Chapter 11

Where To From Here?

Introduction

Risk assessment is a tool for informed decision making. The decision facing Australian environmental agencies is whether to introduce a process of formalised risk assessment; and if so, how should it be done and what should be its scope. Until now this document has been concerned with the technical aspects of risk assessment itself. This chapter will consider the infrastructure needed to undertake successful risk analyses.

A generic Australian framework

The discussion in Chapter 3 examined the difference between an environmental impact analysis and an environmental risk analysis. The key feature is that a risk analysis must deal explicitly with certainties and uncertainties. Indeed, uncertainty analysis provides the common component within a generic framework (Fig. 3.2) that allows risk analysis to be applied in areas as diverse as chemicals, contaminated sites, industrial development, natural hazards, priority setting and politics.

The generic framework provides a model for accomplishing the technical aspects of the risk assessment. But an environmental risk assessment should be but a tool for environmental decision making. Application of a quantitative risk assessment requires capabilities in four primary areas:

(i) a systems analysis capability that can be used for scenario development;

(ii) technical expertise that can be used to quantify hazards;

(iii) statistical skills, possibly in conjunction with computer modelling expertise, that can be applied to uncertainty analysis as in probabilistic modelling, for example; and

(iv) expertise that can be used to quantify the costs and benefits associated with assessing priorities.

Computer models

Certain aspects of risk assessment can be accomplished without recourse to computers and with recourse to only elementary mathematics, for example, setting priority topics for environmental performance reviews (Chapter 5). Nevertheless, in most cases quantitative risk analysis will involve the use of a computer model — in the sense of a surrogate construct of the physical or biological world in which the model behaviour mimics the behaviour of the actual entity. Mathematics provides the language that transforms such models from vague thoughts to precise constructs with precise predictions.

Much of the United States implementation of risk assessment has relied on the regulatory use of computer models. In some cases, such as in air quality assessment, this approach has been adopted in Australia. The Victorian EPA adapted the US EPA model ISCST (Industrial Source Complex — Short Term) to predict the expected concentrations of air pollutants from proposed industrial developments. The resulting model, originally called AUSPLUME and recently revised to AUSPUFF, has won widespread acceptance around Australia as an appropriate means by which to undertake such a task.

The requirements of the US Clean Air Amendment Act of 1990 have meant that the US EPA has also undertaken the next step in the use of such computer models in risk assessment. The ISCST model has been incorporated into the TOXST (TOXic

modelling system — Short Term) which is recommended for situations requiring "a more realistic simulation of intermittent sources and combined source impacts" (National Research Council, 1994: Appendix J).

These examples illustrate the use of computer models as tools with which to perform complex calculations. This is the light in which the scientific community sees them. In fact, they also serve a second function that is even more valuable to the environmental practitioner. The models codify which of the myriad complex calculations are the appropriate ones to undertake. Further, an official agency endorsement of a computer program acts in a couple of indirect ways. It minimises a practitioner's risks related to professional negligence. It also guides future investigations into the channels needed to acquire data as inputs to the model. The need for such guidance to emanate from the EPA has been documented in Chapter 8.

There has been a rapid increase in the availability and capacity of computing power in recent years. Advances in computer software in areas such as geographic information systems and expert systems mean that it is possible to combine such elements into environmental decision support systems (Fedra, 1993, 1995; Fedra & Weigkricht, 1995). Groups developing such software have emphasised different aspects of the issue. The group at the International Institute of Applied Systems Analysis (IIASA) in Austria have emphasised visual ease-of-use. The Environmental Resources Information Network (ERIN) of the Department of Environment Sport and Territories has emphasised the integration of environmental databases and remote sensing data, and delivery of their product over the Internet (Slater, 1995).

The Netherlands have developed a computer model to provide a "Unified System for the Evaluation of Substances (USES)" (Jager & Visser, 1994) designed to integrate the hazard and risk assessment of new chemicals, existing chemicals and pesticides. It exists to provide a tool for rapid, quantitative assessment of the risks of organic substances to man and the environment. It is designed for the screening stage and the intermediate (refined) stage of an evaluation and, as such, provides a first-step model that can be used by risk assessors who are not modellers or programmers. If, as we believe, there remains a need for comprehensive examination of a chemical, such as that provided by the suite of US EPA models (Gallant & Moore, 1992) then experienced operators and modellers are required.

The use of, and the role of, computer models is rapidly advancing and rapidly changing. Australia as a nation needs people with the skills and expertise to develop environmental models. Environmental agencies need people with the understanding and knowledge to be able, intelligently, to use the computer models that have been developed. There is a perceived lack of such people, yet a perceived need for such skills. Court et al. (1994) propose that a funded research institution be established to develop programs for cumulative impact assessment and strategic environmental assessment, and undertake associated research. They note that such a body could provide some of the necessary research output that was recently provided by the Resource Assessment Commission. They suggest that the agenda of such an institution should include promoting and developing predictive tools for modelling the biophysical environment, but do not discuss the availability of skilled manpower to undertake their proposed agenda.

Organisation and infrastructure

It has already been noted that the process of undertaking an environmental impact statement constitutes part of an environmental risk analysis. A commission of inquiry, such as the Fox Commission which examined the issue of Australian uranium mining, has greater powers to deal with interactions between uses and activities, with cumulative impacts, and to delve more deeply into public perceptions and attitudes. Such a process fits all the parts of the generic framework for a risk assessment.

The Minister for Primary Industries and Energy, Mr John Kerin, and his staffers experienced "frustration with endless public inquiries" (Kerin, 1990) and in November 1988 the Commonwealth Government established the Resource Assessment Commission (RAC) as a way of providing information for government on resource

exploitation issues. The internal guidelines under which the RAC operated required it to identify:

- the extent of the resource and the various uses that could be made of it;
- the environmental, cultural, social, industry, economic and other values involved in those uses; and
- the implications for these values of those uses, including uncertain or long-term implications.

In addition, the Commission was required to make an assessment of losses and benefits involved in the various alternative uses or combinations of uses of the resource, including losses and benefits which are uncertain, long term, or seemingly unquantifiable.

Though slightly long-winded, these points can be summarised in the points of the generic framework: identify the concerns; identify their consequences; undertake calculations; deal with uncertainties; and then undertake both a cost-benefit and risk-benefit analysis. Thus, from 1988 until 1993, when the Government terminated the administrative functions of the RAC, Australia had an organisation devoted to environmental risk assessment. Why did it fail?

A number of commentators have tried to answer this question. Stewart & McColl (1994) — members of the RAC — cite Lowe (1993) who commented on the Coronation Hill dispute (see Chapter 10) that politicians and bureaucrats were unhappy about the transparency of the political process. The Commission's crime (according to Lowe) was to use a rational and visible process, thus exposing the nature of the decision to the public gaze. This analysis, if correct, is disturbing in that it implies that the concept of transparency of process and objectivity of decision making are not benefits but are political drawbacks. In fact, the environmental impact assessment process works on eight guiding principles (EPA, 1994):

- participation;
- transparency;
- certainty;
- accountability;
- integrity;
- cost-effectiveness;
- flexibility; and
- practicality,

with public respondents placing highest value on the first five.

Other views on the reasons for the failure of the RAC that have been given include a perception that the Australian States did not get on well with the RAC and even the procedural reason that the legal background of the chairman meant that proceedings were conducted by interviewing participants sequentially. This contrasts with the consultative process involved in the environmental impact process that deals with participants in a flexible and consultative manner. The difficulties involved in obtaining scientific information from a procession of witnesses interviewed one at a time could have led to an amount of residual ill-will.

Announcement of the decision to cease using the RAC was part of the 1993-94 budget which implies that the principal motive was to reduce expenditure. The RAC must have lost the cost-benefit analysis conducted — either explicitly or implicitly — by the Government during the run-up to the budget.

What organisation should carry out environmental risk assessments? An agency such as the EPA has a legislative role to undertake some form of risk assessment associated with chemicals evaluation, contaminated sites, assessment of environmental impact statements, and in the examination of uranium mining in the Northern Territory.

Dealing with matters such as these would provide ongoing work for a risk assessment unit within the organisation. An extra, valuable, role that seems to be necessary for a risk assessment unit is an ability to act in a strategic role to determine and evaluate the risks associated with issues that have not yet become enshrined in regulation, or matters of public concern. This type of function combines that of the Commission for the Future and that of the State of the Environment (SoE) reporting framework, once the implementation of the SoE is widened from documenting known environmental data to evaluating environmental uncertainties.

The likely name, nature and size of such a risk assessment unit are matters for debate and decision. This document offers suggestions for discussion:

A risk assessment body set up within the EPA in Canberra should have its size determined by its role. Further, it is not clear whether a technical unit, such as that of a risk assessment unit, fits well within a policy oriented department — though DEST presently incorporates ERIN, the Environmental Resource Information Network (Slater, 1995) as a technical unit. Similar concerns within the UK Department of Environment led to their establishing a small group called CIERA (Centre for Integrated Environmental Risk Assessment) as a joint consultancy between Her Majesty's Inspectorate of Pollution and the consulting firm Technica-DNV.

The EPA does, however, already run a technical organisation in Jabiru in the Northern Territory. The work of ERISS, the Environmental Research Institute of the Supervising Scientist, originally concentrated on uranium mining in the Northern Territory (when it was called the Alligators Rivers Research Institute), but recently the Institute has used its expertise to examine other mining related problems, such as those of Mt. Lyell in Tasmania. The institute has expertise in computer modelling and ecology. In addition, research work on radiation has long made use of risk assessment to determine the likely health effects of radiation. The technical background is certainly in existence for a risk assessment unit, but many of the issues that it would need to look at (e.g. chemicals, contaminated sites) on behalf of the EPA emanate from Canberra and require rapid lines of communication.

There are also functions undertaken by State environmental authorities that require risk assessments to be undertaken. The New South Wales Department of Planning, for example, has a major hazards policy unit. Some mechanism for effective and coordinated use of such expertise would be valuable.

The US EPA makes extensive use of the US National Research Council, whose members are drawn from the National Academy of Science, the National Academy of Engineering and the Institute of Medicine. The 1990 Clean Air Act specifically directed the US EPA to arrange for the National Academy of Sciences to review risk assessment methods used in relation to air pollutants. In Australia no similar use is made of the learned academies, despite their ability to provide highly competent people representing organisations widely perceived to be authoritative and unbiased.

The US EPA has a Science Advisory Board (SAB) which is a legislatively mandated group of non-government scientists, engineers and economists charged with providing independent technical advice on environmental issues to the EPA administrator (US EPA, 1994). The SAB clears EPA regulations prior to issue. It was the body that conducted the EPA comparative risk assessments and it is presently undertaking an Environmental Futures project. It has 100 members and is dominated by university representatives.

Finally, there are universities, research organisations and private sector consultants that can offer risk analysis and risk assessment services if required, either on the basis of strategic partnerships or on a fee-for-service basis.

Risk-benefit analysis

This document is but a preliminary step. The next step will be a conference on risk and uncertainty in environmental management. This conference, designated a Fenner conference by the Academy of Science, will be held 13-17 November 1995. The final day of the conference will consist of a workshop which is intended to undertake a

risk-benefit analysis of introducing risk assessment. It is anticipated that the costs are quantifiable, once the scope of the process has been determined. The important benefits are expected to be:

- transparency of process;
- informed decision making; and
- input into priority setting.

Thus one purpose of a conference such as this is to decide whether the value of the benefits are likely to exceed the costs.

References

Court, J.D., Wright, C.J. & Guthrie, A.C. 1994, Assessment of cumulative impacts and strategic assessment in environmental impact assessment, Report, Environment Protection Agency, Canberra, ACT.

EPA 1994, Public review of the Commonwealth Environmental Impact Assessment Process — main discussion paper, EPA, Canberra.

Fedra, K. 1993, GIS and environmental modeling, in Goodchild, M.F. Parks, B.O. & Steyaert, L.T. (eds), Environmental Modeling with GIS, 35-50, Oxford University Press, New York.

Fedra, K. 1995, Chemicals in the environment: GIS, models, and expert systems, in *Toxicology Modeling*, **1**, 43-55,

Fedra, K. & Weigkricht, E. 1995, Integrated information systems for technological risk assessment, in G.E.G. Beroggi and W.A. Wallace (eds), Computer Supported Risk Management, 213-232, Kluwer, Dordrecht.

Gallant, J.C. & Moore, I.D. 1992, *Chemical fate models for hazard assessment in Australia*, Working Paper 1992/2, Centre for Resource & Environmental Studies, Australian National University.

Jager D.T. & Visser, C.J.M. 1994, *Uniform system for the evaluation of substances (USES), version 1.0*, Netherlands Ministry of Housing, Spatial Planning and the Environment, The Hague.

Kerin, J. 1990, *Making decisions we can live with*, Canberra Bulletin of Public Administration, 62, 18-20 (quoted also in Toyne, P. *Reluctant Nation*).

Lowe, I. 1993, *Implementing the Precautionary Principle*, paper presented at the Precautionary Principle Conference, Institute of Environmental Studies, University of New South Wales.

National Research Council 1994, *Science and Judgement in Risk Assessment*, National Academy Press, Washington DC.

Slater, W., *Sustainability for Australia: a national environmental information system*, Proc. National Conf. Inst. Engineers, Australia, 1-9, April 1995.

Stewart, D. & McColl, G. 1994, The Resource Assessment Commission: an inside assessment, *Aust. J. Env. Management*, **1**, 12- 23.

US EPA, Science Advisory Board FY1994 annual staff report - the year of reinvention, Report EPA/SAB/95/001, Science Advisory Board, US EPA, Washington DC.