

**A strategic approach to
the use of Environmental Impact Assessment
and Risk Assessment within
the decision-making process**

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Preface

The Resource Management Law Reform process presently underway is likely to result in considerable changes being made to the way in which the assessment processes, which are the subject of this work, fit within the revised institutional arrangements. When this project was proposed it was not obvious that these changes would have as major an influence as is presently understood. This uncertainty has made it difficult to make precise recommendations as was originally intended. This is not necessarily to the detriment of the project since the further this research has progressed the more obvious it has become that impact assessment procedures are in general heavily value laden despite a greater tendency towards the use of quantitative methods. This, along with rapidly changing methodologies means that it is important that the institutional basis for impact assessment remains as flexible as possible, whilst ensuring that the protection afforded by proper evaluation and management impacts is available to society.

There are two main policy questions regarding impact assessment that must be answered before guidelines can be established. First of all, does society wish to regulate for 'risky' situations or does it wish to use other mechanisms such as voluntary compliance? Secondly, if assessment procedures are to be used as a tool in either case, then who is to be responsible for the analysis?

Developers and proponents are looking for clear policy guidelines which: firstly, define the types of allowable activities on a national, regional and local basis; and secondly, define the institutional or regulatory requirements for specific activities. There is a feeling that the problems of dealing with risk will be solved if developers are given a clear guide as to the requirements that must be fulfilled for their project to receive approval. One suggestion is that a checklist capable of being applied to a large number of situations be compiled. The difficulty is that by the time all possible contingencies were covered the checklist would most likely be incomprehensible. This type of approach might, however, be useful for a limited type of development or activity (for example, installations storing or using hazardous substances).

Before explicit management guidelines can be specified the policy issues with respect to the use of assessment procedures need to be clarified. This report discusses the policy/management relationship and related issues, but adopts a management perspective. If assessment procedures are to be effective they must be viewed within a management framework where the full range of conditions including implementation of the selected option and monitoring of the impacts can be assessed.

This report does not attempt to provide a precise process to be followed for impact assessment. What it does do is: examine the need for such procedures; consider where they fit within the traditional decision-making process; and suggest a generalised approach for dealing with public and private proposals where consent procedures are required.

A part of the work presented here in the final part of this project is the product of discussions and correspondence with risk practitioners, or people working in areas involving practical impact assessment. These discussions have been invaluable in the search towards understanding the changing attitudes towards impact assessments in general, risk analysis, risk research and risk management.

Summary

This is a brief summary of the main points discussed in the individual chapters, presented here under their original chapter headings. It is not exhaustive and does not include all the issues discussed.

Chapter 2 Environmental risk management

There are considerable parallels between the risk assessment process and the general decision-making process. Extension of risk assessment to risk management allows us to view the risk assessment/management process as a specialised form of the generalised decision-making process. This approach is useful for examining the relative roles of the agents of the risk decision-making process, which include analysts ('experts'), proponents, decision makers, administrators (of decisions) and managers.

Environmental impact assessment and risk assessment are both contributors to environmental risk decision making. It is useful to consider environmental impact assessment and risk assessment as independent (inexhaustive) components of a composite management process because of the shared experience which can provide a broad background for assessment and evaluation.

Risk assessment and environmental impact assessment are primarily management tools. Related policy tools include technology assessment and social impact assessment (used here in a general sense). The way in which policy is implemented guides managerial decision making and is therefore very important to the outcome of the decision-making process.

Chapter 3 Consents procedures and conflict

Conflicts occur as a direct result of the adversarial approach to decision making. They can be categorised as either 'interest' or 'value' conflicts. This distinction is important for determining the approach to resolving the conflict. Disagreements between interested parties in conflict over technological hazard can arise from a variety of sources. A typical confusion of motives means that it is sometimes difficult to establish the 'real' source of conflict.

Impact assessment can reduce the level of conflict in some circumstances by reducing uncertainty and providing greater information about a system or activity.

Chapter 4 Example

Public perceptions of risk often differ greatly from statistical estimates of risk. The quality and quantity of data available for low probability failures has considerable implications for both the use and the public acceptance of quantitative risk assessment techniques. Provision for independent audit of quantitative and qualitative risk assessments and their implementation may therefore be important part of the risk decision-making process.

Chapter 5 Options

Public sector decision making is a part of the process directed towards the outcome of achieving society's goals. Policy making is involved with providing mechanisms for interpreting society's preferences and setting goals and objectives for the decision-making process.

A critical outcome from the Resource Management Law Reform process is likely to be the way in which national and regional policies are specified and implemented. It is likely that regions will be given the opportunity to develop their own regulations for resource use according to national guidelines. It is desirable that national agencies retain a strong monitoring role with the ability to act swiftly in the case of detrimental actions by local authorities.

There are a variety of regulatory and non-regulatory approaches to areas such as the control of hazardous substances including the use of checklists, quantitative risk assessment, codes of practise and environmental impact assessment procedures.

Options for incorporating environmental risk management procedures within the environmental decision-making process revolve around making the use of environmental impact assessment and risk assessment mandatory or voluntary.

Responsibility for assessment and implementation (monitoring) of decisions may rest with national or regional regulatory agencies, proponents, or third party (contracting) agencies. The role of regulatory agent with respect to impact assessments and management of decisions is very important for future management of potential hazards.

Chapter 6 Selecting a preferred option.

Feasibility and ease of implementation and the likely degree of protection offered to human health and the environment were the two criteria used to evaluate the options.

The advantages to establishing in law a requirement for impact assessment and management procedures are that direct comparisons between similar applications may be made assisting consent-granting authorities in their decision making, that applicants and opponents are aware well in advance of requirements for environmental risk management and can prepare their case accordingly, and that a formal, accepted procedure for monitoring can be established.

The main disadvantage is that unless the procedures to be followed are flexible there may be considerable redundancy to the process. This could be partially overcome by the use of indicators which could be used to 'trigger' a requirement for environmental risk management.

Chapter 7 A general approach to environmental risk management

Recommendations arising from this Chapter are:

that environmental risk management be established as a means of assessing and monitoring proposals involving potential hazard to human health and the environment;

that the application of environmental risk management is likely to be of greatest benefit if both a requirement for and an approach is incorporated in legislation;

that a generalised checklist be applied as an initial form of assessment from which the specific assessments required can be determined; and that a regulatory agency be made responsible for monitoring the application and implementation of environmental risk management and that that agency also have the task of delegating responsibility for the assessment and monitoring of specific proposals.

1. *Introduction*

This report represents the fourth stage of an on-going project. The impetus for this work came from the belief that there was a need for a better approach to that currently employed by society to regulating for and managing risky situations, as they occur in environmental planning.

The issues that were to be considered included the determination of where risk fitted within the current institutional framework associated with consents procedures. This introduced the question of where risk assessment fitted with respect to environmental impact assessment which has in some cases incorporated risk assessment procedures. In order to gain a greater understanding of the way in which risk assessment and environmental impact assessment might interact the whole context of impact assessments including technology assessment was analysed.

The original objectives of this project as stated in Gough 1988a were:

- (1) to improve understanding of the public's attitude to risk and uncertainty with regard to environmental management; and
- (2) to provide a means whereby risk assessment procedures might be incorporated with environmental impact assessment procedures.

The first stage of this project was a major review of risk assessment literature which addressed the first objective. The product was a Centre for Resource Management Information Paper (Gough, 1988a) that summarised current research in the area of risk and uncertainty. It has proved to be a useful reference document.

The second and third stages of the project involved analysis of the relationship between risk assessment and environmental impact assessment. The original proposal for Stage four was that it would "recommend a flexible approach to incorporating risk assessment (RA) procedures with environmental impact assessment (EIA)" in project evaluation. During the course of the second and third stages, however, it was postulated that EIA and RA be viewed jointly as part of an ongoing process of environmental risk management. (This involves a narrow view of RA, which will be discussed further later.) From this, a set of new objectives for Stage four were derived. These are:

- (1) to develop the theme of environmental risk management, as a composite approach to environmental impact assessment and risk assessment;
- (2) to describe a general framework for environmental risk management; and

- (3) to devise a small case study to examine the merits of this approach.

The terms EIA and RA have been used fairly rigidly so far, to describe known and accepted procedures. An appendix to this report presents a set of definitions that have been used. It is worth noting that when we are discussing RA here, we are dealing with a subset of a larger topic that might be termed hazard assessment.

This includes the assessment of natural hazards such as earthquakes and tidal waves as well as man-created hazards such as fire, pollution, health hazards and environmental damage. Here we are employing a narrower view of risk assessment that deals more specifically with risks to man and the environment arising from human intervention or man's activities (often 'causing' or exacerbating natural hazards such as floods). We are concerned with risk assessment of particular development projects or proposals that are likely to affect the environment or cause harm to people. We include new proposals and current installations or conditions.

The first part of this report (Chapter 2) therefore follows up the discussion on environmental risk management (ERM) as originally proposed by O'Riordan (1979). It describes the relative roles of the analyst and the decision maker within the decision-making process and expands these concepts to the management framework. Chapter 3 looks briefly at conflicts arising through the present use of consent procedures. Chapter 4 uses the Lyttelton LPG pipeline hearing as an example of one such conflict. Chapter 5 looks at some of the options available for implementation of impact assessment and Chapter 6 discusses some of the implications of the previous chapters. Chapter 7 recommends an approach to setting guidelines for the use of impact assessments within the anticipated framework of the Resource Management Law Reform (RMLR) process now in progress.

This report emphasises the use of impact assessment in general, and RA in particular as a management tool. The role of RA and management processes within the generalised decision-making process are examined and the respective roles of policy and management decisions are discussed.

2. *Environmental risk management*

How does risk assessment fit into the decision-making framework? Where does risk assessment fit into the management framework? What is environmental risk management? What is the relationship between policy and management? Why is it important to look at management? Why is it useful to consider RA and EIA together?

2.1 *The decision-making process*

Decision making can be described as decomposing and structuring the problem, assessing the uncertainties and values of the possible outcomes and determining the preferred strategies (Hertz and Thomas, 1983).

For a problem to exist, the following conditions must be met:

- (1) there must be an individual or group (the decision maker(s)) who has a felt-needs to be satisfied or objectives and goals to be achieved;
- (2) the decision maker must have at least two possible choices of action available that achieve the objectives;
- (3) there must be some doubt (uncertainty) as to the best choice of action in terms of achieving the decision maker's objectives; and
- (4) there is an environment within which the problem to be solved is relevant (Daellenbach et al., 1983).

With this in mind, the generalised decision-making process can be viewed as a systems approach and represented by a series of five stages. There are a number of minor variations used, of which the following is fairly typical:

- (1) initiation or identification;
- (2) formulation;
- (3) modelling (analysis);
- (4) evaluation; and
- (5) implementation.

Briefly, initiation is the identification or recognition of the problem. Formulation involves defining the components of the problem (the decision maker, the objectives, the alternatives and the environment or boundaries). The modelling or analysis stage requires first setting up the model, including describing the decision variables and criteria based on the objectives which can be later used for evaluation of the options and then using the model to analyse the options. Modelling may be

either quantitative or qualitative. Evaluating involves applying the selected criteria to the modelling results and choosing the preferred option, and the final step, implementation, puts into practise this selected option.

Although these stages are presented sequentially and are usually initiated in this order, they will usually overlap. It is also quite common for an iterative process to evolve between Stages two, three and four as the process is refined and new information is obtained.

Risk assessment is usually represented as having three stages: identification, which corresponds to the first and second stages of the decision-making process; estimation, which corresponds to the third stage; and evaluation (the fourth stage). Risk assessment is extended to risk management by the addition of two further steps of implementation and monitoring. Thus, risk management can be seen as a specialised form of the generalised decision-making process. In an organisational sense there are close links between decision and risk analysis and policy and strategy formulation which we will explore later.

Within the decision-making framework presented above there is a division of responsibility between the analyst and the decision maker which is also important to the risk assessment process. Initiation is usually instigated by the decision maker(s) although, where a public agency is involved the actual impetus may come from agents external to the agency. Formulation and analysis are the responsibility of the analyst. The analyst may also take charge of most of the task of evaluation, however, it is the decision maker who makes the final selection of the preferred option.

The distinction between the analyst and the decision maker is an important one. Many environmental decisions have social and political implications. The analyst is required to present information in as objective a manner as possible. The decision maker then uses the defined criteria that will take social and political factors into account and evaluates the options on this basis. Notice that this implies some overlap of the functions of the analyst and decision maker in defining of the criteria for evaluation. Since these criteria are based on the objectives of the decision maker some interaction (and possible iteration) between the analyst and decision maker is required where the decision maker feels that the criteria do not adequately represent his interests. If the expert or analyst is seen to have shown bias then the validity of the decision is in question since opponents may claim that the decision maker has had the wrong information available. Where bias is inevitable, as for example in circumstances where data are incomplete or unavailable, then making value judgements on the part of the analyst is unavoidable and this must be made quite clear to the decision maker and to those affected by the decision.

This is all relevant to environmental risk decision making. Risk assessment is the

task of the analyst. Risk decisions are made by bureaucrats, politicians and managers, relying on the data presented by the risk analyst. Problems occur because typically risk decisions involve highly technical information which may not be properly understood by the decision makers and managers. Analysts or experts may be called upon to make subjective judgements about the information which they have presented, thus changing their status within the decision-making process. This is complicated by the fact that it is often difficult to get competent independent expert opinion on the analysis so that the analyst may effectively take on a combined role as analyst and decision maker.

The final stage of the decision-making process is implementation. Drawing the parallel with risk analysis, implementation includes communication (with interested parties and the public), putting into effect and monitoring. It is the role of the manager to implement the decision. Risk management encompasses the complete risk decision-making process and involves the analyst, the decision maker and the manager.

This brief summary has been presented in terms of the single analyst, decision maker and manager. Greater complications are introduced in more realistic situations where there is more than one analyst, decision maker or manager. In particular, the multiple decision-maker case where decisions may have to be made sequentially, and which is typical of the public sector decision-making process, causes substantial increased complexity.

Using traditional decision-making terminology, the analyst identifies the options or available actions and the expected outcomes, quantifies (optional) the outcomes and their probability of occurrence and then makes value judgements regarding the options. This is called assessment. Decision makers take this information and choose between the available alternatives or options. Management takes into account the decision and the assessment information and then implements and monitors the decision.

We have stressed this division of responsibility between the analyst, the decision maker and the manager because understanding the relationship is an important aid to understanding the process of RA. The actors, however, are not necessarily uniquely defined and it is important that when the roles are mixed that the 'players' are aware of their responsibility under the different categories. This is a key factor with risk assessment where the expert presents information to the decision maker. The decision maker may not have the necessary technical knowledge to be able to make a rational decision. In this case the decision maker may require judgmental information from the expert or analyst. When this type of presentation is given it must be absolutely clear to all parties that the information required is in the form of

a value judgement by the analyst or expert and that it must be given different weight to the analytical information which it is intended to qualify. How much weight is given to the expert's opinion is itself a value judgement and will depend on factors such as the decision maker's previous experience with the individual or group concerned, comparative expertise with the type of activity involved and personal knowledge. This is itself an evaluation of the expert's opinion which should be kept separate from the risk evaluation part of the assessment.

Tham (1979), Minister for Co-ordination and Energy in Sweden, considers the question of risk from the point of view of the decision maker and concludes that while decision makers seek and desire more 'hard' information on which to base their decisions, because of their responsibilities and sometimes duplicate role in the political arena they cannot afford to neglect human feelings (or perceptions) about risk. An example of this type of conflict is seen in the Sydney airport controversy. Government Ministers have stated that despite the need for expansion, a third runway will not be built at Sydney's Mascot airport. A major reason for this is that there has been considerable public reaction against the proposal and Mascot is surrounded by five marginal seats.

2.2 Impact assessment

The origins and development of EIA and RA were described in Gough 1988b. In that report a relationship between EIA, RA, technology assessment (TA) and social impact assessment (SIA) was proposed. A modified version is shown in Figure 1.

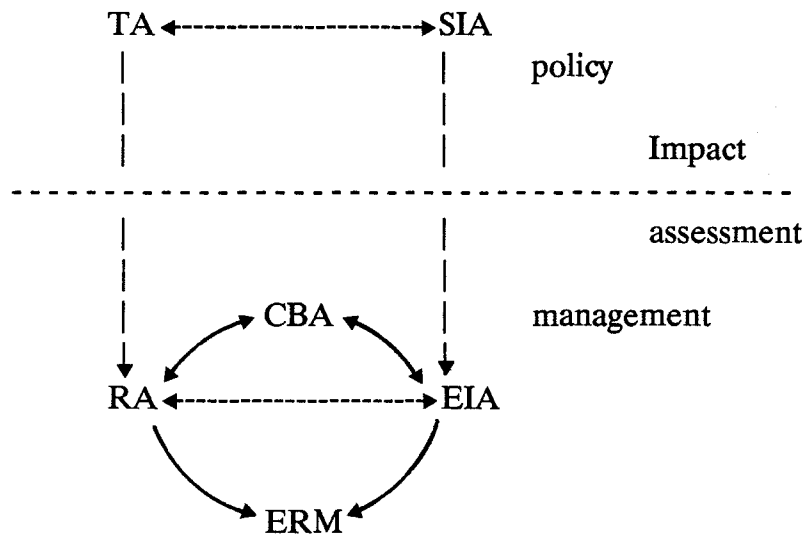


Figure 1. The assessment process.

Figure 1 shows EIA and RA both contributing to ERM. This contributory relationship is important because, as we have discussed, the management function goes beyond the assessment function. It takes into account the assessment and the decision and includes communication, implementation and monitoring of the selected option.

The encompassing term 'impact assessment' has been used here as a generic term to describe all forms of impact assessment including technology assessment (TA), SIA, EIA, cost-benefit analysis (CBA) and RA. As shown in Figure 1, impact assessment is relevant at both policy and management levels. Environmental risk management is used to describe a composite approach to the management functions of EIA and RA. There are a number of benefits which arise from considering EIA and RA as independent components of a combined assessment management process¹.

¹ Note that SIA is also used as a management tool for specific project evaluation. SIA is used here in its broadest sense.

Firstly, when working at the project level it is valuable to have a framework that considers all assessment processes (EIA as used here includes project-specific social impact assessment). It may not be feasible or necessary to perform major quantitative assessments in all circumstances, but the decision not to do this should be a deliberate choice: not a default occurrence.

Secondly, a major deficiency of RA is that although quantitative risk assessment (QRA) has become a reasonably commonly applied and increasingly sophisticated technique, the recommendations and qualifications that are part of the output from the analysis (or even part of the base conditions) are often not implemented in practise. There is considerable value in the greater understanding of the system gained from the analysis, however, the full benefit cannot be obtained until implementation and monitoring is complete. That is, until the management process is complete. Because of this it is often difficult to assess the effectiveness of the assessment process itself. If QRA is to have greater credibility with the general public it needs to have implicit in it an implementation (or self evaluation) component.

Thirdly, there is a growing tendency towards greater quantification of impacts within EIA. The methods of RA and EIA have also been described in Gough (1988b). One of the apparent reasons for these attempts to develop methods that provide numerical outcomes is to improve the status of EIA in consent procedures. In contrast, the emphasis with RA has been away from the quantitative single number outcome which was originally attractive to its proponents and towards a more qualitative and qualified approach².

This is not to say that it is not good to quantify outcomes, but mainly to recognise that there are inbuilt biases arising from the assumptions required to obtain these estimates that require greater attention to be paid to social evaluation of the results. Where a QRA of a single project outcome is done it is difficult for anyone not directly connected with the full analysis and its assumptions and implications to attribute real meaning to a figure representing 'risk' or 'safety' even if sensitivity analysis has been performed. Therefore, it has become apparent that the methods of QRA are most effective when applied to project comparison rather than to the direct acceptance/rejection of a single project.

²In the Netherlands QRA is recognised as an aid to decision making that does not invalidate other inputs. It is stressed that the use of a quantitative technique does not reduce the importance of existing procedures (i.e. qualitative approaches) and that, moreover, the results of risk assessment need to be reviewed at least every five years (Gilby, 1987).

The benefits to be gained from the bringing together of these two areas of analysis are that the shared experience of the two disciplines can provide a broader background for assessment and evaluation (and maybe prevent the re-inventing of the wheel).

CBA is a further component of the management process. It is a tool for decision making in the same way that EIA and RA provide information used by the decision maker. Environmental impact assessment was originally devised as a balance to CBA in the project accounting process. It was seen as a way of providing a balance and taking account of the non quantifiable effects not able to be directly included in the CBA framework. Experience over the past 15 years has shown that it has in fact not worked in this manner. Some critics claim that it has proved cumbersome, time consuming and decision extending, without protecting the environment. It has modified some projects (e.g. the Alaskan pipeline), but it has seldom stopped development. One of the other limitations of CBA is that it is not easy to take account of risk and uncertainty within the CBA framework. Therefore, RA can be seen as providing additional balance to CBA as is explicitly recognised within the techniques used for RA.

In defining the relationships posed in Figure 1, we have not taken into account any of the specific analytical techniques that are used for the different assessment and analysis processes: their methodologies or assumptions and limitations to use. Choosing the most appropriate technique for a particular situation is a very specific task.

2.3 Policy and management

Referring to Figure 1, we have distinguished between policy and management levels of the impact assessment functions to suggest two levels of decision making. However, rather than thinking of two different types of assessment, one related purely to policy and the other to management we should recognise that in many cases there will be an overlap in the decision-making processes. The interface between policy and management is provided by process³. The reason for distinguishing between policy and management functions in Figure 1 is to illustrate the difference between two degrees of impact assessment. That is, different levels of impact assessment will be applied to policy and management decisions but the same basic techniques may be used in both cases.

³ See Chapter 6 where values and process are viewed as two components of decision making.

In general, as indicated in Figure 1, TA and SIA are most commonly used as policy setting tools, while EIA and RA are more commonly used as management tools. At a management level the concern is more directed towards specific proposals. Environmental impact assessment and RA are most commonly applied to limited areas such as projects or activities. The main distinction between EIA and RA is that RA is usually used in situations where there are uncertain outcomes. Environmental impact assessment is used when the outcomes are predictable with reasonable certainty. Assessment methods used may be very similar in all cases.

Our main interest here is with the public decision-making process and therefore the different levels of policy decision making we are concerned with will include international, national, regional, and local. Policy may be either simply a broad statement of intent or it may be a set of detailed goals defined in legislation. Policy goals are implemented through a number of different methods such as legislation, regulation and guidelines. Other policy instruments include dissemination of information, incentive/disincentive structures, provision of mediators and arbitration and insurance policies.

The way in which policy is implemented guides managerial decision making and hence is critical to the outcomes of any managerial assessment process.

3. *Consents procedures and conflict*

What is involved in the present use of consents procedures? Where do conflicts arise? Is it advantageous to some parties for conflict to exist? Are conflicts inevitable under the present system? Does information help to resolve conflict? What are the social and cultural aspects of 'risk' conflicts? Is conflict avoidance possible or desirable? What real use is conflict analysis except as an historical tool?

In New Zealand, public-sector decision making currently operates through the use of consents procedures that are used by administrators of individual Acts such as government departments and local authorities. The approach used is generally an adversarial approach where proponents and opponents present their views before some form of planning tribunal. The tribunal is set up formally using a legal framework that governs the type of evidence that is permitted and the form of presentation. This is similar to the approach used in the United States and many European countries, including Britain, although some variations occur. The advantage of the adversarial approach to decision making is that regulations are developed in open confrontation with relatively free access to information. In contrast the consensus approach to decision making means that decisions are made by 'elite' groups behind closed doors with comparatively little access to information by the public at large.

Concern that environmental interests were not being properly represented led to the introduction of EIA and environmental impact statements (EIS). Although these procedures are now commonly accepted, there is little evidence to show that they have in fact achieved their original intent of providing greater protection for environment. One reason for this is that, as a generally qualitative assessment, they cannot be directly compared with the quantitative CBA results that generally form a major part of the proponent's evidence. Other problems are that very few countries require the use of EIA or the presentation of an EIS and even when this form of analysis is required there are few guidelines as to the necessary content. Since in most cases the EIA is the responsibility of the proponent, there is a tendency to brevity.

Risk assessment has faced similar problems, with even fewer countries (currently only the Netherlands) requiring RA for public and private sector proposals. Risk assessment is generally (though not necessarily) more quantitative in approach than EIA a characteristic that can increase its status in evidential proceedings; however, the many necessary assumptions can lead to increased conflict within the adversarial approach.

Conflicts arise as a direct result of the adversarial approach to decision making that formally requires that opposing parties present their evidence in an environment where it is difficult to achieve consensus. Environmental impact assessment and RA both provide greater information to the decision-making process, however, depending upon the perceived objectivity of the agency performing this analysis it may or may not reduce conflict. Projects with potentially adverse effects on the environment inevitably involve considerable uncertainties that are unlikely to be able to be completely resolved. These uncertainties will be represented differently by opposing sectors of the community whose values or interests are at variance.

Otway and von Winterfeldt (1982) found that disagreements between interested parties in conflict over technological hazards could be broken into six categories of disagreement. These disagreements were over:

- (1) data and statistics;
- (2) risk estimates and probabilities;
- (3) assumptions and definitions;
- (4) risk/cost/benefit tradeoff;
- (5) the distribution of risks, costs and benefits; and
- (6) basic values and ideologies.

Conflicts may also be categorised as either value conflicts or interest conflicts, of which the above list of covert disagreements provides the symptoms. It is often difficult to identify the type of conflict which is occurring, and in some cases opposing parties may have different view the conflict as arising from different origins. For example, there is currently conflict between fishermen (including commercial fishermen and recreational fishermen) and a number of other less identifiable groups regarding a ban on set netting in the Banks Peninsula. The reason for the ban is to protect the rare Hector's dolphin which is found in these waters. Groups opposing the ban generally reflect an interest conflict; they believe that the ban is preventing them from catching fish. Groups in favour of the ban (though with many different motives) generally reflect a value conflict. Their value system is such that they believe that it is important that Hector's dolphins be saved from further reduction in numbers and allowed to move unrestricted in present locations. The fishermen apparently feeling that the value argument has greater strength than the interest argument are changing their stance and saying that they place as high a value on the survival of Hector's dolphin as anyone else, but that their activities were not affecting the dolphin anyway - this despite considerable evidence of dolphin entrapments.

At this point the argument has reduced to the level of individuals casting aspersions on other individuals with no apparent prospect of any real change to either group's stance. Environmental issues are often characterised by emotional and bitter disagreements (Covello, 1985).

In this case, although the conflict was not advantageous to either party initially, it is now advantageous to the fishermen that conflict should continue since they may thus be able to force a reversal of the set net ban. In some other cases conflict may be deliberately provoked. Again in these cases it is common for an interest conflict to be represented as a value conflict in order to gain greater widespread support. A typical example of this type of shifting the basis of the conflict occurs when proposed development affects a group or individual in an interest sense: a mining company may seek to mine on a farmer's land; or property may be requisitioned for motorway expansion. In the former case conservationists may be enlisted to oppose mining on value grounds and in the latter case community values may be invoked. Conflicts therefore often need careful interpretation which is not possible within the present adversarial system.

The important difference between value and interest conflicts and why it is desirable for them to be properly identified is that it is often possible to reduce or remove interest conflicts by either greater provision of information or by making trade-offs. It is seldom possible to reduce genuine value conflict in this way because values are not amenable to trade-off or improved information unless this information radically changes the psychological environment of the conflict.

The obvious advantage of reducing conflict is that this would reduce the complexity of the adversarial approach to consents procedures with corresponding reduction in cost and time to all parties. It would thus appear desirable that both the number of cases requiring recourse to consents procedures and length of time involved in these proceedings should be reduced. On the other hand, when conflicts arise, the investigations that follow may uncover aspects of the situation that were not initially apparent. This suggests the need for a balance between allowable activities and restricted practises which adequately represents the community of interest which may extend well beyond the physical area immediately adjacent to the proposed activity.

Impact assessment will always increase knowledge about the system under study that will be beneficial to future management. Often, opposition to projects will provide benefits in terms of the greater amount of effort put into an assessment when it is known that there will be careful scrutiny of the results. For example, environmental opposition to the Alaskan pipeline meant that a great deal of time was spent on studying aspects of Arctic flora and fauna that would not otherwise

have been possible. Both people and the environment have benefited from this. In a more local sense, the ecology of the Aramoana area received considerable attention when a aluminium smelter proposal was mooted. Perhaps a more appropriate goal than reducing conflict might be to promote more constructive use of time and money resources when conflicts arise, so as to avoid duplicate efforts.

The last question posed in the heading of this chapter concerns the usefulness of various mathematical models used by some analysts to examine conflicts. These models are commonly applied to the analysis of historical conflicts for which they provide a useful insight. Their primary use is therefore as a descriptive tool. Their ability to predict and resolve prospective conflicts is less certain. The role of conflict resolution models is a complex topic that requires considerably more analysis than it is possible to include here. However, the issues involved are very important because they are at the heart of the risk decision-making process. What we are really trying to look at is ways in which ERM can be used to either reduce conflict by increasing the amount of authoritative information available or focus the conflict more clearly on the points at issue by clarifying the necessary trade-offs.

4. *Example*

What were the characteristics of the Lyttelton LPG pipeline conflict? Were the issues raised indicative of the real problems? Are there any obvious lessons to be learnt which might assist a regulatory agency in future similar situations?

In Chapter 3 we listed six categories of conflict over technological hazard. We also discussed briefly the interest versus value characteristic of risk conflicts. Gough (1988a) contains further discussion of this area and explores the reasons for differentiating between the two types of conflict. The topic of conflict resolution will be addressed further in future research.

This chapter briefly introduces the topic using the Lyttelton LPG pipeline debate as an example of a 'risk conflict'. It is a good example because it illustrates some of the typical features of such risk conflicts. It also raises some of the questions associated with the appropriate definition of a community of interest.

The Lyttelton LPG pipeline debate originated in an application by Liquigas Limited for authorisation to "construct, operate and maintain a pipeline for the conveyance of LPG from Lyttelton to Woolston". The debate was finally brought to a head during a Commission of Enquiry hearing set up in 1982 under part II of the Petroleum Act. Following the initial proposals for a pipeline (prior to the hearing) there was considerable antipathy to the project mainly from concerned citizens of Lyttelton (The Press, December 1988). About this time the Lyttelton Borough Council received legal advice to the effect that there was no requirement for a public hearing under the Petroleum Amendment Act No 2, however, this was refuted by the then Minister of Energy, Mr Birch. The debate on this topic and its implications can be followed through the newspapers of the time.

The background to the application was that because of the uncertain state of world oil prices New Zealand needed to reduce its dependence on oil and petroleum products. The best way to do this was seen to be by increasing the use of LPG and CNG. Both of these products were readily available in the North Island. Political decisions had already determined that CNG was not a feasible alternative for the South Island and therefore supply of LPG through bulk tankers and using bulk storage facilities was seen to be the appropriate way of servicing the South Island. Security of supply was seen as an essential feature by both Government and industry.

Local concern about the project centred on the fact that local citizens could not see tangible benefits likely to accrue to their area and at the same time they felt that there was a finite risk to their health and the environment associated with the establishment of the installation. Thus the opposition to the location of the storage

tanks and the building of the pipeline became a question of equity.

At the Commission of Enquiry the debate focused on several issues: the risk of having LPG tankers entering the harbour and discharging their cargo through the pipeline to Woolston; whether there would be any economic advantage to the Canterbury region as a result of the construction of the pipeline; whether from an energy feasibility point of view LPG was in fact a suitable fuel for use in the region; and the strategic and economic necessity of reducing dependence on oil.

Factors that were notable were the widely different results of the economic analyses presented in evidence. There was surprising disagreement by experts over the amount of LPG currently being used in the Canterbury area and predictions of use for 1990-91 ranged between 15,000 and 30,000 tonnes. This indicated a considerable amount of uncertainty at that time even when there was a general assumption that oil prices would continue to rise at a fairly rapid rate.

Although not formally required, Liquigas did report on the social and physical environment through which the pipeline was going to pass. This report was presented as part of their evidence in support of the application. Included with this was a safety assessment undertaken at the behest of the applicants by A.D. Little International Incorporated. This safety assessment reported comprehensively on the proposal and was supported by an audit by Prof. R.B. Keey. It included fault tree analysis and covered a wide number of possible failures. Social acceptability of risk was also examined.

Opponents expressed considerable concern about this safety assessment. Some of these concerns were associated with the use of QRA, others centred on the specifics of the scenarios, the assumptions made regarding the physical environment and engineering aspects of the operation and the models used for analysis. These illustrate some of the problems associated with the use of QRA when there is considerable uncertainty about the possible outcomes. There was also concern about the integrity of the mathematics involved in the modelling procedure. Further, it was felt that cultural aspects of social acceptability of risk were not properly dealt with.

In terms of the use of the QRA process the two major criticisms which can be levelled are firstly, that the A.D. Little report considered only one option, that is, the Liquigas proposal. Current thinking on QRA suggests that this is not an appropriate application of the methodology. Secondly, the distinction between voluntary and involuntary risk was not made explicit. Acceptable risk figures derived from voluntary risk situations were compared with risk estimates from the QRA with the conclusion drawn that the risk associated with the pipeline was well within

acceptable levels. Study of acceptable risk has established that this type of comparison is invalid.

Some opponents were not opposed to the principle of the pipeline, but considered that the economic case for it did not establish the economic need. Therefore a delay of four or five years would be beneficial and allow greater analysis of the safety options.

Another objector put the case that under the terms of the Town and Country Planning Act there was no case for granting permission on the grounds that the proposal did not represent a predominant or conditional use and that the ruling was likely to have significant planning significance. Also, the proposal involved potentially dangerous effects which had not been removed or modified.

The controversy over LPG bulk storage continued after permission to build the Lyttelton pipeline was granted with subsequent hearings for the Seaview bulk storage depot. There was considerable controversy over this latter project also and in this case the result was that the bulk storage depot was never built.

Referring to the issues which were raised in the planning hearing, it is not possible to say how representative these were of the 'real' issues. It is probably fair to say that the objectors in Lyttelton were genuinely afraid of the potential dangers of the LPG storage facility. Therefore, the risk issue was genuine. The economic issues are more difficult to judge. The proponent used economic arguments to justify the proposal. The opponents may have tried to counter with alternative economic arguments solely in order to present an effective opposition.

Environmental impact assessment and RA were not required under current regulation, and nor was the work done monitored by any regulatory agency. Liquigas did commission an audit of the safety report by a local expert, however, this cannot be considered as an independent audit. Lathrop and Linnerooth (1983) discuss at length the need for an established format for RA and along with the question of bias associated with commissioned reports with respect to QRA and LNG facility sitings on the California coast between Los Angeles and San Francisco. One of the features of QRA is the lack of data on 'real' failures available and the consequent need to interpolate and make considerable assumptions as to the types of possible failures, the likely consequences and the probabilities of both failures and outcomes.

One of the major features of the study by Lathrop and Linnerooth was the demonstration of the effects of attitudinal bias on the results of QRA. This Californian experience showed the major differences in results that can arise when QRA is commissioned by public and private agencies with different objectives and

expectations. The conflicts that arise in these circumstances are very difficult to resolve because the base assumptions often depend on value judgements and it is here that the biases originate.

Auditing of QRA by a regulatory agency acting as an independent monitoring authority has substantial benefits. These can be maximised if the agency has experience in the area and if it is able to apply a series of standard tests to the data used and the approach taken, as proposed by Lathrop and Linnerooth (1983). This assists in judging the quality of both the QRA itself and the data and assumptions. The expectation is that if this type of approach is adopted then conflict over proposals such as the Lyttelton LPG pipeline application may be reduced.

5. Options

What are the main issues for risk policy arising from this present view of the risk decision-making process? Can the formal incorporation of impact assessment in the decision-making process 'improve' present procedures? Are we trying to protect ourselves or the environment by the use of impact assessments? Do they really work? From whose point of view are they successful? Does looking at equity questions merely perpetuate and reinforce the adversarial position?

This chapter refers primarily to risk decision making and risk assessment. However, most of the arguments are applicable to impact assessment in general. The distinction between impact assessment (IA) and assessment plus management (that is, ERM) needs to be maintained.

5.1 *The role of policy in the risk decision-making process*

The Institute for Risk Research in Waterloo, Canada, is presently undertaking a project on risk policy, decisions and communication (Institute for Risk Research, 1988). In their preliminary report on this project they propose the concept of two decision activities within risk decision making: values and process. The issues associated with the values activity include risk characteristics, benefits/costs, rights, (un)certainities and actions. The issues associated with process include hearings, debate, lobbying/consultation, voting, negotiation and litigation. The linkages are provided by the premise that values are developed as principles for regulation and that regulations are then implemented through the bureaucratic process.

Public sector decision making is seen as part of a whole process directed towards the outcome of achieving society's goals, which derive from societal values. Policy making is involved with specifying society's preferences and providing mechanisms for their interpretation. Thus policy making sets goals and objectives for the decision-making process. In seeking to describe a strategic approach to risk decision making we are aiming to set guidelines for risk policy decisions.

Risk characteristics have been fully described in Gough (1988a). Briefly, they include the probability and magnitude of the risk plus temporal and spatial elements. Benefits and costs are allied to the acceptability of the risk, and cost-risk-benefit methods are used to evaluate particular risks. Estimates of acceptable risk and risk comparisons are heavily value laden due in the main to the lack of sufficient or relevant data and the difficulties in comparing ill-defined and non-commensurate measures. Thus, any attempt at setting policy for the risk decision-making process must involve the consideration of uncertainty.

Rights also provide an important policy perspective in that they can be considered from a number of different points of view. The rights of individuals (allied to the Bill of Rights concept), the rights of firms (defined through legislation and historical perspective) and the rights of society (determined by the actions of elected representatives) may conflict and require conciliation. The choice of a particular strategic approach to a decision process may be viewed as an attempt to thwart the rights of others and it is important that this should not be the case. Therefore, before a decision-making process can be established, clarification of the relevant rights is required and provision for all interested parties should be made.

The current direction of the Resource Management Law Reform (RMLR) process suggests that the recommendations for policy evolving from the reform process are likely to involve a composite approach to impact assessment which will include the consideration of EIA, RA, CBA and SIA. It is obvious that some selection process regarding the specific forms of analysis required will have to be performed.

It is also anticipated that a major amount of policy setting will be devolved to regional authorities. That is, major policy objectives will be established at a national or central government level and responsibility for interpreting these objectives and developing their own policies will rest with the regions.

A critical issue is likely to be the way in which national and regional policies are implemented. If national goals are specified in terms of general broad goals and are not established in legislation then the regions will be able to develop their own policies under a system of guidelines. This could result in widely diverging operating conditions between the different regions. At the other extreme, if national policies are rigidly defined in legislation then regional interests will have little freedom for developing their own particular style of operation. Many projects and activities with environmental risk implications have a wide community of interest that may go beyond regional boundaries. Growing concern over some aspects of global risk suggest that there is a need for international legislation in some areas.

Between the two extremes of no national legislation and full national legislation there is room for a wide range of different combinations of trade-offs between regulation and guidelines. Some skill will be needed in determining which areas of concern require stricter controls and which areas can appropriately be allowed greater flexibility. Whichever route is chosen, there will need to be a national body charged with the monitoring of policy implementation.

To summarise, the main advantage of devolution is that it allows the region the opportunity to set its own rules or regulations for most resource use. Environmental

parameters become design features of regional strategy and developers or proponents are able to easily deduce whether their proposal falls within the permitted use for the region. If it does not, then recourse to the consents procedure for a specified departure is required and impact assessment procedures invoked.

The main disadvantage of devolution of resource management responsibilities is that the checks and balances of this type of system might not be sufficiently broadly based to prevent damage to the environment or potential harm to humans. A major feature of activities involving potential harm to the environment or human health is the likelihood of considerable uncertainty as to the possible outcomes. If regional agencies were allowed major control of policy interpretation then it would be desirable for specific national agencies to retain the ability to enforce a strong and flexible monitoring strategy with the power to act swiftly in the case of non compliance or outcomes at variance with those anticipated.

Major administrative questions will be 'who does the impact assessment' when it is judged necessary, and 'who does the monitoring'. This returns us to the decision-making framework outlined in Chapter 2, where one of the major questions which needs to be addressed involves the 'naming of the players': the decision maker, the analyst and the manager. The options are discussed later in this chapter.

5.2 International regulatory approaches to the incorporation of impact assessment in consents procedures

A good survey of international approaches to regulatory and administrative systems can be found in Appendix 3 of the Report to the co-ordinating committee on hazardous substances (ICC, 1987). This brief summary has been derived mainly from Burton *et al.* (1983) and the OECD (1986). Another source is Covello *et al.* (1981) in which a number of authors discuss different country's experience.

Environmental impact assessment has been used throughout the world since its inception in 1969 for a number of different purposes as either a formal requirement or an informal descriptive tool. One important point that should be remembered is that currently, in most cases, EIA systems are not designed to protect the environment but rather as decision-making mechanisms providing information to all interested parties. This illustrates the change in function of EIA from the original intention of a balancing factor for CBA.

In the United States, EIA is a formal requirement linked to particular Federal laws. It is thus closely linked to the decision-making process since the formal

proceedings cannot be started until the process is complete. The Australian and Canadian experience is similar but less restrictive (that is, required formally less often).

In western Europe EIA tends to be informal and implicit and confined to major projects whereas in eastern Europe assessment is explicit and required and emphasis is placed on comprehensive approaches.

Risk assessment is used even less formally. It is not a legislative requirement in any country except the Netherlands. It is, however, used informally in a number of countries including 10 member countries of the OECD. There are a number of reservations as to the use of quantified risk assessments, and as at May 1986 only the United States, Canada, the Netherlands and the United Kingdom of the OECD countries had declared themselves in favour of these techniques.

An OECD report on RA in member countries (OECD, 1986) made the interesting point that most large firms used risk assessment to facilitate decision making rather than in response to government directives. The main uses to which RA was put by firms were:

- "- to assess the risk of fatalities, damage to property, production losses, pollution;
- to identify the factors which contribute to the risk and select the best strategies to reduce it;
- to assess improvements in design, develop safety systems and assess their reliability;
- to contribute to the planning of emergency measures; and
- to show that the risk is acceptable for the firm, government and the public."

This concurs with the statement made by Kunreuther and Ley (1983) that in the United States there is "lots of risk assessment but little risk management". Although RA is a commonly used tool, the application of RA is often seen as an end in itself rather than part of a complete management process that includes implementation and management. A similar problem arises with EIA. Unless the full process is completed the effectiveness of the assessment, which depends upon the way in which the procedures are found to work in practise, cannot be evaluated.

The main use by authorities on the other hand was in licensing and siting procedures for potentially hazardous installations, though it was also used by authorities to set compulsory technical arrangements and safety measures for monitoring purposes, that is, as a management function.

Another issue which has to be resolved before effective policy with respect to IA and ERM can be established is the objective of such policy. Is the purpose to protect the environment for its own sake or is it to protect human's from ill-conceived exploitation of the environment. Ethical questions such as this are an important consideration for any policy-making process directed towards environmental decision making.

5.3 *Alternative regulatory and nonregulatory approaches*

In a Ministry for the Environment discussion paper entitled 'Method of Control of Hazards' (Boshier, 1988), the author refers to the options for the control of hazardous substances in New Zealand and concludes that "a regulatory agency is needed, therefore, to act as the public's agent to check the manufacturer's competence and performance". One of the major benefits of such an agency is that it can incorporate and oversee the complete ERM process, thus avoiding the problems of a lack of management function. She continues by outlining the management options available to such a regulatory agency.

- (1) a checklist approach;
- (2) generalised control (where basic principles and objectives are defined);
- (3) quantitative risk assessment;
- (4) codes of practise/ guidelines;
- (5) voluntary measures; and
- (6) environmental assessment procedures.

This introduces the two aspects of IA operation which are that of licensing and location. The difference between these two functions is fairly small, however, some of the above management options are more applicable to one than the other. In a typical licensing application, a company or agency applies for a licence to use or store a particular substance on a particular site or to undertake a particular activity on that site. A typical location application applies for permission to build a particular type of plant on a site where the main question is the appropriateness of the site to the activity. Often, of course both questions will need to be considered simultaneously, and the more general approach is probably to consider licensing as a specialised form of location application.

The checklist approach has a number of different possible applications. It involves setting up a 'checklist' of questions to be answered whenever an application is received by a regulatory authority. The checklist may be very general and applicable to many different situations or there may be a series of different checklist for

different applications. A regulatory agency as the decision-making body takes the answers and determines whether or not a licence may be granted according to a pre-set formula. Checklists are simple to operate, they can be very comprehensive but they do not have a great deal of flexibility. They would be suitable for regional use where resources were limited.

The concept of a generalised contract is similar to the checklist in that a set of basic principles would be set with a possible further set of objectives to be met. A regulatory agency would be required to determine whether or not the conditions were properly met initially and to monitor subsequent use. In a specific application of the approach it might be possible to incorporate more flexibility than the checklist.

Quantitative risk assessment has been mentioned previously as a specialised form of RA. In previous discussion (Gough, 1988a, 1988b) we have concluded that because of the reservations regarding its use and the number of necessary assumptions, in most cases it is suitable only as an aid to decision making and not as the sole tool. Quantitative risk assessment is most suitably used to compare a number of different possible options, and not as a means of determining the safety of a single specific application. Quantitative risk assessment is not necessarily the function of a regulatory agency and is currently most commonly used as a management tool within industries and government agencies.

Codes of practise and guidelines are very effective management tools that have been used successfully in civil and chemical engineering applications for many years. They may be set either by industry or by regulatory agencies charged with administration and monitoring. They are most successful when large bodies of information are available from which to calculate 'safe' limits. They are flexible in that in most cases regular review is an important feature of their use and are effective when well monitored.

Voluntary measures are a different form of code of practise or guideline that does not involve the intervention of a regulatory agency in a monitoring role (though the agency may be involved in setting the original standard). They are most effective when they are implemented in the form of an industry wide code of practise where there is an industry based central body willing and able to undertake a monitoring function, whether it be monitoring of compliance or monitoring of the effectiveness of the standard. In some areas they are useful, but overseas experience in areas such as pesticide use has shown that there can be considerable unintentional misuse (Tait, 1988).

Environmental assessment procedures that incorporate RA, or aspects of safety and contingency planning, have been used as described in the previous sections and in Gough (1988b). One useful feature of this approach is that some or all of the previous five approaches can be incorporated within the framework of the IA. We stress that all of these approaches are directly linked to the management function and that implementation and monitoring of the activity must be part of the function of the regulatory authority. Boshier (1988) believes that one of the main strengths of assessment procedures is that they provide one of the few predictive approaches. A further advantage is that they are flexible and able to be adapted to specific or one-off situations.

5.4 Responsibility for assessment and management

One of the most important questions with respect to IA within the public decision-making process is that of who should be responsible for the assessment. This decision is independent of whether or not IA is required by regulation or through some form of voluntary or implicit agreement. In the public decision-making process there are three possible parties. They are: the party responsible for the proposal or the proponent; the regulatory agency charged with responsibility for ameliorating potentially harmful activities (established at either a national or regional level); and a third party or independent consulting agency.

The proponent has the advantage of having the best access to the required information, but the disadvantage of possible lack of expertise in the required techniques and an inbuilt bias towards the promotion of the project. A regulatory agency may have greater difficulty in obtaining the necessary data but should have greater expertise through experience with the methodology. The difficulty here too is that they may not have sufficient resources to undertake major project assessments. This will depend upon the level at which the regulatory agency is established. Third parties may have the most expertise, but may also reflect the biases of the agent briefing them (refer to Chapter 4). In fact, although RA typically purports to assess risks and 'safety' it also tends to have the secondary political purpose of supporting one side or the other with respect to the acceptability of the risk.

In the United States all statutes place responsibility for assessing risk on the regulatory agency charged with implementing the statute (Morris and Duvernoy, 1984). The proponent is responsible for RA up to the point of evaluating the risk, which is the task of the regulatory agency. This avoids the problem of the agency having inadequate access to data. However, the agency is responsible for reviewing the proponent's data and analysis.

In Sweden, the United States, the Netherlands and the United Kingdom public authorities are responsible for environmental impact statements and in the United States and Canada RA is undertaken in conjunction with EIA's and this is at the expense of the petitioner or applicant. In France, Germany, Denmark and Norway the petitioner is responsible for EIA (OECD, 1986).

5.5 *Summary of options*

Our objective in this report is to recommend an approach to incorporating ERM within the environmental decision-making process. The main choices revolve around whether this should be a formal part of the process or whether it should as at present be treated as an informal option. These issues to be determined are: whether it is appropriate to require in legislation that ERM be undertaken; whether it is appropriate to legislate for a specific approach to ERM; within the selected legislative framework what are the appropriate indicators that ERM is required; and who are the appropriate agents to perform the analysis and oversee the monitoring process.

These options can be viewed as a series of choices. The first choice is a policy choice where the (national) policy maker sets goals as to the requirements for ERM and then determines how these goals should be implemented: in law or as guidelines to the regions who would then be required to interpret these goals as regional policy. If policy goals are specified in legislation then the next policy decision is to determine how much of the specific process of IA is required to be similarly specified. These decisions are likely to be made through the RMLR process.

The options are:

- (1) to establish legislation requiring ERM and specifying general requirements and methods to be used;
- (2) to establish legislation requiring ERM but allowing regional interpretation of methods; or
- (3) to translate national goals for the use of ERM into guidelines for the regions.

Options (1) and (2) require the inclusion of a set of criteria to be used as indicators to determine when ERM is required.

A second set of choices relates to the options available as to the agents responsible for ERM. Here the options are:

- (1) a (national or regional) regulatory agency charged with responsibility for the assessment;
- (2) the proponent of the project; or
- (3) a third party or contracting agency.

Chapter six assesses these options and, using the selected alternative, derives a strategy for implementation.

6. *Selecting a preferred alternative*

Section 5.5 summarised the main alternatives available for the use of ERM within the public environmental decision-making process.

Without knowing the specific recommendations likely to result from RMLR it is difficult to assess these options and make specific recommendations for the incorporation of ERM in the decision-making process. This chapter therefore looks at the general implications of the options, selects preferred alternatives and recommends a policy/management strategy.

Because of the uncertainties involved with RMLR, only two criteria are considered at this stage. They are: the feasibility and ease of implementation; and the likely degree of protection offered to human health and the environment.

6.1 *Legislation for the use of ERM*

In the area of practical ERM the degree of decision-making control devolved to the regions is likely to be critical. A commonsense approach would suggest that the decision-making authority should rest with the community of interest. The difficulty then is that although in a number of simple location-type decisions where there is little likelihood of widespread damage to health or the environment the community of interest is easy to define, in many circumstances this is not likely to be the case. For example, should a decision to build a nickel smelter in the Lyttelton area be a decision made by local, regional or national authorities? This depends partly on the parameters chosen as criteria for the decision-making process: for example economic benefit (to the nation, region or local population), employment, environmental degradation, human health etc.

Because of their smaller constituencies, regional and local authorities are likely to take a much narrower view of proposals than national authorities or agencies. That is, regional and national criteria for assessing policy will vary. National criteria are more likely to include wider concerns such as inter-regional linkages, global interests and the rights of future generations. If national policy is not enacted in legislation then there is the very real likelihood that national and regional interests will conflict.

One of the implicit objectives of RMLR is to simplify the present system of consents procedures for both proponents and opponents. Developers have interpreted the idea of simplification to mean making it easier for developments to proceed. Environmentalists are concerned that it will become much more difficult for the public to have access to the decision-making process and that accelerated

development may be the end result. The real intention is to clarify types of development that are acceptable in certain areas so that developers and environmentalists alike will have a clear understanding of what is likely to be allowed and thus reduce the number of times applicants are required to resort to the expensive and time consuming process of public hearings. The expectation is that developers will then concentrate their efforts in areas where they know their project or activity is acceptable to the local or regional community. Consents procedures need only be invoked if the development is outside that allowed by the regional authority.

In practise it is likely that developers will test the boundaries of the system. If they believe that the indicator for modifying the regulations on allowable developments is likely to be the number of times in which a proposal does not fit within the allowed activities then it is to their advantage to force a greater number of hearings. Therefore, if a decentralised system were selected then a necessary safeguard would be the establishment of a monitoring process preferably the responsibility of a national agency.

Our concern here is specifically with ERM and whether or not it is desirable to legislate so that ERM is a requirement in licensing and siting applications. The benefits to the applicant in being required to perform ERM are that as a result of the assessment process the applicant is likely to obtain a greater understanding of the process associated with the proposal which may be of benefit in the management of the project. Monitoring of the project during the management phase will also provide greater information that may be of benefit for subsequent similar applications.

The benefits to the regulatory authority (either national or regionally based) would be the existence of a common framework for assessing applications that would be invoked whenever questions regarding health or environmental safety arise. This would also be of benefit to opponents of the proposal.

The disadvantage of legislating for ERM is that it would reduce flexibility and the time taken to complete licensing and siting decisions might be longer than if a formal ERM process were not required. This could be mitigated by establishing a flexible approach to determining which components of ERM would be required in any particular circumstance, and by varying the degree of analysis required.

6.2 Legislation covering the approach to environmental risk management

If national policy requiring ERM is established in law, then there are considerable advantages in also having a set procedure to be followed also established in law. These are that:

- (1) direct comparisons between similar applications may be made assisting consent-granting authorities in their decision making;
- (2) applicants are aware well in advance of requirements for ERM and can prepare their case accordingly;
- (3) opponents similarly are aware of the requirements and know the type of information that will become available from the process;
- (4) a known procedure for monitoring can be established.

The disadvantages are that unless the procedures to be followed are flexible there may be considerable redundancy. It is difficult to envisage a single comprehensive system of regulation that would be sufficiently flexible to be satisfactory for all situations. However, it would be feasible to consider several frameworks each of which were suitable for dealing with a broad selection of situations or risk categories.

6.3 Preferences regarding legislation

In order to be effective regulation has to be enforceable. Regulation at an international level has always been difficult to enforce and as a consequence international regulations tend to be restricted to certain areas where enforcement is possible. Areas where national differences of opinion occur tend to be neglected even if they appear to be of some significance. An example of this is the continuing controversy over and attempts to establish international regulations for the use of chlorofluorocarbons which it is believed are having a damaging effect on the ozone layer.

Similarly, regulation at local levels can be equally impotent where regulators have inadequate resources to assess and monitor compliance. Pressure on local agencies in tough economic times may prove difficult to resist and result in the sacrifice of safety measures or allow a degree of environmental damage in the interests of short term economic expediency.

If the requirement for ERM is established in law at a national level but the approach to ERM is not similarly regulated for then the situation is likely to change little from the present where EIA and RA are performed with very different levels of

competence and considerable diversity as to the amount of information considered. Although individual regions might establish their own guidelines for ERM, without nationally fixed guidelines the advantages of comparison are lost.

When applying the simple criteria listed at the beginning of this chapter the preferred alternative is for the establishment of legislation requiring ERM and including a selection of frameworks detailing methods to be used.

6.4 *Agents*

If ERM is established in law then there is also a need for a national regulatory agency to oversee the operation of the decision-making process and monitor the results of this process. This agency would delegate the responsibility for the assessment and monitoring of specific proposal functions to alternative (local or regional) agencies where possible.

An important decision to be made with respect to ERM is the determination of the agent responsible for performing and monitoring the appropriate analyses. Commonly, as in the brief example discussed in Chapter four, the agent who performs the assessment (EIA and RA) is typically the applicant. In the United States, when an RA is commissioned (by the regulatory agency) the assessment is done by the applicant and audited by the regulatory agency. This approach is commonly applied to EIA in a number of countries. It is a suitable compromise when the regulatory agency has neither the resources nor easy access to all the information required. The third choice is for either the applicant or the regulatory agency to commission a third party with experience in the area to perform the analysis. If this is the case, then it is desirable that this third party either be commissioned independently of the application (that is, be the agent of the regulatory agency) or that the performed assessment be audited in the same way as for an assessment performed by the applicant. The reason for this is that, particularly in the case of RA there is usually a lack of relevant data and a considerable amount of uncertainty as to the possible outcomes, and it is important that any assessments be as objective as possible without jeopardising the process through lack of expertise on the part of the regulatory agency.

The auditing referred to above is a monitoring of the assessment itself. It does not refer to the implementation and monitoring stages of the ERM process. These functions may be performed internally or externally depending on the recommendations arising from the assessment.

Where possible it may be beneficial for the regulatory agency to carry out a selection

of the assessments which are an integral part of ERM in order to increase their expertise and assist them in their audit function through greater knowledge of the processes.

6.5 *Indicators*

When should ERM be required? Morris and Duvernoy (1984) describe some typical indicators appropriate for enforcing the use of RA in the United States. In common law, the only indicator is the prospect of being held liable for harmful consequences. Under statutory environmental or health and safety regulations indicators may include the action of applying for a permit for hazardous activities, the receipt by regulators of information suggesting potential hazard or the establishment of regulations.

A more easily defined indicator which is used at present for other mechanisms is the 'size' of the proposal. This can be defined in terms of anticipated dollar cost, number of people affected or land area concerned. For practical application this would require a table detailing specific activities and industries to be referred to upon receipt of an application. This information could be obtained initially from a checklist completed by an applicant. The checklist approach is considered further in Chapter seven.

7. *A general approach to environmental risk management*

The list of management functions proposed by Boshier (1988) and listed in Section 5.3 describes a series of approaches available to regulatory agencies. They are all valid tools for ERM.

In Section 6.5 we discussed typical 'Indicators' which might be used for ERM. This is part of the question as to whether it is possible to devise a generalised approach to determining which aspects of the assessment process (if any) are required in a particular circumstance. The requirements are for a general and standardised approach which can incorporate information regarding the level or degree of analysis required. It may also need to specify the tools appropriate to the different levels of analysis and consider questions as to who makes the decisions (how much, by whom etc.)?

As stated earlier, because of the uncertainty regarding the outcomes of the RMLR process it is difficult to make specific recommendations for management guidelines. Given some reasonable assumptions about these outcomes, however, there are some general points that can be made.

As a basis for the following recommendations, therefore, we make a number of assumptions that might be termed as either a 'wishlist' or informed 'guestimates'.

Firstly, we assume that central government will set policy regarding developments and activities affecting environmental concerns which will be relevant to both new projects/proposals and current 'installations' (where 'installations' may also refer to practices).

Secondly, we assume (and recommend) that this policy, that is a requirement for impact assessment or environmental risk management, be enacted in the form of legislation. Whilst there are a number of different policy tools available, we believe that effective policy in this area requires a major legislative component.

Thirdly, we assume that regional authorities will have greater control over the institutional arrangements for their own region than is presently the case. That is, that whilst some central government policy will exist in the form of legislation, other sections of policy are likely to take the form of guidelines to the regions which they will have the flexibility to develop to their own advantage.

The most appropriate tool for determining whether or not ERM is required is a checklist. We believe that a simple checklist, which is suitably general and standardised, can be developed from which it could be determined whether or not

EIA, RA or any other assessments such as SIA, CBA etc. are required. This checklist should be invoked for public and private developments whenever there is a likelihood of risk to human health or the environment. This would form part of the licensing procedure but could also be invoked externally by either third parties or regulatory agencies.

The type of questions that would be required for such a checklist include:

- (1) what is the nature of the development?
- (2) does it involve a new project or extension to an existing plant/installation/project?
- (3) does it involve potential damage to property, human health or the environment, and if so, can this potential damage be specified?
- (4) is it possible to mitigate the potentially damaging effects?
- (5) does it impinge upon cultural values?
- (6) are there likely to be equity issues with respect to the distribution of costs and benefits?
- (7) does the development have local implications, regional implications or national implications and can weightings be given to these?
- (8) what is the anticipated dollar cost of the project?

This is an inexhaustive list of the type of information required. The questionnaire should be completed by an agent of the licensing authority (which may also be the regulatory authority) as a form of an initial IA. Information obtained would indicate whether or not the proposal fell within the guidelines for development for that area, and whether or not further IA were required. Developing the checklist would require considerable pilot testing, trial and error and consultation with both prospective licensing authorities and developers. It is likely that this form of assessment is already an informal tool used by licensing authorities and we recommend greater use of the approach.

This procedure should be sufficient to determine whether EIA, RA, SIA or CBA etc. are required. The degree of analysis should also be determined by this initial assessment. The decision for quantitative or qualitative analysis, for example, might depend on the existence of comparable developments, the availability of data, whether the proposal specifies a single option or a range of alternatives, and the dollar value of the project.

Who should be responsible for performing the assessment component of ERM and who should be responsible for paying for it? The answers to these questions require

looking back to the reasons why IA's are performed. Obviously, when assessments are done to assist with internal decision making then the cost is borne by the company. When impact assessment is required by a licensing authority for the consents procedure process then it is desirable that the analysis be as objective as possible. Overseas experience has shown that in many cases RA's performed by consultants for proponents of a scheme have reflected the inherent biases of proponents. There is strong political element attached to risk assessment because of the value judgements and assumptions required to be made. Lathrop and Linnerooth (1983) have shown that the effectiveness of a risk assessment depends "not only on its analytic rigor, but on the persuasiveness of its presentation". Therefore, we believe that there is a need for a regulatory agency responsible for initiating the ERM process, auditing any assessments performed, and delegating responsibility for monitoring to an appropriate authority according to the scope of the project (determined by the initial IA).

Responsibility for payment for the assessment must rest with the applicant with some dispensation available for particular circumstances. This may include where the regulatory authority wishes to test the types of assessment required for a new type of application but feels that it is unfair to load additional costs on to the applicant. Alternatively, the regulatory agency may wish to test a new form of computer software. This is an important point. In the area of QRA standardisation of approach and the use of 'canned' programs is reducing the cost, but it is often still too high to be practical.

One method of introducing the required objectivity is to have a special purpose agency or group charged with the task of undertaking all IA's. For example, the New South Wales Department of Environment and Planning operates a Major Hazards Policy Unit which undertakes hazard assessment and the establishment of land use safety requirements. The work is performed by both Department staff and consultants. This is feasible when there exists a large population base with a correspondingly large number of applications requiring processing so that the group can maintain experience and expertise in the required areas. However, in New Zealand it is unlikely that this would be possible. The use of overseas consulting agencies, as has been done in the past in New Zealand, has two disadvantages. Firstly, they lack the 'New Zealand' experience and cultural sensitivity which is very important in both EIA and RA and secondly, the country loses by not adding to local experience in these techniques.

A final important note with respect to the linking of the assessment process and the decision-making process is that in the reporting of the results of assessments all findings should be presented in standardised form. Lathrop and Linnerooth (1983) discuss the use of RA and recommend standardisation of the content and the

presentation of RA's. They suggest the use of a Technical Advisory Board which could get around the problem of having judges who are not trained in quantitative methods by critiquing the content of technical reports for users.

Lathrop and Linnerooth, however, also believe that it is informative to have opposing views presented because it highlights conflicting approaches to problems, but only if the evidence can be judged equally on technical terms and if the actual evidence is not overshadowed by method of presentation. They propose, as a means of ensuring this that a set of "rules of evidence" be used for presentation of technical results so that debate can focus on comparing aspects of the alternatives rather than comparing the assessments and presentations.

Recommendations

That ERM be established as a means of assessing and monitoring proposals involving potential hazard to human health and the environment.

That the application of ERM is likely to be of greatest benefit if both a requirement for and an approach is incorporated in legislation.

That a generalised checklist be applied as an initial form of assessment from which the specific assessments required can be determined.

That a regulatory agency be made responsible for monitoring the application and implementation of ERM and that that agency also have the task of delegating responsibility for the assessment and monitoring of specific proposals.

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