furthermore, industrial projects produce a variety of pollutants, depending on the type of industry and are, thus, a potential source of environmental impact. As a rapidly industrializing country, many industries are established in Thailand. Many of them are not subjected to EIA since their characteristics are below the designated threshold values. As this study concerns project monitoring, it was necessary to compare industries which produce, broadly, the same types of impact. The paper pulp mill industry, a category for which EIA is mandatory, and the fish processing industry, not a "prescribed activity" under NEQA 1992, were investigated. Both industries are the source of, predominantly, same type of water pollution, but the appraisal procedures for the two differ. Pulp and paper projects are assessed and approved under NEQA by EIED, while fish processing is regulated under pollution control legislation by the Department of Industrial Works.

The study is arranged into four main aspects with respect to projects requiring EIA. These are: monitoring requirements; mitigation programmes conditions and compliance; monitoring programmes conditions and compliance; and the post-EIS appraisal. For projects not requiring EIA, two issues were, namely, environmental monitoring of these projects and the results of monitoring.

The methods of study involved several elements to get the accomplished outcome. These included: to investigate the EISs for project requirement, EIA in order to extract the information regarding the results of impact assessment, the mitigation and monitoring identification; to study the conditions of licenses and investigate the monitoring reports; to interview the agencies concerned, including the proponents, the responsible agencies and the service contractors in order to get the performance regarding mitigation/monitoring conditions. Finally, the project types were compared to determine whether EIA is beneficial for the monitoring of projects.

Results

Monitoring Procedures for Projects Requiring EIA

Background to the Projects

For the purposes of this paper, the pulp industries that were investigated are referred to as POPE 1, POPE 2 and POPE 3. All were subjected to EIA. The annual production of pulp and paper is around 280,000, 200,000 and 400,000 tons for POPE 1, 2 and 3, respectively. Waste water is the main pollutant, with some air pollution and solid and hazardous waste also being generated. Pollution control for these projects is similar. Activated sludge is designed for waste water treatment and electrostatic precipitators are used for air pollution abatement to control particulates. The solid and hazardous wastes which cannot be burnt or reused are dumped within the landfill associated with each project.

The treatment of the effluent from waste water treatment is slightly different. In the case of POPE 1, effluent is applied for agricultural use within the local public irrigation system. For POPE 2, effluent is retained within ponds in the green area associated with the project prior to part being discharged into local water courses and part being used for irrigation within the project area. The treated effluent for POPE 3 is stored in a main reservoir which is used for irrigation of a plantation associated with the project and discharged to natural waters via a piped drainage system during the rainy season.

The projects differ somewhat. For example, POPE 1 attained the environmental management quality standard ISO 14001 in 1997, whilst the other two have not qualified. Furthermore, only POPE 1 has established a clear environmental policy, a key tool in environmental management and a comprehensive environmental plan has been established, the individual components of which are followed by the company. For the remaining projects, the environmental plan concentrates on monitoring measures as the companies have not adopted an environmental policy.

EISs for the Projects

Thus, the basic features of the projects both with respect to production processes and waste treatment are similar. However, environmental management of the projects including various aspects related to post-EIS performance is different. These differences affect the competence of project control activities.

EISs provide basic information for the design of subsequent project monitoring. In particular, the mitigation and monitoring programmes included in an EIS, are crucial in formulating the conditions described to project licenses. In principle, the programmes should be followed by the results of impact assessment gained from the EIA study.

The results of impact assessment are revealed in Table 1. As to the EIS of POPE 1, the impact assessment illustrates that many components, especially water quality which is the main pollutant receive the negligible impact and only air quality gets the moderate impact. The result of impact prediction of POPE 1 is not related to the mitigation and monitoring programmes which are highlighted on the water quality.

Similarly, POPE 2 and POPE 3 result the impact prediction of many components in unsatisfactory level and only medium negative impact level of both projects is assessed for water quality.

Mitigation Programme Conditions and Compliance

The results of impact assessment should guide the design of mitigation. From Table 1, the components that would create the most significant negative impacts are water quality (POPE 2 and POPE 3), air quality (POPE 1), noise (POPE 3) and occupational health (POPE 2). Consequently, it is to be expected that there would be the priorities for mitigation. However, when mitigation measures specified in the EISs were investigated, it was found that this was not the case. Mitigation is proposed for many components of the project having in all EISs even where these are predicted as low, or even no impact (see Tables 2 and 3).

Mitigation measures were classified into three categories in this research, namely site specification, engineering design and policy application. Engineering design would involve, for example, the standard adoption

Table 1: Impact assessment in the EISs of POPE 1, POPE 2 and POPE 3

Environmental components	*Construction phase*				*Operation phase*			
	None	*Low*	*Medium*	*High*	*None*	*Low*	*Medium*	*High*
Water quality		1,3				1	2,3	
Air quality		1,3			2	3	1	
Topography		3			3			
Hydrology	3				3			
Noise			3				3	
Terrestrial ecology		1,3			2	1,3		
Aquatic ecology		1,3				1,2,3		
Land use		1,2, (3)			1,3	(2)		
Transportation		1,2,3				1,2,3		
Water supply		1,3			3	1,2		
Power supply	1	3			3	1		
Drainage	1,3				1	3		
Solid and hazardous waste	3					3		
Agriculture		1				1		
Socioeconomic		(1)	(3)			(1),(3)	(2)	
Public health		1,3				1,2,3		
Occupational health		1,2,3				1,3	2	

Note: 1 = POPE 1, 2 = POPE 2, 3 = POPE 3, ( ) = positive impact

Table 2: Types of mitigation measure adopted for three pulp and paper projects

Environmental components	*Site specific*	*Engineering design*	*Policy specification*
Construction phase			
Water quality	1,2,3	2,3	1,3
Air quality	3		1,2,3
Noise	3		3
Solid waste	3		2,3
Drainage	3	3	
Water supply	3		3
Transportation			1,2,3
Occupational health	3		1,3
Operation phase			
Surface water	2	1,2	1,2
Waste water	1,2,3	1,2,3	1,2,3
Ground water	1	1	1
Air quality	1,2,3	1,2,3	1,2,3
Noise			3
Water supply			3
Aquatic ecology	2	2	2
Transportation			1,2
Solid and hazardous waste	2,3	3	2,3
Drainage	3	3	
Socioeconomic			2
Public health			2
Occupational health			1,2,3

Note: 1 = POPE 1, 2 = POPE 2, 3 = POPE 3

of some pollution abatement technology, which focusses on physical works such as instrument control activities and maintenance. Policy specification would encompass regulatory aspects related to implementation, such as a decision to control pollutants by meeting environmental targets. Generally, policy details are adapted from government agencies and environmental standards. Site specific mitigation may involve engineering or policy mitigation adapted to the particular conditions of the site, the surrounding area or the development project. Table 2 shows the range of mitigation measures adopted for the three pulp and paper plants.

There are some complications in the investigation of mitigation compliance because developers are not required to report mitigation performance to the responsible agency. Compliance with mitigation during the construction phase is also hard to examine since proponents, generally, transfer all responsibility to the construction company. Furthermore, in practice, construction often commences before completion of the EIA, with the result that it is not possible for the EIS, in many instances, to address the mitigation of construction impact. However, mitigation which is detailed as engineering design can be indirectly investigated by examination monitoring plans and monitoring reports. Generally, mitigation that involves engineering design supplemented by site specific provisions provides the most appropriate and useful indicator for monitoring mitigation. Thus, consistency between monitoring and mitigation plans could improve the efficiency of post-EIS performance in terms of programme design. It seems that many of the measures included in mitigation plans in EISs are formulated as policy details. However, the main issues, especially water quality and air quality, are addressed through all types of mitigation (Table 2).

For the reason quoted above, compliance with mitigation, particularly for the main potential impact, could only be assessed retrospectively for the operational phase. The means for achieving compliance are detailed in the environmental plan. Compliance with mitigation was determined by desk study and site visit. Analysis

Table 3: The compliance with mitigation

Environmental components	*Aspects identified in EIS*	*Project's environmental plan*	*Compliance*
Construction phase			
Water quality	1,2,3		
Air quality	1,2,3		
Noise	3		
Solid waste	2,3		
Drainage	3		
Water supply	3		
Transportation	1,2		
Occupational health	1,3		
Operation phase			
Surface water	1,2	1,2	1,2
Waste water	1,2,3	1,2,3	1,2,3
Ground water	1		1
Air quality	1,2,3	1,2,3	1,2,3
Noise	3	3	3
Water supply	3		
Aquatic ecology	2	2	2
Transportation	1,2		1
Solid and hazardous waste	2,3		2,3
Drainage	3		3
Socioeconomic	2		
Public health	2		
Occupational health	1,2,3	1,3	1,2,3

Note: 1 = POPE 1, 2 = POPE 2, 3 = POPE 3

can be divided into three components. Aspects identified in the EIS relates to conditions with which the proponent must comply. Whether these are incorporated into the environmental plan is also indicated. Finally, compliance with these conditions as revealed by a review of monitoring reports as well as site visit is also shown. These results are presented in Table 3. It can be shown that construction phase impacts were poorly addressed in all three projects. For the operational phase, POPE 2 failed to address social aspects even though these were identified in the EIS. Otherwise, most issues identified in the individual EISs were incorporated into project activities.

POPE 1 rests heavily on the environmental management system that has led to its ISO 14001 recognition. Under the environmental management system of POPE 1, mitigation aspects are clearly addressed in the project environmental policy. POPE 2, on the other hand, does not have a mitigation plan. Rather, mitigation measures for POPE 2 are defined by the results of monitoring programmes. A similar situation occurs with POPE 3.

Monitoring Programme Conditions and Compliance

The conditions of the project license, which directly control project performance, are based entirely upon the EIS. From Table 4, it can be seen that water quality, air quality, and occupational health are the main components that are mentioned. There are, however, some supplementary aspects which relate specifically to the policy of the responsible agency, such as hazardous waste and trace metals in surface water, required as part of the environmental monitoring for POPE 1. The details of the environmental plan and compliance for POPE 1 and POPE 2 come directly from the respective EIS.

Table 4: Compliance with monitoring conditions

Environmental components	*The EIS conditions plan*	*Project's environ-mental*	*The project compliance*
Waste water	1,2,3	1,2,3	1,2,3
Surface water	1,2,3	1,2,3	1,2
Ambient air	1,2,3	1,2,3	1,2,3
Emission air	1,2,3	1,2,3	1,2,3
Noise	3	1,3	1,3
Aquatic ecology	2,3	2	2
Hazardous waste		1	1
Soil quality	3		
Workplace's environment	2,3	2,3	2,3
Occupational health	1,2,3	1,3	1,2,3

Note: 1 = POPE 1, 2 = POPE 2, 3 = POPE 3

Monitoring conditions do not always follow the detailed content of the EIS. For example, monitoring parameters detailed in the EIS of POPE 3 only identified Total Suspended Particle (TSP), but monitoring of the actual project has also included Particulate Matter <10 micrometres (PM10), hydrogen sulfide, sulfur dioxide, and nitrogen dioxide. These additional monitoring parameters arise from supplementary studies necessary to comply with the EIA procedures of an international financing institution from which aid was sought.

The frequency of monitoring is largely determined by standard procedures for sampling a particular environmental medium. Thus, a monthly period is used for water quality, biannual for air quality and yearly for the remaining parameters.

The Results of Post-EIS Performance

Projects requiring EIA seem to perform the monitoring task in a satisfactory way since there is a specific tool, the EIS, to provide the basis for monitoring procedures and certain persons (proponents and service contractors) to carry out the monitoring works. An EIS also provides beneficial information for further environmental management as shown by POPE 1. This project is now certified to the environmental management standard (ISO 14001), in part, based on its monitoring procedures. Thus, POPE 1 applies the mitigation and monitoring provisions detailed in the EIS as a minimum requirement in the environmental plan for the project. If public feedback is used as an indicator with which to gauge the success of project activities, it must be judged satisfactory. Not only is there little public objection to the project, an operation which underpins the income of the local community, but it is also located within a suitable area from an environmental perspective.

POPE 2 is scrutinized by the government agencies more than the other two case studies, since pollution control problems have been growing since the early stages of project operation. Indeed, POPE 2 was forced to stop operations for 20 days in 1998 for the alleged discharge of waste water to local water courses. However, it should be recognized that POPE 2 has completely complied with the provisions imposed as conditions of approval. It is evident from this project that the public image of a development which is very politically sensitive is the major cause of public controversy.

In comparison, the monitoring of POPE 3 fails to comply with respect to many parameters, especially surface water, but the project is not scrutinized by the responsible agencies. Only two issues have created any public concern, namely waste water and odour problems.

It should be noted that odour was not identified as a negative impact in the EIS for the project. From an overall perspective, however, POPE 3 does not appear to be an intractable problem, unlike POPE 2, for public complaints only arise within the immediate local area.

Monitoring Procedures for Projects Not Requiring EIA

Background to the Projects

Three seafood freezing and canning industries were investigated, henceforth referred to as POPN 1, POPN 2 and POPN 3. POPN 1 is within an industrial area. The main product is a wide variety of frozen seafood. Waste water is the main waste which is produced at a rate of 1,800 cubic metres per day. An aerated lagoon is the waste abatement process. Odour is a minor pollutant derived from the raw materials, but no methods are used to reduce this kind of pollution.

POPN 2 is located within a sensitive area, surrounded by many dwellings. The main product is canned seafood. Waste water from washing and cooking the raw materials is the main pollutant, at about 600 cubic metres per day. Activated sludge technology is applied to treat the effluent. Minor pollutants are solid waste and odour. Odour is the major cause of public complaints. The plant operator has tried to reduce this impact by diverting waste gases to the waste water treatment plant. Up to the present, however, this method has not been successful in reducing odour. Had EIA been carried out for this project, odour should have been identified at the EIA stage, rather than after public complaints, and the problem designed out.

POPN 3 is a subsidiary of POPN 2, so the process of seafood canning is similar. Waste water is also the main pollutant at around 500 cubic metres per day. Activated sludge is the only waste abatement.

Monitoring Procedures

Conditions attached to the license are the main tool of environmental management for these projects. These conditions generally include monitoring. From an analysis of these licenses, however, it is evident that the monitoring prescriptions are too general and concentrate only on waste water treatment. The requirements of the Department of Industrial Works, as the responsible agency, have an influence on the monitoring of these projects. The project proponents are also the key in assessing monitoring performance, with the external environmental consultants playing only an advisory role. Since waste water is the main pollutant, both the regulations of the responsible agency and the control of project activities are directed at meeting the waste water standard. Similarly, monitoring frequency is determined by the timing of the monitoring report that must be submitted to the responsible agency. Although projects are regulated by the same agency, in practice, monitoring procedures for these projects differ. POPN 1 sends water samples, which they collect themselves, to a service contractor for analysis. For POPN 2, all monitoring procedures are undertaken by service contractor. With respect to POPN 3, all monitoring activities are contracted to an external consultant who subcontracts the work to a service contractor. In the monitoring report, which is the main source for the agency to check compliance, only the results of parameter analysis are presented. Thus, other aspects of environmental management are ignored as only waste water abatement and parameter analysis are considered by the agency.

Monitoring Performance

Public complaints have been used as the main indicator to gauge the effectiveness of project control activities in this study. However, it is clear that project location is the main cause of public controversy. POPN 1 is located within an industrial area and the project operation supports employment in the local community. These factors are sufficient to eliminate public complaints about POPN 1. Conversely, POPN 2 is in a residential area. Although the project operator tries to control all pollutants from project activities and carries out intensive environmental monitoring, public controversy still remains. Similarly, effects on agriculture and recreation areas are the causes of public conflict over POPN 3. The conditions imposed by the responsible agencies are not sufficient to compel adequate project monitoring in all cases for, as POPN 2 and POPN 3 show, the licenses prescribe only waste water issues whilst the major cause of public complaint is odour problems.

Comparisons of Project Implementation

EISs are the basic tool for indicating the positive and negative impacts of projects requiring EIA. Hence, accurate impact studies are necessary for post-EIS follow-up activities. From the results of this study, however, it is clear that impact predictions for these projects tended to present a biased view of the impacts in that few impacts are regarded as significant. As a consequence, the results of impact predictions are a minor consideration in defining mitigation programmes. The major issues with respect to individual parameters hinges on the kind of industrial project involved. Although these observations reflect inadequacies in EISs, nevertheless, EISs do provide valuable information in defining the monitoring requirements during project construction and operation.

For projects not requiring EIA, comprehensive criteria for defining the adverse impacts of a project are lacking. The normal practice is that, for one type of project, only a particular suite of issues will be considered. In effect, these issues reflect the legal responsibilities of the agency based on past experience.

Thus, it seems that EIA is a more satisfactory tool for identifying the adverse impact of projects and, hence, monitoring the administrative procedures of government agencies. The environmental studies reported in an EIS are detailed and specific to the individual project. Furthermore, the prescriptions to reduce impact that arise from a project are the mitigation and monitoring programmes that are included in an EIS.

However, this study has shown that in Thailand there is no verification of the performance of mitigation programmes following EIA, as the actual procedures do not have to be reported upon in official documents. Indeed, only the results of parameter analysis for the major components are highlighted. In this respect, Tongcumpou and Harvey (1994) also confirm that the modification of mitigation conditions is normally carried out during project follow-up after the EIS in Thailand. One reason for this, argued by Wood (1996), is that the cost of mitigation is normally too high. In practice, especially for long-term mitigation, it is impossible to demonstrate the effectiveness of mitigation measures because monitoring is inadequate. Hence, there is a need to ensure that monitoring programmes are designed to provide appropriate data for assessing the effectiveness of mitigation measures. Canter (1996) and Glasson, Therivel and Chadwick (1994) also confirm this. From the project case studies, it is evident that mitigation cannot be investigated, if there is no monitoring of the appropriate components. Additionally, a specification for mitigation is also necessary, since proponents often present biased results, especially with respect to mitigation details implemented through policy changes.

Regarding the nature of monitoring programmes, comparisons of the results of parameter analysis with environmental quality standards outweigh all other issues. This agrees with the finding of Buckley (1991) concerning the content of EIA auditing in Australia. The number and types of parameters, sampling frequency and monitoring stations influence cost. However, increasing the number of parameters that are sampled does not necessarily increase the efficiency of a monitoring programme. Indeed, it may do no more than waste money. Many experts (Morrison-Sauders, 1996; Wood, 1996; Marr, 1997) recommend that monitoring programmes are enhanced when only particularly significant components are investigated. Thus, careful design of monitoring is necessary to achieve this efficiency. Consequently, the quality of EISs is critical in the correct identification of issues that should be incorporated into monitoring programmes.

To enhance project environmental management further, conditions in the EISs should be applied as the minimum requirements of an environmental management plan. The value of this is confirmed, in this study, by the performance of POPE 1, where the key issues identified in the EIS were incorporated into a comprehensive environmental management plan.

Section 50 of the NEQA (Thailand) stipulates that the mitigation and monitoring recommendations included in an EIS must be prescribed in the license for project implementation. Although for projects requiring EIA, EISs are the key factor in the licensing of projects, some questions are raised. Firstly, mitigation and monitoring programmes are often not fully elaborated in an EIS, and, these deficiencies are normally perpetuated in the license issued by the responsible agency. Secondly, examination of monitoring performance by the responsible agency tends to pay attention only to selected key components depending on its responsibilities. Sometimes, it seems that EIS conditions only appear on official papers, and do not necessarily result in action. The value of the EIS is further underlined by a consideration of projects not requiring EIA. For such projects, details of the license issued depend upon the regulations of the responsible agency. Generally, details of any monitoring are not included in the license. Clearly, this affects the performance of the project proponent. Only the specific concerns of the responsible agency are applied, whereas the operation of a project creates a complex of issues which need to be considered on an individual basis.

The conditions included in a license provide the basic tool for project monitoring. Clearly, there are more ways to control the adverse effects of development for projects requiring EIA than for those that do not. The case study confirms that EISs are an essential guide for formulating the detailed monitoring mechanisms. However, the actual performance may vary. The three case studies of projects requiring EIA reveal significant differences. POPE 1 complies completely with the license conditions and environmental management of the project is achieved in a fully satisfactory way. The EIS is applied as the key source of information for project management and is the basic tool for improving its environmental performance. Project monitoring is also rigorously performed for POPE 2, but it is the external pressure that is the key in project implementation. In contrast, POPE 3 fails to comply with

nearly 40% of its licence conditions. Although the operation of POPE 3 creates some public controversy, the public perception of this project is better than for POPE 2. The failure to monitor POPE 3 is a reflection of the lack of response to this deficiency by the relevant agencies.

Service contractors carry out monitoring work under the direction of the project proponent. The monitoring details in an EIS, such as parameters, frequencies, and stations are applied as the target that service contractors have to meet. Usually, however, it is the proponent, who prepares the environmental report with no independent verification of its content.

As for projects not requiring EIA, monitoring performance depends on the requirements of the responsible agency. Generally, the proponent transfers all monitoring responsibilities to the service contractors. As a consequence, the monitoring performance differs between projects both in the method of sampling and, in the presentation of the report.

Monitoring costs are one determinant of project performance. Projects requiring EIA reveal much higher monitoring costs than for other projects (Table 5). Even where the same types of project are involved, variations in these costs occur. EIS content, the environmental management of a project and the precise duties of the service contractor are the factors that affect monitoring costs for projects requiring EIA. In contrast, only the service contractor's activities influence monitoring costs for projects not requiring EIA. However, in both cases it is the monitoring reports that provide the specific information for environmental monitoring of projects, in effect, providing the legal documentation of this process.

With respect to public perception of the impact of a development, it is evident that the land use surrounding a project is the main factor in determining conflict. Projects that are located in industrial areas and that provide jobs for local people tend to generate less public conflict. In contrast, projects located in residential areas that conflict with the customs of local people create the greatest debate. These observations broadly conform to those of Shepherd and Ortolono (1997).

Conclusions

On the basis of the lessons learnt from these case studies, it is clear that mitigation and monitoring programmes for projects requiring EIA are more satisfactory than for projects not requiring EIA. The results of this research indicate EISs are the major source of information for defining monitoring for a project. As a consequence, the post EIS performance should be considered from the early stages of project design through to project implementation. In addition, more attention should be paid to monitoring and should begin during the initial stages of project construction and operation.

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Table 5: The costs of monitoring (baht/annum)

The monitoring components	*The projects requiring the EIA*			*The projects not requiring the EIA*		
	POPE 1	*POPE 2*	*POPE 3*	*POPN 1*	*POPN 2*	*POPN 3*
Waste water	86 400	128 000	90 000	30 400	20 400	16 200
Surface water	145 800	144 800	-	-	-	-
Ambient air	65 800	33 600	65 800	-	-	-
Emission air	28 200	66 400	64 000	-	-	-
Workplace environment	-	134 000	21 000	-	-	-
Noise	-	-	3 000	-	-	-
Occupational health	28 000	64 000	40 000	-	-	-
Total monitoring costs	**354 200**	**570 800**	**283 200**	**30 400**	**20 400**	**16 200**

Note: 1 dollar = 35 baht (2007)

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